DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM

PART- A: Introduction

Program: Bachelor in Science *(Honors/Honors with research)*	Semester - VII	Session: 2024-25

1	Course Code	CHSC-07T
2	Course Title	INORGANIC & PHYSICAL CHEMISTRY-II
3	Course Type	DSC
4	Pre-requisite (if, any)	*As per Program*
5	Course Learning. Outcomes (CLO)	➢ *Study the formation, stability and electronic spectra of complexes* ➢ *Analyze the chemistry of metal carbonyls and metal nitrosyls.* ➢ *Solve the Schrodinger equation for the hydrogen atom and utilize Huckel theory for conjugated systems.* ➢ *Analyze collision theory and transition state theory to understand chemical reactions.*
6	Credit Value	3 Credits — *Credit = 15 Hours - learning & Observation*
7	Total Marks	Max. Marks: 100 — Min Passing Marks: 40

PART -B: Content of the Course

Total No. of Teaching–learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	**MOT & Electronic Spectra of Complexes** Electronic spectra and MO theory of Transition Metal complexes , M.O. Theory for octahedral, tetrahedral and square planar complexes with and without π-bonding Determining the Energy terms, Spin-orbit (L-S) coupling scheme, Hund's rule for term symbol, Hole formalism, Determination of the term symbol (ground and excited states) for d 1 to d 9 configurations, Electronic spectra of transition metal complexes, Types of transitions, Laporte 'orbital' selection rule, spin selection rule. Orgel diagrams for octahedral metal complexes. Charge transfer spectra, Racah parameters, calculations of 10Dq, B, β parameters. Tanabe- Sugano Diagrams of octahedral complexes with d 2 and d8 configuration.	12
II	**Metal – Ligand Equilibria** A) Metal – Ligand Equilibria in Solution: Stepwise and overall formation constants; trends in stepwise formation constants; factors affecting stability of metal complexes with reference to nature of metal ion, ligand, chelate effect and thermodynamic origin. Determination of formation constant by: (1) spectrophotometric method (Job's and Mole ratio method) (2) Potentiometric method (Irving-Rossotti Method) B) **Reaction Mechanism of Transition metal complexes-**: Energy Profile of a reaction, reactivity of metal complexes, Inert and Labile complexes, Kinetics of Octahedral substitution C) **Metal carbonyls**: vibrational spectra of metal carbonyls for bonding and structure elucidation, important reaction of metal carbonyls. Metal carbonyl clusters with reference to classification, synthesis and structures. D) **Metal nitrosyls**: Nitrosylating agents for synthesis of metal nitrosyls, vibrational spectra and X-ray diffraction studies of transition metal nitrosyls for bonding and structure elucidation.	11
III	**Advanced Quantum Mechanics** Discussion of solutions of the Schrodinger equation to three - dimensional box, concept of degeneracy, the harmonic oscillator, the rigid rotor, the hydrogen atom. **Approximate Methods**	11

	The variation theorem and perturbation theory (first order and non-degenerate). Applications of variation method and perturbation theory to hydrogen and helium atom. **Angular Momentum** Ordinary angular momentum, eigen functions and eigen values of angular momentum, ladder operator, concept of spin, antisymmetry and Pauli's exclusion principle. **Molecular Orbital Theory** Huckel theory of conjugated systems, Applications to ethylene, butadiene and cyclobutadiene.	
IV	**Advanced Chemical Dynamics** **A)** Methods of determining rate laws, Temperature dependence of chemical reaction rates, Arrhenius equation, Energy of activation, pre-exponential factor and its limitations, Collision theory and its limitations, steric factors, Transition State theory of gas and liquid phase bimolecular reactions, comparison of three theories of reaction rates, kinetic salt effects. Kinetics of Photochemical reactions (Hydrogen-bromine and hydrogen - chlorine reactions). **B)** Bodeinstein steady state approximation and its application in consecutive reactions, Dynamics of unimolecular reactions :Lindeman-Hinshelwood mechanism, RRKM theory, Thermodynamic formulation of transition state theory, Enthalpy, Gibbs free energy and enthalpy of activation.	**11**
Keywords	***Electronic spectra, MO theory, Complex stability, Spectrophotometry, Vibrational spectra, Bonding, Metal nitrosyls, Schrodinger equation, Huckel theory , Collision theory, Transition state theory***	

Signature of Convener & Members (CBoS) :

PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. *Bali, R. (2014). Principles of inorganic chemistry (5th ed.). New Age International.*
2. *Prasad, R. K. (2012). Quantum mechanics (3rd ed.). New Age International.*
3. *Puri, B. R., Sharma, L. R., & Rastogi, V. D. (2012). A textbook of physical chemistry. Vishwa Prakashan.*
4. *Rakshit, P. C. (2014). Elements of physical chemistry. S. Chand & Company.*

Reference Books Recommended:-

1. *Lee, J. D. (2008). Inorganic chemistry (4th ed.). Wiley India.*
2. *Greenwood, N. N., & Earnshaw, A. (2012). Chemistry of the elements (2nd ed.). Elsevier.*
3. *Laidler, K. J. (1987). Chemical kinetics (3rd ed.). Pearson Education.*
4. *Cotton, F. A., Wilkinson, G., Boch, P. L., & Bailar, M. Bailar Jr. (2018). Inorganic chemistry (6th ed.). John Wiley & Sons.*
5. *Mathews, P. M., & McFarlane, F. W. (2014). A textbook of quantum mechanics (2nd ed.). Mc Graw Hill Education.*
6. *Houston, P. L. (2001). Chemical kinetics and reaction dynamics. Dover Publications.*

Online Resources–

- https://nptel.ac.in/courses/115106066
- https://nptel.ac.in/
- https://onlinecourses.nptel.ac.in/noc23_cy02/preview
- https://swayam.gov.in/

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment (CIA):	**30 Marks**
End Semester Exam (ESE):	**70 Marks**

Continuous Internal Assessment (CIA): **(By Course Teacher)**	Internal Test / Quiz-(2): **20** +**20** Assignment / Seminar - **10** Total Marks - **30**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20 Marks** Section B: Descriptive answer type qts.,**1out of 2** from each unit-**4x10=40 Marks**	

Name and Signature of Convener & Members of CBoS:

Indira Bohra

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM

PART- A: Introduction

Program: Bachelor in Science *(Honor/Honors with Research)*			**Semester - VII**	Session: **2024-2025**
1	**Course Code**	**CHSC-07P**		
2	**Course Title**	**CHEMISTRY LAB. COURSE-VII**		
3	**Course Type**	**DSC**		
4	**Pre-requisite** (if, any)	***As per Program***		
5	**Course Learning. Outcomes (CLO)**	➢ *Master separating and estimating acidic and basic radicals in inorganic mixtures.* ➢ *Apply qualitative and quantitative analysis skills to real samples. • Inorganic Synthesis & Characterization* ➢ *Gain hands-on experience synthesizing inorganic compounds and identify them using spectral analysis.* ➢ *Grasp basic physical chemistry concepts through practical experiments and learn to operate basic equipment.*		
6	**Credit Value**	**1 Credits**	*Credit =30 Hours Laboratory or Field learning/Training*	
7	**Total Marks**	**Max. Marks: 50**		**Min Passing Marks: 20**

PART -B: Content of the Course

Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)

Module	Topics (Course contents)	No. of Period
Lab./Field Training/ Experiment Contents of Course	**Qualitative analysis of mixture containing eight radicals including two less common metals from among the following by semi micro method.** **Basic Radicals:** Ag, Pb, Hg Bi, Cu, Cd, As, Sb, Sn, Fe, Al, Cr, Zn, Mn, Co, Ni, Ba, Sr, Ca, Mg, Na, K, Ce, Th, Zr, W, Te, Ti, Mo, U, V, Be, Li, Au, Pt. **Acidic Radicals:** Carbonate, Sulphite, Sulphide, Nitrite, Nitrate, Acetate, Fluoride, Chloride, Bromide, Iodide, Sulphate, Borate, Oxalate, Phosphate, Silicate, Thiosulphate, Ferricyanide, Sulphocyanide, Chromate, Arsinate and Permanganate. **Separation and determination of two metal ions in ores, alloys, or mixtures in solution, one by volumetric and the other by gravimetric methods.** **Estimations** (a) Phosphoric acid in commercial orthophosphoric acid. (b) Boric acid in borax. (c) Ammonia in an ammonium salt. (d) Manganese dioxide in pyrolusite. (e) Available chlorine in bleaching powder. (f) Hydrogen peroxide in a commercial sample. **Preparations** Preparation of selected inorganic compounds and their study by I.R. Electronic spectra, Mossbauer, E.S.R. and magnetic susceptibility measurements. Handling of air and moisture sensitive compounds. Theoretical study of structure and their identification of some preparations by spectral analysis	**30**

1. $VO(acac)_2$
2. $TiO(C_9H_8NO)_2 2H_2O$
3. Cis-K $[Cr(C_2O_4)_2(H_2O)_2]$
4. $Na[Cr(NH_3)_2(SCN)_4]$
5. $Mn(acac)_3$
6. $K_3[Fe(C_2O_4)_3]$
7. Prussian Blue, Turnbull's Blue.
8. $[Co(NH_3)_6][Co(NO_2)_6]$
9. Cis-$[Co(trien)(NO_2)_2]Cl.H_2O$
10. $Hg[Co(SCN)_4]$
11. $[Co(Py)_2Cl_2]$
12. $[Ni(NH_3)_6]Cl_2$
13. $Ni(DMG)_2$
14. $[Cu(NH_3)_4]SO_4.H_2O$

Adsorption

1. To study surface tension – concentration relationship for solution (Gibb's equation).
2. To study the adsorption of oxalic acid on charcoal and to verify Freundlich adsorption isotherm.

Chemical Kinetics

1. Determination of the effect of (a) Change of temperature (b) Change of concentration of reactants and catalyst and (c) ionic strength of the media on the velocity constant of hydrolysis of an ester/ionic reactions.
2. Determination of the rate constant for the oxidation of iodide ions by hydrogen peroxide studying the kinetics as an iodine clock reaction.

Polarimetry

1. Determine the specific and molecular rotation of optically active substance.
2. To determine the concentration of a solution of an optically active substance.

Solutions

1. Determination of molecular weight of non-electrolyte/electrolyte by cryoscopic method and to determine the activity coefficient of an electrolyte.
2. Determination of molecular weight of non-volatile substances by Landsberger's method.

Spectrophotometry

1. Verification of Beer-Lambert law and determination of concentration of unknown solution.
2. Effect of pH in aqueous coloured system.

Potentiometry/pH metry

1. Determination of temperature dependence of EMF of a cell.
2. To determine pKa of the given monobasic acid by pHmetric titration.
3. Determination of the dissociation constant of monobasic/dibasic acid by Albert- Serjeant method.

Keywords	***Qualitative Analysis, Separation and Determination, Estimations, Preparations, Spectroscopic Techniques, Adsorption, Chemical Kinetics, Polarimetry, Solutions, Instrumental Methods***

Signature of Convener & Members (CBoS) :

PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended

1. *Das, R. C., & Behra, B. (2009). Experimental Physical Chemistry (1st Ed.). Tata Mcgraw-Hill Education.*
2. *Chatwal, G. R., & Sharma, A. (2019). Instrumental Methods of Chemical Analysis. Himalaya Publishing House.*

Reference Books Recommended

1. *Bassett, J., Denney, R. C., Jeffery, G. H., & Mendham, J. (1974). Vogel's Textbook of Qualitative Chemical Analysis (5th Ed.). ELBS.*
2. *Jolly, W. L. (1970). Synthesis and Characterization of Inorganic Compounds. Prentice Hall.*
3. *James, A. M., & Prichard, F. E. (1981). Practical Physical Chemistry (4th Ed.). Longman.*
4. *Plevitt, B. (1974). Findlay's Practical Physical Chemistry (9th Ed.). Longman.*

Online Resources–

- **(https://www.wiley.com/en-us/Microscale+Inorganic+Chemistry%3A+A+Comprehensive+Laboratory+Experience-p-9780471619963)**
- **(https://onlinelibrary.wiley.com/doi/book/10.1002/9780470405840)**
- **(https://www.amazon.com/Physical-Chemistry-Molecular-Donald-McQuarrie/dp/0935702997)**
- **(https://www.amazon.com/Laboratory-Manual-Physical-Chemistry-Davison/dp/1297998979)**

Online Resources–

- **e-Resources / e-books and e-learning portals**

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**50 Marks**
Continuous Internal Assessment (CIA):	**15 Marks**
End Semester Exam (ESE):	**35 Marks**

Continuous Internal Assessment (CIA): **(By Course Teacher)**	Internal Test / Quiz-(2): **10 & 10** Assignment/Seminar +Attendance - **05** Total Marks - **15**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory / Field Skill Performance: On spot Assessment** **S. Performed the Task based on lab. work - 20 Marks** **T. Spotting based on tools & technology (written) – 10 Marks** **U. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

Name and Signature of Convener & Members of CBoS:

FOUR YEAR UNDERGRADUATE PROGRAM(2024 – 28)
DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM

PART-A: Introduction				
Program:Bachelor in Science *(Honors/Honors with Research)*			**Semester VII**	Session: **2024-2025**
1	**CourseCode**	**CHSE-05T**		
2	**CourseTitle**	**PHOTOCHEMISTRY AND PERICYCLIC REACTION**		
3	**CourseType**	**DSE**		
4	**Pre-requisite(if,any)**	*As per Program*		
5	**Course Learning. Outcomes(CLO)**	➢ *To study the photochemical reaction and pericyclic reaction* ➢ *To gain knowledge about mechanism of light induced reaction.* ➢ *To learn the mechanism of thermal reaction* ➢ *To understand the difference between light and thermal reaction.*		
6	**CreditValue**	**3 Credits**	*Credit = 15 Hours -learning & Observation*	
7	**TotalMarks**	**Max.Marks: 100**	**Min Passing Marks:40**	

PART -B: Content of the Course

TotalNo.of Teaching–learning Periods(01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics(Coursecontents)	No.ofPeriod
I	**Photochemical reactions and Reaction Mechanism** Interaction of electromagnetic radiation with matter, types of excitations, fate of excited molecules, quantum yield, transfer of excitation energy, actinometry. Classification, rate constants and life times of reactive energy states - determination of rate constants of reactions. Effect of light intensity on the rate of photochemical reactions. Types of photochemical reactions – Photo-oxidation, photo-reduction, photo-dissociation, gas phasephotolysis.	12
II	**Photochemistry of Alkenes** Intramolecular reactions of the olefinic bond - geometrical isomerism, cyclisation reactions, photochemical rearrangement of alkenes,rearrangement 1, 4- and 1,5-dienes. **Photochemistry of Aromatic Compounds:** Photochemical isomerization of aromatic compounds, Photochemical addition and substitutions reactions shown by aromatic compounds.	11
III	**Photochemistry of Carbonyl Compounds** Photochemical reactions of carbonyl compounds: Norrish type I and II reactions Intramolecular reactions of carbonyl compounds - saturated cyclic and acyclic, β, γ - unsaturated and α, β - unsaturated compounds. Cyclohexadienones. Intermolecular cycloaddition reactions –photo-dimerisation reaction and oxetane formation. **Miscellaneous Photochemical Reactions** Photo-Fries reactions of anilides. Photo-Fries rearrangment. Barton reaction. Singlet molecular oxygen reactions. Photochemical formation of smog. Photodegradation of polymers. Photochemistry of vision.	11
IV	**Pericyclic Reactions** Molecular orbital symmetry, Frontier orbitals of ethylene, 1,3- butadiene, 1,3,5-hexatriene and allyl system. Classification of pericyclic reactions. Woodward-Hoffman correlation diagrams. FMO and PMO approach. Electrocyclic reactions- conrotarory and	11

	disrotatory motions, 4n, 4n+2 and allyl systems. Cycloadditions- antarafacialand suprafacial additions, 4n and 4n+2 systems, 2+2 addition of ketenes.Sigmatropic rearrangements, suprafacial and antarafacial shifts of H, sigmatropic shifts involving carbon moieties, 3, 3-and 5,5- sigmatropic rearrangements. Claisen, Cope and aza-Cope rearrangements.	
Keywords	***Photochemical reaction, thermal reaction,***	

SignatureofConvener&Members (CBoS):

PART–C:Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

1. *Singh, J., & Singh, J. (n.d.).* ***Photochemistry and pericyclic reactions****. [Publisher not provided].*
2. *Gupta, A. L. (2024).* ***Photochemistry****. Pragati Prakashan (7th Edition).*

Reference books Recommended:

1. *Ramamurthy, V., & Schanze, K. S. (1999).* ***Organic photochemistry****. Taylor & Francis.*
2. *Wardle, B. (2000).* ***Principles and applications of photochemistry****. John Wiley & Sons.*

Online Resources–

- **https://nptel.ac.in/courses/104105038**
- **https://archive.nptel.ac.in/courses/104/106/104106077/**
- **https://www.scribd.com/document/512848351/Photochemistry-and-Pericyclic-Reactions-by-J-Singh**

PART-D:Assessment andEvaluation

Suggested Continuous Evaluation Methods:
MaximumMarks: 100 Marks
ContinuousInternal Assessment(CIA):30 Marks
EndSemesterExam(ESE):70 Marks

Continuous InternalAssessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): **20 +20** Assignment/Seminar- **10** Total Marks -**30**	Better marks out of the two Test / Quiz+ obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20Marks** Section B: Descriptive answer type qts.,**1out of 2** from each unit- **4x10=40Marks**	

NameandSignatureofConvener&MembersofCBoS:

Indira

FOUR YEAR UNDERGRADUATE PROGRAM(2024 – 28)
DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM

PART-A: Introduction				
Program: Bachelor in Science *(Honors/Honors with Research)*			**Semester VII**	Session: **2024-2025**
1	**CourseCode**	**CHSE-05P**		
2	**CourseTitle**	**PHOTOCHEMISTRY& PERICYCLIC REACTION LAB. COURSE**		
3	**CourseType**	**DSE**		
4	**Pre-requisite(if,any)**	-		
5	**Course Learning. Outcomes(CLO)**	➢ *To learn the advanced organic chemistry concept that will applied in solving their future chemistry problems.* ➢ *To learn about arenium ion ,classical versus non classical carbonium ion ,different rearrangement reactions* ➢ *To make student aware the level of basic organic chemistry to apply in different reaction mechanisms and organic transformations.*		
6	**CreditValue**	**1 Credits**	*Credit =30 Hours Laboratory or Field learning/Training*	
7	**TotalMarks**	**Max.Marks:50**		**Min Passing Marks:20**

PART -B: Content oftheCourse		
TotalNo.of learning-Training/performancePeriods:30 Periods (30 Hours)		
Module	**Topics(Coursecontents)**	**No.ofPeriod**
Lab./Field Training/ Experiment Contents of Course	1. Synthesis of organic compound involving important chemical reaction:- (a)Acetylations salicylic acid, aniline, glucose and hydroquinone, (b) Benzoylation of aniline and phenol. (c) Aliphatic electrophilic substitution: preparation of iodoform from ethanol and acetone (d) Arromatic electrophilic substitution: nitration-preparation of meta dinitrobenzene, p-nitroacetinalide, halogenation: preparation of p-bromoaetanilaide,2,4,6-tribromophenol. (e) Diazotisation/ coupling :- Preparation of methyl orange and methyl red, (f)Oxidation: Preaparation of benzoic acid from toluene (g) Reduction: Preparation of aniline from nitrobenzene, m-nitroanilene from m-dinitrobenzene. 2. Isolation of some natural products(casein from milk, lycopene from tomato, nicotine from tobacco leaves etc.) 3. Detection of element, functional group and organic compound.	**30**
Keywords	***Synthesis of organic compound, functional group test. Lassagne test.***	

Signature of Convener& Members (CBoS):

PART–C:Learning Resources

Text Books, Reference Books and Others

Text books Recommended:

1. *Bansal, R. K. (1994).* ***Laboratory manual of organic chemistry****. New Age International Publishers.*
2. *Vogel Textbook of Practical Organic Chemistry 5th edition, Pearson Publication.*

Reference books Recommended:.

1. *Vishnoi, N. K. (2010).* ***Advanced practical organic chemistry*** *(3rd ed.). Vikas Publishing House.*
2. *Saikia, B. (Year).* ***Organic chemistry-I with practical.****.*
3. *Agrawal, O. P. (Year).* ***Advanced practical organic chemistry****. Krishna Publication.*

Online Resources:

https://www.organic-chemistry.org/synthesis/

https://www.orgsyn.org/

https://vlab.amrita.edu/?sub=2&brch=191&sim=344&cnt=1#:~:text=In%20order%20to%20detect%20them,detected%20by%20simple%20chemical%20tests.

PART-D:Assessment andEvaluation

Suggested Continuous Evaluation Methods:
MaximumMarks: 50 Marks
ContinuousInternal Assessment(CIA):15 Marks
EndSemesterExam(ESE):35Marks

Continuous InternalAssessment(CIA): **(By Course Teacher)**	Internal Test / Quiz-(2): **10 &10** Assignment/Seminar +Attendance- **05** Total Marks **-15**	Better marks out of thetwo Test / Quiz **+**obtained marks in Assignment shall be considered against **15** Marks

End Semester Exam (ESE):	**Laboratory / Field Skill Performance: On spot Assessment** **M. Performed the Task based on lab. work - 20 Marks** **N. Spotting based on tools& technology (written) – 10 Marks** **O. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

Name and Signature of Convener & Members of CBoS:

Indira

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Science *(Degree/Honors)*			**Semester - VII**	Session: **2024-2025**
1	**Course Code**	**CHSE-06T**		
2	**Course Title**	**SPECTROSCOPY-I**		
3	**Course Type**	**DSE**		
4	**Pre-requisite** (if, any)	***As per Program***		
5	**Course Learning. Outcomes (CLO)**	➢ ***To equips students with advanced spectroscopic techniques for in-depth molecular analysis.*** ➢ ***To enable classification, isotope effect analysis, and vibrational energy calculations of techniques like microwave and infrared spectroscopy*** ➢ ***To provide detailed information on structure, environment, and electronic configuration on advanced methods like NMR, NQR, and PES.*** ➢ ***To allows students to probe chemical and surface properties of materials using Photoacoustic spectroscopy.*** ➢		
6	**Credit Value**	**3 Credits**	***Credit = 15 Hours - learning & Observation***	
7	**Total Marks**	**Max. Marks: 100**		**Min Passing Marks: 40**

PART -B: Content of the Course

Total No. of Teaching–learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	**Molecular Spectroscopy** Energy levels, molecular orbital, vibronic transitions, vibration progressions and geometry of the excited states, Franck - Condon principle, electronic spectra of polyatomic molecules. Emission spectra: radiative and non-radiative decay, internal conversion, spectra of transition metal complex, charge transfer spectra. **Microwave Spectroscopy** Classification of molecules, rigid rotor model, effect of isotopic substitution on the transition frequencies, intensities, non-rigid rotor. Stark effect, nuclear and electron spin interaction and effect of external field. Applications.	12
II	**Infrared spectroscopy** Review of linear harmonic oscillator, vibrational energy of diatomic molecules, zero point energy, force constant and bond strengths, anharmonicity. Morse potential energy diagram, vibration – rotation Spectroscopy, P, Q, R branches. Breakdown of Oppenheimer approximation, vibration of polyatomic molecules. Selection rules, normal modes of vibration, group frequencies, overtones, hot bands, factors affecting the band positions and intensities, far IR region, metal ligand vibrations, normal co-ordinate analysis. **Raman Spectroscopy** Classical and quantum theories of Raman effect – Pure rotational, vibrational and vibrational–rotational Raman spectra, selection rules, mutual exclusion principle. Resonance Raman Spectroscopy, coherent anti stokes Raman Spectroscopy (CARS)	11
III	**Nuclear Magnetic Resonance Spectroscopy** Nuclear spin, nuclear resonance, saturation, shielding of magnetic nuclei, chemical shift and its measurements, factors influencing chemical shift,	11

	deshielding, spin- spin interactions, factors including coupling constant 'J'. Classification (ABX, AMX, ABC, AB etc), spin decoupling. Basic ideas about instruments, FT NMR, advantages of FT NMR, use of NMR in medical diagnostics. **Nuclear Quadruple Resonance Spectroscopy** Quadruple nuclei, Quadruple moments, electric field gradient, coupling constant, splitting, applications.	
IV	**Photoelectron Spectroscopy** Basic principle: photo-electric effect, ionization process, Koopmans theorem, photoelectron spectra of simple molecules, ESCA, chemical information from ESCA. **Photo acoustic Spectroscopy** Basic principles of photo acoustic spectroscopy (PAS), PAS gases and condensed systems, chemical and surface applications. **Electron Spin Resonance Spectroscopy** Basic principles, zero field splitting and Kramer's degeneracy, factors affecting the 'g' value. Isotropic and anisotropic hyperfine coupling constants, spin Hamiltonian, spin densities and McConnell relationship, measurement techniques, applications.	**11**
Keywords	***Electronic Transitions, Emission Spectra, Isotope Effect, Vibrational Energies, Raman Spectroscopy, Nuclear Magnetic Resonance (NMR), Nuclear Quadrupole Resonance (NQR), Photoelectron Spectroscopy (PES), Photoacoustic Spectroscopy (PAS), Molecular Structure***	

Signature of Convener & Members (CBoS) :

PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

1. *Muthu, K. S. (2010). Applications of spectroscopy. Medtech Publications.*
2. *Ambika, Dr., & Singh, P. P. (2017). Organic spectroscopy. Viva Books.*

References Books Recommended –

1. *Hollas, J. M. (2019). Modern Spectroscopy (John Wiley & Sons).*
2. *Applied Electron Spectroscopy For Chemical Analysis (Wiley-Interscience).*
3. *Parish, R. V. (1983). NMR, NQR, EPR and Mossbauer Spectroscopy in Inorganic Chemistry (Ellis Horwood).*
4. *Drago, R. S. (1977). Physical Methods in Chemistry (Saunders Company).*
5. *Nakamoto, K. (2009). Infrared and Raman Spectra: Inorganic and Coordination Compounds (Wiley).*
6. *Williams, D. H., & Fleming, I. (2010). Spectroscopic Methods in Organic Chemistry (Tata Mcgraw-Hill).*
7. *Dyer, J. R. (1975). Application of Spectroscopy of Organic Compounds (Prentice Hall).*

Online Resources–

- **e-Resources / e-books and e-learning portals**

Online Resources–

- **(https://archive.nptel.ac.in/courses/104/106/104106122/**
- **(https://m.youtube.com/watch?v=o8zELwp358A**
- **https://archive.nptel.ac.in/courses/103/108/103108139/)**
- **(https://nptel.ac.in/courses/104108078)**

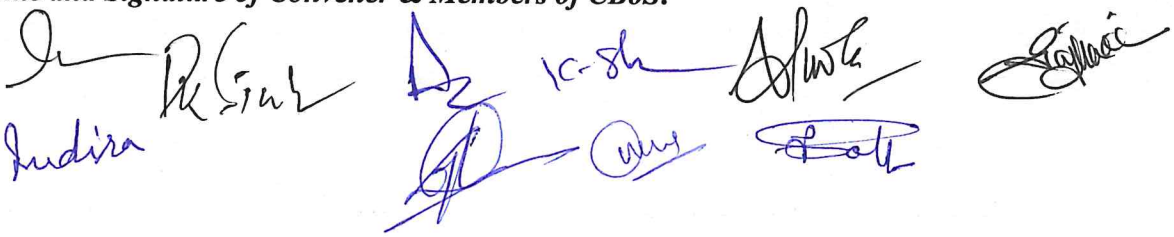
PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment (CIA):	**30 Marks**
End Semester Exam (ESE):	**70 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): **20** +**20** Assignment / Seminar - **10** Total Marks - **30**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20 Marks** Section B: Descriptive answer type qts.,**1out of 2** from each unit-**4x10=40 Marks**	

Name and Signature of Convener & Members of CBoS:



FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Science *(Certificate / Diploma / Degree/Honors)*			**Semester - VII**	Session: **2027-2028**
1	**Course Code**	**CHSE-06P**		
2	**Course Title**	**SPECTROSCOPY-I LAB. COURSE**		
3	**Course Type**	**DSE**		
4	**Pre-requisite** (if, any)	***As per Program***		
5	**Course Learning. Outcomes (CLO)**	➢ ***Understand the fundamental principles of different spectroscopic techniques (Microwave, Infrared, Raman, NMR, UV-Vis (optional) and interpret the data obtained from various spectroscopic experiments.*** ➢ ***Relate the observed spectroscopic features to the structure, bonding, and dynamics of molecules.*** ➢ ***Develop practical skills in operating spectroscopic instrumentation and analyzing data.*** ➢ ***Enhance critical thinking and problem-solving skills in a laboratory setting.***		
6	**Credit Value**	**1 Credits**	***Credit =30 Hours Laboratory or Field learning/Training***	
7	**Total Marks**	**Max. Marks: 50**		**Min Passing Marks: 20**

PART -B: Content of the Course

Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)

Module	Topics (Course contents)	No. of Period
Lab./Field Training/ Experiment Contents of Course	**Rotational Spectroscopy of a Diatomic Molecule (Microwave Spectroscopy):** Analyze the rotational spectrum of simple molecules and calculate its moment of inertia. **Infrared (IR) Spectroscopy of a Simple Molecule:** Record and interpret the IR spectrum of a molecule, identifying functional groups based on characteristic frequencies. **Raman Spectroscopy of a Liquid Sample:** Compare the Raman spectrum of a liquid to its IR spectrum and explore the concept of mutual exclusion principle. **Nuclear Magnetic Resonance (NMR) Spectroscopy of Simple Molecules:** Analyze the ^{1}H NMR spectrum of simple organic molecule, understanding the effects of chemical environment and spin-spin coupling. **(Ultraviolet-Visible (UV-Vis) Spectroscopy of a Conjugated System: Concentration Determination of Using Lambert Beer's Law,** measurement of the UV-Vis spectrum of a chromophore-containing molecule (e.g., conjugated diene, transition metal complex) and analyze the observed absorption bands based on their λ_{max} (wavelength of maximum absorption) values, Investigate the electronic transitions of a conjugated molecules (polyenes and conjugated carbonyls) using UV-Vis spectroscopy, study the formation of a colored complex in a complexation reaction, Calculation of the equilibrium constant using Beer's Law and relevant equations. **ESR:** Common examples include studying free radicals generated during chemical reactions or analyzing organic radicals in biological systems.	**30**

Keywords	*Electronic Transitions, Emission Spectra, Raman Spectroscopy, Nuclear Magnetic Resonance (NMR), Electron Spin Spectroscopy (ESR), UV-Visible Spectroscopy*

Signature of Convener & Members (CBoS) :

PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

1. Mukherjee, P. S. (2009). *Electronic Absorption Spectroscopy and Related Techniques* (1st Ed.). New Age International (Publishers).
2. Sharma, Y. R. (2007). *Elementary organic spectroscopy* (Reprint). S. Chand Publishing.
3. Yadav, D. S. (2004). *Organic spectroscopy*. [Kindle Edition]. doi: 10.1007/978-1-4020-2575-4

Reference Books:

1. Smith, R. A. (1974). *Infrared and Raman Spectra of Inorganic Compounds*. CRC Press.
1. Abraham, R. J., & Settle, F. A. (2011). *Interpreting NMR Spectra*. Wiley-Blackwell.
2. Jaffe, H. H., & Orchin, M. (1962). *UV-Vis Spectral Library of Common Organic Molecules*. Prentice-Hall.
3. Carnevale, A., & Piacenti, P. (2017). *Experimental Techniques in Nuclear Magnetic Resonance Spectroscopy*. Royal Society of Chemistry.
4. Chalmers, J. M., & Griffiths, P. R. (2002). *Handbook of Vibrational Spectroscopy*. John Wiley & Sons, Ltd.

Online Resources–

- **e-Resources / e-books and e-learning portals**

- (https://www.nist.gov/)
- (https://edu.rsc.org/resources/spectroscopy-videos/1041.article)
- (https://acsanalytical.org/)
- (https://nscl.msu.edu/)
- (https://new.nsf.gov/funding/opportunities/nsf-national-quantum-virtual-laboratory-nqvl)
- (https://www.chemtube3d.com/sym-operationsrotations/)

Online Resources–

- **e-Resources / e-books and e-learning portals**

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**50 Marks**
Continuous Internal Assessment (CIA):	**15 Marks**
End Semester Exam (ESE):	**35 Marks**

Continuous Internal Assessment (CIA): **(By Course Teacher)**	Internal Test / Quiz-(2): **10 & 10** Assignment/Seminar +Attendance - **05** Total Marks - **15**	Better marks out of the two Test / Quiz **+** obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory / Field Skill Performance: On spot Assessment** **P. Performed the Task based on lab. work - 20 Marks** **Q. Spotting based on tools & technology (written) – 10 Marks** **R. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

Name and Signature of Convener & Members of CBoS:

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM

PART-A: Introduction				
Program: Bachelors in Science *(Honors/Honors with Research)*		**Semester–VII**		Session:**2024-25**
1	**CourseCode**	**CHSE-07T**		
2	**CourseTitle**	**CHEMICAL KINETICS AND NUCLEAR CHEMISTRY**		
3	**CourseType**	**DSE**		
4	**Pre-requisite(if,any)**	***As per Program***		
5	**CourseLearning. Outcomes(CLO)**	➢ ***To understand types/kinetics of composite reactions and elucidate mechanism and derive rate laws, calculate various activation parameters and predict feasibility of reaction of its basis.*** ➢ ***To explain the concept of acidity functions and illustrate the various rate correlations, isotopic effect and solvent effect.*** ➢ ***To discuss various aspects of nuclear models, nuclear reactions and nuclear reactors.*** ➢ ***To understand the principles of radioactivity, its measurements, counters, apply in determining reaction mechanism, structures, physicochemical properties and in chemical analysis.***		
6	**CreditValue**	**03Credits**	***Credit = 15 Hours - learning & Observation***	
7	**TotalMarks**	**Max.Marks:100**		**MinPassingMarks:40**

PART-B: Content of the Course

TotalNo.of Teaching–learning Periods(01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics(Coursecontents)	No.of Period
I	**Kinetics of CompositeReactions** Types of composite mechanism, rate equation for composite mechanisms- simultaneous and consecutive reactions, microscopic reversibility, some inorganic mechanisms- formation and decomposition of phosgene, decomposition of nitrogen pentoxide and ozone and thermal para-ortho hydrogen conversion. **Kinetics of Catalytic Reactions** Kinetics of acid-base catalysis: general and specific, hydrolysis of ester and amide; Enzyme catalysis, Micellar catalysis. **Activation Parameters** Activation parameters from experimental results- Arrhenius factor, standard free energy of activation, standard enthalpy of activation, entropy of activation and their physical significance.	**12**
II	**Acidity function and various rate correlations** Hammett acidity function, various treatments of rate correlation, Linear Free Energy Relationship (LFER), The Hammett equation, Zucker-Hammett hypothesis, Bunnett-Olsen parameter. **Isotopic Effect** Theory of isotopic effects; Primary and secondary kinetic isotope effects. Heavy atom isotope effects, Tunneling effect. Kinetic solventeffects. **Solvent Effect** Qualitative theory of influence of solvent on reaction rate; Solvent effect in terms of dielectric constant, Grunwald - Weinstein parameter, Z and E values. Application of solvent polarity, Koppel - Palmtreatment.	**11**

III	**Nuclear Models** Shell model – magic numbers, salient features and merits; liquid drop model – analogy with liquid drop, merits, semi-empirical equation; Fermi gas model; collective model and opticalmodel. **Nuclear Reactions** Nuclear fusion and fission; Nuclear fission – mass, energy and charge distribution of fission products; fission neutrons; liquid drop model. **Nuclear Reactors** Natural uranium reactors, classification of reactors – typical reactors, Breeder reactor.	11
IV	**Radioactivity** General characteristics of radioactive decay and decay kinetics, measurement of radioactivity: Ionization chamber, electron pulse counters – variation of pulse size with voltage, Geiger-Muller counter, proportional counter and scintillation counters. **Applications of Radioactivity** Typical applications of radioisotopes as tracers; chemical investigation – reaction mechanism and structure determination; physicochemical applications – solubility of sparingly soluble and surface area of a powder; analytical applications – isotope dilutionanalysisand neutron activation analysis; age determination and medical applications.	11
Keywords	***Kinetics, composite reactions, catalytic reactions, activation parameters, acidity function, isotopic effect, nuclear models, radioactivity.***	

Signature of Convener & Members (CBoS):

PART–C

LearningResources:Textbooks,ReferenceBooksandOthers

Textbooks Recommended–

1. Arnikar, H. J. (1995). *Essentials of nuclear chemistry* (No. 1653). New Age International.

Reference Books Recommended–

1. Laidler, K. J., & Keith, J. (1965). *Chemical kinetics* (Vol. 2). New York: McGraw-Hill.
2. Chorkendorff, I., & Niemantsverdriet, J. W. (2017). *Concepts of modern catalysis and kinetics*. John Wiley & Sons.
3. Vannice, M. A., & Joyce, W. H. (2005). *Kinetics of catalytic reactions* (Vol. 134). New York: Springer.Investigation of Reduction Rates and Mechanism of Reactions. Edward Lewis.

OnlineResources–e-Resources/e-booksande-learningportals

- **https://chem.libretexts.org/Bookshelves/General_Chemistry/Map%3A_Chemistry_-_The_Central_Science_(Brown_et_al.)/14%3A_Chemical_Kinetics/14.S%3A_Chemical_Kinetics_(Summary)**
- **https://www.vssut.ac.in/lecture_notes/lecture1425072667.pdf**
- **https://www.khanacademy.org/science/chemistry/chem-kinetics/arrhenius-equation/a/types-of-catalysts**
- **https://wou.edu/chemistry/courses/online-chemistry-textbooks/ch103-allied-health-chemistry/ch103-chapter-3-radioactivity/**
- **https://www.orano.group/en/unpacking-nuclear/all-about-radioactivity**

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment (CIA):	**30 Marks**
End Semester Exam (ESE):	**70 Marks**

Continuous InternalAssessment (CIA): **(By Course Teacher)**	Internal Test / Quiz-(2): **20 &20** Assignment / Seminar - **10** Total Marks - **30**	Better marks out of the two Test / Quiz **+** obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20 Marks** Section B: Descriptive answer type qts.,**1out of 2** from each unit-**4x10=40 Marks**	

Name and Signature of Convener and Members of CBoS

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Science *(Honors/ Honors with Research)*		**Semester - VII**		Session: **2024-2025**
1	**CourseCode**	**CHSE-07P**		
2	**CourseTitle**	**CHEMICAL KINETICS AND NUCLEAR CHEMISTRY LAB. COURSE**		
3	**CourseType**	**DSE**		
4	**Pre-requisite(if,any)**	*As per Program*		
5	**Course Learning Outcomes(CLO)**	➢ *To understand basic concepts in Physical Chemistry through experiential learning.* ➢ *To acquaint with the basic principles of equipment/instruments and its applications.* ➢ *To determine the order of reaction with respect to various reactants and overall order and activation parameters using experimental data.* ➢ *To acquire the knowledge of radioactive decay and GM counter.*		
6	**Credit Value**	**01Credit**	*(Credit = 30 Hrs laboratory or Field learning / training)*	
7	**Total Marks**	**Max.Marks:50**	**MinPassingMarks:20**	

PART -B: Content of the Course

Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)

Module	Topics(Course contents)	No. of Period
Lab./Field Training/ Experiment Contents of Course	**Chemical Kinetics** 1. Determination of the effect of (a) Change of temperature (b) Change of concentration of reactants and catalyst and (c) ionic strength of the media on the velocity constant of hydrolysis of an ester/ionic reactions. 2. Determination of the rate constant for the oxidation of iodide ions by hydrogen peroxide studying the kinetics as an iodine clock reaction. **Polarimetry** 1. Determine the specific and molecular rotation of optically active substance. 2. To determine the concentration of a solution of an optically active substance. **Viscosity** 1. To determine viscosity of an organic liquid using Ostwald viscometer. 2. To verify Kendall's equation. 3. To study the variation of viscosity with temperature. 1. To study the effect of concentration of the reactant and catalysts on the rate of hydrolysis of ester. 2. To study the effect of temperature, concentration of the reactant and catalysts on the rate of hydrolysis of ester and to calculate energy of activation, frequency factor, enthalpy of activation, entropy of activation and free energy of activation.	**30**

	3. To study the kinetics of saponification of ethyl acetate by (a)Volumetric method (b) Conductometric method 4. To study the influence of ionic strength on the reaction between potassium persulphate and iodide. 5. To study the Kinetics of reaction between H_2O_2 and KI. 6. To study the kinetics of reaction between sodium formate and iodine. 7. To study the kinetics of reaction between acetone and iodine. 8. To determine the rate constant of hydrolysis / inversion of sugar using polarimeter and factors effecting. 9. To study some simple enzyme catalysed reaction. 10. To determine plateau and optimal operating voltage of Geiger-Muller counter. 1. To determine the dead time or resolving time of GM counter. 2. Simulation of Radioactive decay using rolling of dice.	
Keywords	***Chemical Kinetics, nuclear chemistry, Activation energy,GM counter, Decay kinetics***	

Signature of Convener &Members (CBoS):

PART–C

LearningResources:TextBooks,ReferenceBooksandOthers

Textbook Recommended-

1. *Athawale, V. D., & Oza, N. R. (2001). Experimental physical chemistry. New Age International Publishers.*
2. *Bahl, B. S., Bahl, A., & Tuli, G. D. (2018). Essentials of physical chemistry (Vol. 2: Practical physical chemistry). S. Chand Publishing.*

Reference Books Recommended

1. *Friedlander, G., Kennedy, J. W., Miller, J. M., Seaborg, G. T., & Nuclear Regulatory Commission. (2014). **Radiochemistry and nuclear chemistry** (Vol. 2: Practical radiochemistry).*

OnlineResources–

https://www.mdpi.com/books/reprint/4856-synthesis-and-characterization-of-nanomaterials
https://swayam.gov.in
https://epathshala.nic.in
http://as.wiley.com/WileyCDA/WileyTitle/productCd-EHEP000803.html

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 50 Marks
Continuous Internal Assessment (CIA): 15 Marks
End Semester Exam (ESE): 35 Marks

Continuous Internal Assessment (CIA): **(By Course Teacher)**	Internal Test / Quiz-(2): **10 & 10** Assignment/Seminar +Attendance - **05** Total Marks - **15**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam(ESE):	**Laboratory/Field Skill Performance : on spot Assessment** **A: Perform task Based on the lab work- 20 Mark** **B: Spotting Based on tools and techniques- 10 marks** **C: Viva-voce (Based on principle/technology)-05 Marks**	**Managed by Course teacher as per Lab. Status.**

Name and Signature of Convener & Members of CBoS:

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM

PART-A: Introduction				
Program: Bachelors in Science *(Certificate/Diploma /Degree/Honors)*			Semester–VII	Session:2024-2025
1	CourseCode	CHSE-08T		
2	CourseTitle	ELECTRO CHEMISTRY & SURFACE CHEMISTRY		
3	CourseType	DSE		
4	Pre-requisite(if,any)	*As per Program*		
5	CourseLearning. Outcomes(CLO)	➢ *Understand electrochemistry fundamentals, explain laws and industrial applications* ➢ *To explain and derive equations related to the theory of strong electrolytes – Debye-Huckel law and its extensions, structure/models and thermodynamics of electrified interfaces, polarography and its applications.* ➢ *To describe and interpret various adsorption isotherms and its applications, concept and various aspects of micelles.* ➢ *To understand the fundamentals, types, and applications of surfactants and micelles.*		
6	CreditValue	03Credits	*Credit = 15 Hours - learning & Observation*	
7	TotalMarks	Max.Marks:100		MinPassingMarks:40

PART-B: Content of the Course

TotalNo.of Teaching–learning Periods(01 Hr. per period) - 45 Periods (45 Hours)

Module /Unit	Topics(Coursecontents)	No.of Period
I	**Electrochemistry-1** Electrolyte conductance: specific and equivalent conductance, measurement of equivalent conductance, effect of dilution on conductance, Kohlrausch law, application of Kohlrausch law indetermination of dissociation constant of weak electrolyte, solubility of sparingly soluble electrolyte, absolute velocity of ions, ionic product of water, conductometric titrations. Single electrode potential, standard electrode potential, electrochemical series and its applications. Concept of overvoltage.	12
II	Theory of strong electrolyte: limitation of Ostwald's dilution law weak and strong electrolyte, Debye-Huckel-Onsager's(DHO) equation for strong electrolytes, relaxation, and electrophoretic effect. Migration of ions: Transport number-definition and determination by Hittorf method and movingboundary method. Electrochemical cells or Galvanic cells: reversible and irreversible cells, conventional representation of electrochemical cells. EMF of a cell, effect of temperature on EMF of cell, Nernst equation calculation of ΔG, ΔH andΔ S for cell reaction.	11
III	**Electrochemistry-2** Electrochemistry of solutions: Ion- solvent interactions, Debye-Huckel theory for activity coefficient of electrolyte solutions, ionic strength, Debye-Huckel limiting law, Debye- Huckel- Onsager treatment and its extension. Thermodynamics of electrified interface equations: Derivation of electro-capillarity, Lippmann equations, determination of surface excess. Structure of electrified interfaces: Guoy-Chapman and Stern models. Over	11

	potentials, exchange current density, derivation of Butler-Volmer equation. Tafel plot. Polarography theory - Ilkovic equation, half wave potential and its significance.	
IV	**Surface Chemistry** Adsorption Surface tension, capillary action, pressure difference across curved surface (Laplace equation), Gibbs adsorption isotherm, BET equation and estimation of surface area using BETequation. **Micelles** Surface active agents, classification of surface active agents, micellization, critical micellar concentration (CMC), factors affecting the CMC of surfactants, counter ion binding to micelles, thermodynamics of micellization, reverse micelles.	**11**
Keywords	***Electrochemistry, Kohlrausch law, electrode potential, standard electrode potential, electrochemical series, Debye-Huckel limiting law, surface chemistry, micelles, adsorption.***	

Signature of Convener & Members (CBoS):

PART–C

LearningResources:Textbooks,ReferenceBooksandOthers

Textbooks Recommended–

1. Soni, P. L., & Mahajan, S. N. (2013). **A textbook of physical chemistry** (Vol. 3: Electrochemistry and surface chemistry). Sultan Chand & Sons.
2. Rakshit, P. C. (2009). **A textbook of physical chemistry** (Vol. 2: States of matter). Tata McGraw-Hill Education.

Reference Books Recommended–

1. Moroi, Y. (2013). *Micelles: theoretical and applied aspects*. Springer Science & Business Media.
2. Glasstone, S. (2011). *An introduction to electrochemistry*. Read Books Ltd.
3. Plieth, W. (2008). *Electrochemistry for materials science*. Elsevier.
4. Bikerman, J. J. (2013). *Surface chemistry: theory and applications*. Elsevier.
5. Somorjai, G. A., & Li, Y. (2010). *Introduction to surface chemistry and catalysis*. John Wiley & Sons.

OnlineResources–e-Resources/e-booksande-learningportals

- https://ceramrtr.ceramika.agh.edu.pl/~szyszkin/eis/Modern%20Electrochemistry%20Vol%202B%20Electrodics%20in%20Chemistry,%20Engineering.pdf
- https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SCYA5303.pdf
- https://www.genesis-tutorials.com/wp-content/uploads/2018/04/Surface-chemistry.pdf
- https://study.com/academy/lesson/micelles-biology-structure-function.html

Part-D:Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment(CIA):	**30 Marks**
EndSemester Exam(ESE):	**70 Marks**

Continuous InternalAssessment (CIA): **(By Course Teacher)**	Internal Test / Quiz-(2): **20 &20** Assignment / Seminar - **10** Total Marks - **30**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam(ESE):	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20Marks** Section B: Descriptive answer type qts.,**1out of 2** from each unit-**4x10=40 Marks.**	

Name and Signature of Convener and Members of CBoS

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Science *(Honors/Honors with Research)*		**Semester - VII**		Session: **2024-2025**
1	**CourseCode**	**CHSE-10P**		
2	**CourseTitle**	**NANOTECHNOLOGY AND SOLID STATE LAB. COURSE**		
3	**CourseType**	**DSE**		
4	**Pre-requisite(if,any)**	*As per Program*		
5	**CourseLearning.Outcomes(CLO)**	➢ *The consolidation of knowledge about the structure-property relationship of solids through the self-directed synthesis, structure and property determination* ➢ *To apply the knowledge gained on the synthesis, structure and function of solid-state compounds.* ➢ *To acquire knowledge to synthesize nanomaterials and interpret its characteristics.* ➢ *To acquire the knowledge of basic sciences required to understand the fundamentals of nanomaterials*		
6	**CreditValue**	**01Credit (Practical)**	*(Credit = 30Hrs laboratory or Field learning / training)*	
7	**TotalMarks**	**Max.Marks:50**		**MinPassingMarks:20**

PART-B: Content oftheCourse

TotalNo.ofTraining/performancePeriods (01Hr.perperiod)(30 Period 30hours)

Module	Topics(Coursecontents)	No.of Period
Lab./Field Training/ Experiment Contents of Course	Preparation of several solid-state compounds using different synthesis methods Characterization of the compounds by FTIR and X-ray diffraction Analysis of the crystal structures and the properties of the prepared solids Synthesis and characterization of nanoparticle of Fe_3O_4 by chemical method. Synthesis of graphene oxide from graphene by chemical methods. Synthesis of graphene oxide from graphene by green methods. Synthesis and characterization of Ag nano-particles by green method. Synthesis and characterization of Ag nano-particles by chemical method. Synthesis and characterization of Cu nano-particles by green method. Synthesis and characterization of Cu nano-particles by chemical method. Synthesis and characterization of Ni nano-particles by chemical method. Synthesis and characterization of Ni nano-particles by green method Microwave synthesis of materials. organic compounds. The Nano World. Nanomaterials and Their Synthesis. Characterization Methods for Studying Nanomaterials. Laboratory Safety and Scientific Report Writing.	**30**
Keywords	*X-ray Diffraction;Microwave Synthesis,Nanomaterails, Charecterization, Green Methods.*	

Signature of Convener &Members (CBoS):

PART–C

Learning Resources: Text Books, Reference Books and Others

TextBooks Recommended-

1. *Venkatraman, D., Mukhopadhyay, C., & Das, K. (2018).* ***Introduction to nanoscience and nanomaterials****. McGraw-Hill Education.*
2. *Byrappa, K., & Yoshimura, M. (2010).* ***Functional nanomaterials and devices****. Elsevier.*
3. *Kumar, S. (2018).* ***Green chemistry for sustainable development****. Springer Nature Singapore Pte Ltd.*

Reference Books Recommended-

1. Rao, C. N. R., Müller, A., & Cheetham, A. K. (2007). Nanomaterials chemistry. Wiley-VCH.
2. Chakravarty, A., & Singh, P. (2024). Green synthesis of nanomaterials: Biological and environmental applications. Wiley.
3. Sharon, M. (2018). **Green processes and sustainable chemistry**. Springer Nature Singapore Pte Ltd.
4. Anastas, P. T., & Warner, J. C. (1998). **Green chemistry: Theory and applications**. Oxford University Press.

OnlineResources–

- **https://www.mdpi.com/books/reprint/4856-synthesis-and-characterization-of-nanomaterials**
- **https://swayam.gov.in**
- **https://epathshala.nic.in**
- http://as.wiley.com/WileyCDA/WileyTitle/productCd-EHEP000803.html

Web Resources :-

Not Voodoo
The Safety Net
Comp Chem Website

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment (CIA):	**30 Marks**
End Semester Exam (ESE):	**70 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): **20 ~~/20~~** Assignment / Seminar - **10** Total Marks - **30**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20 Marks** Section B: Descriptive answer type qts.,**1out of 2** from each unit- **4x10=40 Marks**	

Name and Signature of Convener & Members of CBoS:

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF BOTANY
COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Sciences *(Honors)*			**Semester - VII**	Session: **2024-2025**
1	**Course Code**	**BOSC- 07 T**		
2	**Course Title**	**Ecology and Phytogeography**		
3	**Course Type**	**Discipline Specific course (DSC)**		
4	**Pre-requisite** (if, any)	*As per program*		
5	**Course Learning. Outcomes (CLO)**	At the end of this course, students will be able to understand: ▪ The interrelationship between organisms and environment. ▪ Methods to study vegetation, community patterns and processes, ecosystem functions, and principles of phytogeography. ▪ Evolving strategies for sustainable natural resource management and biodiversity conservation. ▪ Climatic changes and its restoration ▪ Familiar with sustainable development		
6	**Credit Value**	**3 Credits**	*Credit = 15 Hours - learning & Observation*	
7	**Total Marks**	**Max. Marks: 100**	**Min Passing Marks: 40**	

PART -B: Content of the Course

Total No. of Teaching–learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	Ecological Factors and Management : Climatic- light; temperature, air and water, topographic, edaphic, soil formation soil texture, type of soil, soil profile, classification, physio-chemical properties, soil organic matter, biotic factors, interrelationships, major soil type of the world. Ecological management: Concepts, sustainable development, sustainability indicators.	12
II	. Ecosystem Organization : Structure and function, primary production (methods of measurements, global pattern, controlling factors), energy dynamics, trophic organization, energy flow pathways, ecological efficiencies, litter fall and decomposition- mechanism, substrate quality and climate factors, global biogeochemical cycle of C, N, P, S, minerals cycle- pathways, processes, budgets in terrestrial and aquatic ecosystem.	11
III	**Community and Eco-Stability** Concepts of community and continuum, analysis of communities (analytical and synthetic characters), community coefficients, inter-specific associations, ordination, concept of ecological niche. Vegetation Development: Temporal changes (cyclic and non-cyclic), mechanism of ecological successions (relay floristic and initial floristic composition, facilitation, tolerance and inhibition models), changes in ecosystem properties during succession. Ecological Stability: Concept of resistance and resilience, ecological perturbations (natural and anthropogenic) and their impact on plants and ecosystem, ecology of plant invasion, environmental impact assessment, ecosystem restoration.	11
IV	**Phytogeography Pollution, Climatic Changes** Phytogeographical regions of India with reference to Chhattisgarh. Pollution : Air, Water, Soil & Sound - kinds, sources, quality parameters, effect on plans and ecosystem. Climate change: Green house gases(CO_2, CH_4, N_2O, CFCs) sources, trends and role, ozone layer and ozone hole, consequences of climate changes, (CO_2 fertilization, global warming, sea level rise, UV radiation).	11
Keywords	Ecological Factors community and continuum ecosystem ,Phytogeographical ,climate changes	

Signature of Convener & Members (CBoS) :

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PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

1. Brady, N. C. (1990) The Nature and Properties of Soil Macmillan, Sydney, Australia.
2. Begon, M; Harper, J. L. And Townsend, C. R. (1996) Ecology. Blackwell Science, Cambridge, USA
3. Chapman, J. L. and Raiss, M. J. (1988) Ecology: Principles and Applications. Cambridge Univ. Press, Cambridge, U.K.
4. Kumar, H. D. (1986) Modern Concept of Ecology, Vikas Publishing House Private Ltd., New Delhi.

Reference books:

1. Hill, M. K. (1997) Understanding Environmental Pollution. Cambridge Univ. Press, Cambridge, U. K.
2. Odum, E. P. (1971) Fundamentals of Ecology. Saunders, Phildelphhia.
3. Odum, E. P. (1983) Basic Ecology. Saunders, Philasephia

Online Resources–

- **e-Resources / e-learning portals**
- **www.swayam.ac.in**
- **www.ignou.ac.in**
- **www.egyankosh.ac.in**
- **www.iitm.ac.in**
- **www.eskillindia.org**
- **www.eshiksha.mp.gov.in**
- **www.vlab.co.in**
- **www.internshala.com**
- **www.ndl.iitkgp.ac.in**

Online Resources–

- **e-Resources / e-books and e-learning portals**

- **https://courses.lumenlearning.com/wm-biology2/chapter/community-structure-and-dynamics/**
- https://education.nationalgeographic.org/resource/ecosystem/

- **https://www.embibe.com/exams/ecological-factors/**
- **https://www.sciencedirect.com/topics/earth-and-planetary-sciences/environmental-pollution#:~:text=Environmental%20pollution%20is%20unwarranted%20disposal,both%20quantitatively%20and%20qualitatively%20(Hussain%2C**
- https://onlinecourses.nptel.ac.in/noc24_ce03/preview

- https://onlinecourses.swayam2.ac.in/nou24_ge10/preview

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment (CIA):	**30 Marks**
End Semester Exam (ESE):	**70 Marks**

Continuous Internal Assessment (CIA): 30 **(By Course Teacher)**	Internal Test / Quiz-(2): **20 +20** Assignment / Seminar - **10** Total Marks - **30**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE): 70	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20 Marks** Section B: Descriptive answer type qts.,**1out of 2** from each unit-**4x10=40 Marks**	

Name and Signature of Convener & Members of CBoS:

(1) (2) (3) (4) (5) (6) (7) (8) (9) (10)

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF BOTANY
COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Sciences *(Honors)*			**Semester - VII**	Session: **2024-2025**
1	**Course Code**	**BOSC-07**		
2	**Course Title**	**Lab. Course – 07 (Ecology and Phytogeography)**		
3	**Course Type**	**Laboratory course**		
4	**Pre-requisite** (if, any)	***As per program***		
5	**Course Learning. Outcomes (CLO)**	➢ Students will be able to determine frequency, abundance and density of any area. ➢ Learn community relationships of plants. ➢ Understand IVI and biomass. ➢ Can determine diversity indices. ➢ Biodiversity of different ecosystems ➢ Interaction among different community ➢ Pollution and its effect		
6	**Credit Value**	**1 Credits**	***Credit =30 Hours Laboratory or Field learning/Training***	
7	**Total Marks**	**Max. Marks: 50**	**Min Passing Marks: 20**	

PART -B: Content of the Course

Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)

Module	Topics (Course contents)	No. of Period
Lab./Field Training/ Experiment Contents of Course	1. to determine minimum size and number of quadrates required for reliable estimate o biomass in grass land ecosystem. 2. To study the frequency, abundance and density of plants in the local ecosystem by quadrat method. 3. To determine gross and net productivity by light and dark bottle method. 4. To determine soil moisture content, porosity and bulk density of soil collected from different locations. 5. To determine the water holding capacity of various soils. 6. To determine the basal cover, or vegetational cover of one herbaceous community by quadrat method. 7. To determine IVI of the grass land. 8. To measure the above-ground plant biomass in a grassland. 9. To determine diversity indices (richness, Simpson, Shannon-Wiener) in grazed an protected grassland. 10. Experiment on Physico-Chemical Analysis of Water (pH, Temperature, etc. 11. To determine transparency or turbidity of different water bodies. 12. To measure the amount of dissolved oxygen in pond water. 13. To determine the total dissolved solids (TDS) in water 14. To measure the amount of BOD in different types of water. 15. Ombrothermic diagram of your locality.	**30**
Keywords	***Quadrate, Productivity, Turbidity ,TDS.***	

Signature of Convener & Members (CBoS) :

PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

1. Bendre and Kumar, 2018. A text book of botany practical , Vol-2
2. Raj Mandeep, 2022. Principles of ecology .
3. Rao K S, 1993 Practical Ecology
4. Ashok K. Rathoure Bioremediation: Current Research and Applications .

Text Books Recommended –

1. Penny A. Cook, James R. Bell , C. Philip Wheater , 2011.Practical Field Ecology: A Project Guide
2. D. D. Gilbertson , M. Kent , F. B. Pyatt, 1985. Practical Ecology for Geography and Biology
3. Masood, A.A. A text book of botany practical , Edn.-5
4. Gaurav Saxena Vineet Kumar and Maulin P. Shah . Bioremediation for Environmental Sustainability: Toxicity, Mechanisms of Contaminants Degradation, Detoxification and Challenges .

Online Resources–

- **e-Resources / e-books and e-learning portals**
- **www.swayam.ac.in**
- **www.ignou.ac.in**
- **www.egyankosh.ac.in**
- **www.iitm.ac.in**
- **www.eskillindia.org**
- **www.eshiksha.mp.gov.in**
- **www.vlab.co.in**
- **www.internshala.com**
- **www.ndl.iitkgp.ac.in**

Online Resources–

- **e-Resources / e-books and e-learning portals**

- https://ecologicalprocesses.springeropen.com/articles/10.1186/s13717-022-00401-0
- https://www.internationalscholarsjournals.com/articles/applied-ecology-and-its-economical-applications-88784.html
- https://link.springer.com/book/10.1007/978-981-15-3372-3
- https://www.jstor.org/stable/2405009
- https://en.wikipedia.org/wiki/Bioremediation
- https://www.sciencedirect.com/topics/earth-and-planetary-sciences/bioremediation
- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5026719/
- https://www.ysi.com/parameters/turbidity
- https://www.davidzeleny.net/wiki/doku.php/vegsurvey:materials:how_to_calculate_ivi

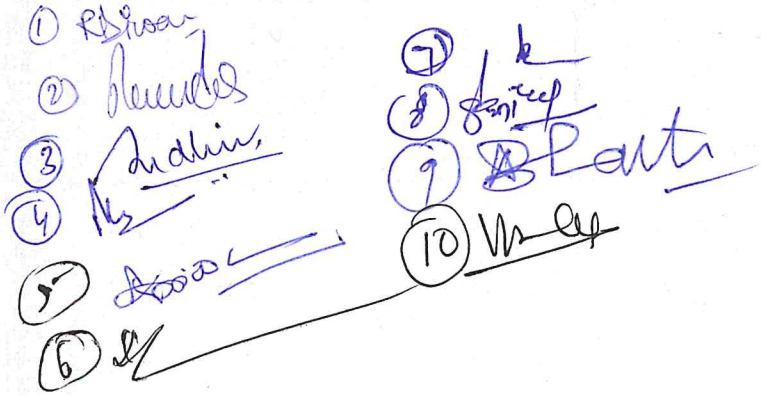
PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**50 Marks**
Continuous Internal Assessment (CIA):	**15 Marks**
End Semester Exam (ESE):	**35 Marks**

Continuous Internal Assessment (CIA): 15 **(By Course Teacher)**	Internal Test / Quiz-(2): **10 & 10** Assignment/Seminar +Attendance - **05** Total Marks - **15**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE): 35	**Laboratory / Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work - 20 Marks** **B. Spotting based on tools & technology (written) – 10 Marks** **C. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

Name and Signature of Convener & Members of CBoS:



FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF BOTANY
COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Honors)*			**Semester - VII**	Session: **2024-2025**
1	**Course Code**	**BOSE-05 T**		
2	**Course Title**	**Biosystematics and Biodiversity**		
3	**Course Type**	**Discipline Specific elective (DSE)**		
4	**Pre-requisite** (if, any)	***As per program***		
5	**Course Learning. Outcomes (CLO)**	*At the end of the course, the students will be able :* ➢ Understand different classification and nomenclature system in botany. ➢ Learn plant collection and preservation techniques . ➢ Get knowledge about the biodiversity and its importance. ➢ Analyse the different conservation practices for nature.		
6	**Credit Value**	**3 Credits**	***Credit = 15 Hours - learning & Observation***	
7	**Total Marks**	**Max. Marks: 100**	**Min Passing Marks: 40**	

PART -B: Content of the Course

Total No. of Teaching–learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	Definition and basic concepts of biosystematics taxonomy and classification. History and theories of biological Classification. Difference between botanical and zoological nomenclature system. Trends in biosystematics: Chemotaxonomy, cytotaxonomy and molecular taxonomy. Dimensions of speciation.	12
II	Taxonomic procedures: Taxonomic collections, preservation, process of identification. Taxonomic keys, different types of keys, their merits and demerits. How to use flora, Species concepts: Typological, Nominalist and Biological species concepts. Subspecies and other infra-specific categories.	11
III	Biodiversity : Concept and level, role of biodiversity in ecosystem, function and stability, speciation and extinction, IUCN categories of threat, distribution and global pattern, terrestrial biodiversity, hot spots. Plant biodiversity: Concept, status in India, utilization and concerns.	11
IV	Principal of Conservation: *In-situ* conservation: Strategies for In situ conservation, international efforts and Indian initiatives, protected areas in Indian sanctuaries, national parks, biosphere reserves, wetland, mangroves and coral reefs for conservation of wild biodiversity. Ex-situ Conservation: Strategies for *Ex- situ* conservation, Principles and practices, Botanical gardens, gene bank, seed in vitro repositories, cryo banks.	11
Keywords	***Chemotaxonomy, Cladogram, Biodiversity, Conservation.***	

Signature of Convener & Members (CBoS) :

PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

1. Kochar, S. L. (1998) Economic Botany of The Tropics. McMillan India Ltd., New Delhi.
2. Paroda, R. S. and Arora R. K. (1991) Plant Genetic Resources and Conservation and Management IPGRI (publications). South Asia Office, c/o NBPGR, Pusa Campus, New Delhi.
3. Scheri, R. W. (1972) Plants for Man. Englewood Cliffs, New Jersey, Prentice Hall.
4. Annonymous (1997) National Gene Bank. Indian Heritage on Plant Genetic Resources (Booklet) NBPGER, New Delhi.
5. Swaminathan, M. S. And Kocchar (1989) Plants and Society, MacMillan Publication Ltd. London.
6. Kothari, A. (1997) Understanding Bio-Diversity: Life Sustainability and Equity. Orient Longam
7. Johri, B.M. (1984). Embryology of Angiosperms. Springer-Verlag, Berlin
8. Singh, G. (2012) Phant Systematics. Theory and Practice. Oxford & IBH Pvt. Ltd, New Delhi.
9. Bhojwani, SS. & Bhatnagar, SP (2011). Embryology of Angiosperms. Vikas Publication House Pvt. Lid. New Delhi 5 edition
10. Mauseth. 1.1) (1988) Plant Anatomy. The Benjamin Cummings Publisher. USA
11. Pandey, B. P. (LatesEdt), Plant Anatomy
12. Maheshwari, J.K. (1963). Flora of Delhi. CSIR, New Delhi.
13. Saxena N.B. and Saxena S. (2012). Plant Taxonomy Pragati Prakashan.
14. Sharma O.P. (2013). Plant Taxonomy. MC GRAW HILL INDIA.
15. Sharma, M.K. (2013) Plant Structures (An Introduction to Plant Anatomy). VayuEducation of India.
16. Chopra G.L. (2005) Angiosperm, Pradeep Publication, Jalandhar.

Reference Books Recommended –

1. Rogers, P.P., Jalal, K.F. and Boyd, J.A. (2008). An Introduction to Sustainable Development. Prentice Hall of India Private Limited, New Delhi.
2. Radford, A.E. (1986). Fundamentals of Plant Systematics. Harper and Row, New York
3. Jeffrey, C. (1982). An Introduction to Plant Taxonomy. Cambridge University Press,Cambridge.
4. Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F. (2002). Plant Systematics-APhylogenetic Approach. Sinauer Associates Inc., U.S.A. 2 nd edition.
5. Simpson, M.G. (2006) Plant Systematics. Elsevier Academic Press, San Diego, CA, USA
6. Beck, C.B. (2010). An Introduction to Plant Structure and Development, II edition.
7. Heywood, V. (1995) Global Bio-Diversity Assessment, UNEP. Cambridge Univ. Press, Cambridge, U.K.
8. Heywood, V.H. and Wyse Jackson, P. S. (1991) Tropical Botanical Garden: Their Role in Conservation and Developinent. Academic Press, San Digo.
9. Barker, H. G. (1978) Plant and Civilization. C. A. Wadsworth, Belmont.
10. Frankel, O. H., Brown, A. H. D. and Burdon, J. J., (1995) Conservation, of Plant Diversity. Cambridge Univ. Press, Cambridge, U. K.
11. Pinstrup- Anderson, P. Et Al (1999) World Food Prospects; Critical Issues for Early 21st Century. International Food Policy Research Institute, Washington D. C. USA.
12. Rogers, N. A. And Panwar, H. S. (1998) Planning A Wild Life Protected Area Network In India Vol. I The Report, Wildlife Institute Of India, Dehradun.

Online Resources–

e-Resources / e-books and e-learning portals

- **https://www.sciencedirect.com/topics/social-sciences/natural-resource**
- **https://efaidnbmnnnibpcajpcglclefindmkaj/https://egyankosh.ac.in/bitstream/123456789/66166/2/Unit4.pdf**
- **https://efaidnbmnnnibpcajpcglclefindmkaj/https://www.ers.usda.gov/webdocs/publications/41964/30289_biological.pdf?v=0#:~:text=16-,What%20Are%20Biological%20Resources%3F,forests%2C%20and%20other%20natural%20lands.**
- http://surl.li/spcdd
- https://shorturl.at/ewyIP
- https://shorturl.at/cimoF

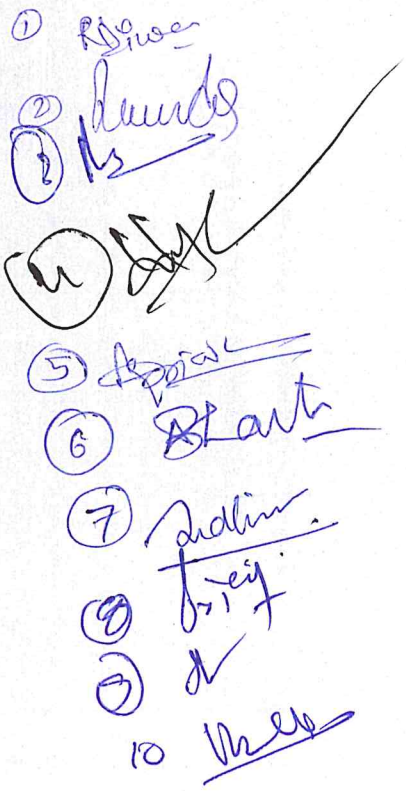
Online Resources–

e-Resources / e-books and e-learning portals

- **www.swayam.ac.in**
- **www.ignou.ac.in**
- **www.egyankosh.ac.in**
- **www.iitm.ac.in**
- **www.eskillindia.org**
- **www.eshiksha.mp.gov.in**
- **www.vlab.co.in**
- **www.internshala.com**
- **www.ndl.iitkgp.ac.in**

PART -D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: **Maximum Marks:** **100 Marks** **Continuous Internal Assessment (CIA):** **30 Marks** **End Semester Exam (ESE):** **70 Marks**		
Continuous Internal Assessment (CIA): 30 **(By Course Teacher)**	Internal Test / Quiz-(2): **20 +20** Assignment / Seminar - **10** Total Marks - **30**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE): 70	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20 Marks** Section B: Descriptive answer type qts.,**1out of 2** from each unit-**4x10=40 Marks**	

Name and Signature of Convener & Members of CBoS:



FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF BOTANY

COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Honours)*			**Semester - VII**	Session: **2024-2025**
1	**Course Code**	**BOSE-05 P**		
2	**Course Title**	**Lab course -05 (Biosystematics and Biodiversity)**		
3	**Course Type**	**Laboratory course**		
4	**Pre-requisite** (if, any)	***As per program***		
5	**Course Learning. Outcomes (CLO)**	At the end of this course, students will be able to: ➢ Understand collection and preservation techniques for plants. ➢ Learn use of flora for plant identification. ➢ Understand about protected area of the country ➢ Analyze various IUCN categories of threats.		
6	**Credit Value**	**1 Credits**	***Credit =30 Hours Laboratory or Field learning/Training***	
7	**Total Marks**	**Max. Marks: 50**	**Min Passing Marks: 20**	

PART -B: Content of the Course		
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)		
Module	**Topics (Course contents)**	**No. of Period**
Lab./Field Training/ Experiment Contents of Course	• Herbarium technique. • Non destructive collection of plants • Preservation techniques for plants part . • Prepration of taxonomic keys • How to use flora and digital flora for plant identification. • Use of flora for identification of plants of college campus. • Cladogram and dendrogram • Visit of any botanical garden , national park/wildlife sanctuary/ protected area. • Learn about IUCN categories of threats. 1) Evaluation of alfa, beta and gama biodiversitiy of college campus..	**30**
Keywords	***Herbarium, Flora, Protected area, IUCN categories.***	
Signature of Convener & Members (CBoS) :		

PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

1. Kothari, A. (1997) Understanding Bio-Diversity: Life Sustainability and Equity. Orient Longam
2. Singh, G. (2012) Phant Systematics. Theory and Practice. Oxford & IBH Pvt. Ltd, New Delhi.
3. Maheshwari, J.K. (1963). Flora of Delhi. CSIR, New Delhi.

Reference Books Recommended –

1. . flora of India by Botanical Survey of India
2. Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F. (2002). Plant Systematics-APhylogenetic Approach. Sinauer Associates Inc., U.S.A. 2 nd edition.
3. Simpson, M.G. (2006) Plant Systematics. Elsevier Academic Press, San Diego, CA, USA

Online Resources–

- **e-Resources / e-books and e-learning portals**

- https://www.worldfloraonline.org/
- https://bsi.gov.in/page/en/digital-resources
- https://indiaflora-ces.iisc.ac.in/FloraPeninsular/
- http://www.efloras.org/
- https://creately.com/guides/what-is-a-dichotomous key/herpsteppp.inflibort.ac.in/Home/VirwSubject?catid=1pBOY7YTBCLSD2K
- https://eppp.inflibert.ac.in/Home/ViewSubjectPratid-10OYJVTRCLSDKUBW
- . httpssivproinflibnet.ac.in/Home/View Subject catid-1pbbyZY1BCS02E
- https://www.amazon.in/Plant-Taxonomy-past-present-future-chook/dp/B016021014
- https://www.instructables.com/How-to-Make-a-Cladogram/
- file:///C:/Users/user/Downloads/ajol-file-journals_452_articles_122070_submission_proof_122070-5365-335203-1-10-20150914%20(1).pdf

Online Resources–

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- **www.swayam.ac.in**
- **www.ignou.ac.in**
- **www.egyankosh.ac.in**
- **www.iitm.ac.in**
- **www.eskillindia.org**
- **www.eshiksha.mp.gov.in**
- **www.vlab.co.in**
- **www.internshala.com**
- **www.ndl.iitkgp.ac.in**

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**50 Marks**
Continuous Internal Assessment (CIA):	**15 Marks**
End Semester Exam (ESE):	**35 Marks**

Continuous Internal Assessment (CIA): 15 (By Course Teacher)	Internal Test / Quiz-(2): **10 & 10** Assignment/Seminar +Attendance - **05** Total Marks - **15**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE): 35	**Laboratory / Field Skill Performance:** On spot Assessment A. Performed the Task based on lab. work - **20 Marks** B. Spotting based on tools & technology (written) – **10 Marks** C. Viva-voce (based on principle/technology) - **05 Marks**	Managed by Course teacher as per lab. status

Name and Signature of Convener & Members of CBoS:

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF BOTANY

COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Honors)*			**Semester - VII**	Session: **2024-2025**
1	**Course Code**	**BOSE-06 T**		
2	**Course Title**	**Plant breeding and Seed technology**		
3	**Course Type**	**Discipline specific Elective (DSE)**		
4	**Pre-requisite** (if, any)	***As per program***		
5	**Course Learning. Outcomes (CLO)**	At the end of this course, the students will be able to ➢ Gain knowledge and comprehension of the breeding systems ➢ knowledge of reproductive biology in angiosperms to address real-world challenges related to plant breeding, crop production, and conservation. provide students with a comprehensive understanding of plant breeding principles and techniques.		
6	**Credit Value**	**3 Credits**	***Credit = 15 Hours - learning & Observation***	
7	**Total Marks**	**Max. Marks: 100**	**Min Passing Marks: 40**	

PART -B: Content of the Course

Total No. of Teaching–learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	**Plant breeding**: Introduction and objectives. Breeding systems: modes of reproduction in crop plants. Important achievements and undesirable consequences of plant breeding.	12
II	**Methods of crop improvement:** Introduction: Centers of origin and domestication of crop plants, plant genetic resources;Acclimatization; Selection methods: For self pollinated, cross pollinated and vegetativelypropagated plants; Hybridization: For self, cross and vegetatively propagated plants – Procedure, advantages and limitations. Role of mutations; Polyploidy; Distant hybridization and role of biotechnology in crop improvement.	11
III	**Breeding Methods for Stress Resistance:** Breeding for drought, salinity, heat, cold, disease and insect resistance, breeding forprotein and oil quality. Heterosis and inbreeding depression, hybrid and synthetic varieties.Hardy-Weinberg law, systems of mating.	11
IV	**Seed Technology**: Principle & Concept of Seed Technology. Quality seeds, Indian seed act. Classes of quality seeds - breeder, foundation, registered and certified seeds, operations essential for seed production, seed processing, certification and maintenance storage of improved seeds, seed productions organizations- national and state seed corporations and private seed companies. Artificial seeds, terminator seeds.	11
Keywords	**Breeding,Heterosis, Self incompatibility, Hybridization.**	

Signature of Convener & Members (CBoS) :

PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

1. Plant breeding by B.D Singh.
2. BD Singh (2003) Plant Breeding. Kalyani Publishers
3. PLANT BREEDING: PRINCIPLE AND METHODS B D SINGH - IN HINDI
4. Sharma JR (1994) Principles and Practices of Plant Breeding. Tata McGraw-Hill Pub. Co. New Delhi.
5. Chaudhari, H.K. (1984). Elementary Principles of Plant Breeding. Oxford – IBH.
6. Acquaah, G. (2007). Principles of Plant Genetics & Breeding. Blackwell Publishing.
7. Agrawal, P.K. 1993, Hand Book of Seed Technology, Dept. of Agriculture and Cooperation, National Seed Corporation Ltd., New Delhi.

Reference Books Recommended –

1. Allard (1960) Principles of Plant Breeding. John Wikkey and Sons, Inc. New York.
2. Hayes, Immer and Smith (1955) Methods of Plant Breeding, MacGraw- Hil Book Co. Inc. New York.
3. Jonossy and Lupton (1976) Heaterosis in Plant Breeding. Elsevier, Amsterdam.
4. Poehlman and Borthakur (1969) Breeding Asian Field Crops With Special Reference To Crops I India. Oxford and IBH Publishing Company, New Delhi.

Online Resources–

- **e-Resources / e-books and e-learning portals**

1. **https://chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://courseware.cutm.ac.in/wp-content/uploads/2020/05/Download-Notes-8.pdf**
2. **https://chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/http://www.eagri.org/eagri50/GBPR211/lec16.pdf**
3. **https://efaidnbmnnnibpcajpcglclefindmkaj/http://www.eagri.org/eagri50/GBPR211/lec16.pdf**
4. **https://www.sciencelearn.org.nz/resources/77-pollination-and-fertilisation**
5. **https://www.crops.org/about-crops/seed-technology#:~:text=What%20is%20seed%20technology%3F,that%20people%20and%20livestock%20eat.**
6. **https://plantbreeding2010.blogspot.com/2020/12/seed-and-seed-technology-introduction.html**
7. **https://www.nature.com/articles/s41477-018-0309-4**

Online Resources–

- **e-Resources / e-books and e-learning portals**
- **www.swayam.ac.in**
- **www.ignou.ac.in**
- **www.egyankosh.ac.in**
- **www.iitm.ac.in**
- **www.eskillindia.org**
- **www.eshiksha.mp.gov.in**
- **www.vlab.co.in**
- **www.internshala.com**
- **www.ndl.iitkgp.ac.in**

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment (CIA):	**30 Marks**
End Semester Exam (ESE):	**70 Marks**

Continuous Internal Assessment (CIA): 30 (By Course Teacher)	Internal Test / Quiz-(2): **20** +**20** Assignment / Seminar - **10** Total Marks - **30**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE): 70	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20 Marks** Section B: Descriptive answer type qts.,**1out of 2** from each unit-**4x10=40 Marks**	

Name and Signature of Convener & Members of CBoS:

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF BOTANY

COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Honors)*			**Semester - VII**	Session: **2024-2025**
1	**Course Code**	**BOSE-06 P**		
2	**Course Title**	**Lab. Course- 06 (Plant breeding and Seed Technology)**		
3	**Course Type**	**Laboratory course**		
4	**Pre-requisite** (if, any)	***As per program***		
5	**Course Learning. Outcomes (CLO)**	At the end of the course students will be - ➢ Idea of seeds which carries a new generation. ➢ Knowledge of plant breeding techniques. ➢ Knowledge of breeding methods for stress tolerance. ➢ Idea of seed processing and certification of seeds.		
6	**Credit Value**	**1 Credits**	***Credit =30 Hours Laboratory or Field learning/Training***	
7	**Total Marks**	**Max. Marks: 50**	**Min Passing Marks: 20**	

PART -B: Content of the Course		
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)		
Module	**Topics (Course contents)**	**No. of Period**
Lab./Field Training/ Experiment Contents of Course	1. Study of seed parts 2. Collection of different types of mature seeds 3. Techniques of hybridization- Emasculation. 4. Techniques of hybridization - Bagging and tagging. 5. Study of vegetatively grown plants part of your locality 6. Collection of seeds of different varieties of locally grown crops. 7. Inter-varietal cross in an ornamental plant. 8. Visit to state and national seed corporation companies and prepare a report.	**30**
Keywords	Seed, Emasculation, Bagging and tagging.	

Signature of Convener & Members (CBoS) :

PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

1. Allard (1960) Principles of Plant Breeding. John Wikkey and Sons, Inc. New York.
2. Hayes, Immer and Smith (1955) Methods of Plant Breeding, MacGraw- Hil Book Co. Inc. New York.
3. Plant breeding by B.D Singh

Reference Books Recommended –

1. Jonossy and Lupton (1976) Heaterosis in Plant Breeding. Elsevier, Amsterdam.
2. Poehlman and Borthakur (1969) Breeding Asian Field Crops With Special Reference To Crops I India. Oxford and IBH Publishing Company, New Delhi.

Online Resources–

- **e-Resources / e-books and e-learning portals**
- **https://www.merriam-webster.com/dictionary/emasculate**
- **https://agritech.tnau.ac.in/crop_improvement/crop_imprv_emasculation_cereals.html**
- **https://www.toppr.com/guides/biology/reproduction-in-organisms/vegetative-propagation/#:~:text=Vegetative%20Propagation%20by%20Roots,example%2C%20Sweet%20potato%20and%20Dahlia.**

Online Resources–

- **e-Resources / e-books and e-learning portals**
- **www.swayam.ac.in**
- **www.ignou.ac.in**
- **www.egyankosh.ac.in**
- **www.iitm.ac.in**
- **www.eskillindia.org**
- **www.eshiksha.mp.gov.in**
- **www.vlab.co.in**
- **www.internshala.com**
- **www.ndl.iitkgp.ac.in**

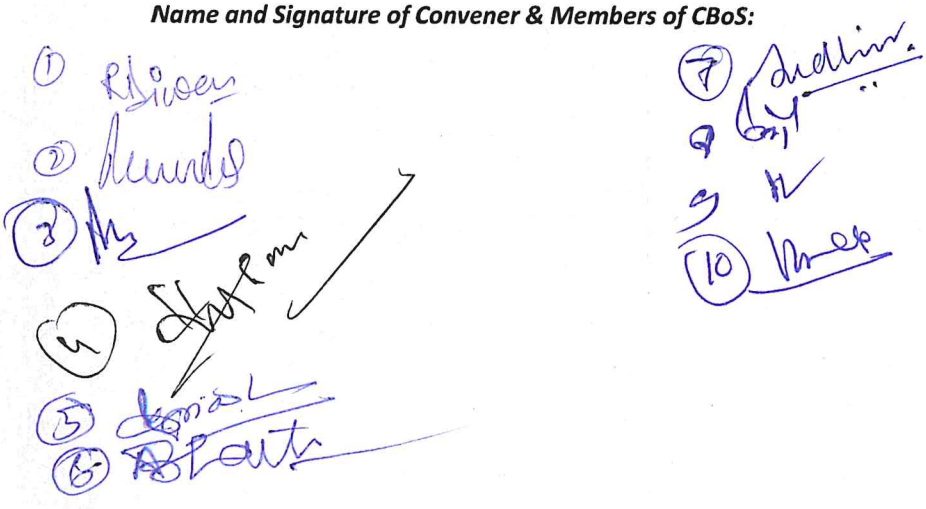
PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**50 Marks**
Continuous Internal Assessment (CIA):	**15 Marks**
End Semester Exam (ESE):	**35 Marks**

Continuous Internal Assessment (CIA): 15 (By Course Teacher)	Internal Test / Quiz-(2): **10 & 10** Assignment/Seminar +Attendance - **05** Total Marks - **15**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE): 35	**Laboratory / Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work - 20 Marks** **B. Spotting based on tools & technology (written) – 10 Marks** **C. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

Name and Signature of Convener & Members of CBoS:



FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF BOTANY
COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Honors)*			**Semester - VII**	Session: **2024-2025**
1	**Course Code**	**BOSE-07 T**		
2	**Course Title**	**Instrumentation and biochemical technology**		
3	**Course Type**	**Discipline specific Elective (DSE)**		
4	**Pre-requisite** (if, any)	***As per program***		
5	**Course Learning. Outcomes (CLO)**	At the end of this course, the students will be able to ➢ Develop a solid understanding of different analytical methods and instruments used in plant sciences. ➢ Acquire practical skills in sample preparation, data collection, and data analysis using analytical techniques. ➢ Understand the working principles of important instrumentation tools. ➢ Understand modern technologies in the field of Biochemistry		
6	**Credit Value**	**3 Credits**	***Credit = 15 Hours - learning & Observation***	
7	**Total Marks**	**Max. Marks: 100**	**Min Passing Marks: 40**	

PART -B: Content of the Course

Total No. of Teaching–learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	• Principles of microscopy; Light microscopy; Fluorescence microscopy; Confocal microscopy; • Use of fluorochromes in : (a) Flow cytometry (b) fluorescence microscopy: for Chromosome banding • Phase contrast, electron, scanning and transmission electron microscopy, • Single and double staining techniques for light microscopy for temporary and permanent slides • Stain techniques: Single and double staining.	12
II	Instruments: Salient features, Principle and applications. • Autoclave, • Oven, • Laminar air flow, • Centrifuge. • Colorimetry • Spectrophotometry, • Fermenters., • Water bath, • pH meter	11
III	• Chromatography: Principle and its application in biological research: Paper chromatography, Column chromatography, Affinity chromatography, TLC, GLC, HPLC. • Electrophoresis: AGE, PAGE, SDS-PAGE. • Radioisotopes: Principles and its application in biological research. • ELISA test	11
IV	Biochemical Technology, Biofuel, CRISPR Technology Genetic Engineering, Vaccine, Biodegradable plastics Gene Therapy, DNA fingerprinting, GMO food, Pest resistant crops.	11
Keywords	Microscope, biochemical technology	

Signature of Convener & Members (CBoS) :

PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

1. **Bioinstrumentation by L. VEERAKUMARI**

Reference Books Recommended –

1. **Biological Instrumentation & Methodology by Bajpai P. K.**

Online Resources–

- **e-Resources / e-books and e-learning portals**

1. **https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SMB2103.pdf**
2. **https://cbpbu.ac.in/userfiles/file/2020/STUDY_MAT/ZOO/PK%20(4).pdf**
3. **https://kanchiuniv.ac.in/coursematerials/Biomedical%20instrumentation.pdf**

Online Resources–

- **e-Resources / e-books and e-learning portals**
- **www.swayam.ac.in**
- **www.ignou.ac.in**
- **www.egyankosh.ac.in**
- **www.iitm.ac.in**
- **www.eskillindia.org**
- **www.eshiksha.mp.gov.in**
- **www.vlab.co.in**
- **www.internshala.com**
- **www.ndl.iitkgp.ac.in**

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 100 Marks

Continuous Internal Assessment (CIA): 30 Marks

End Semester Exam (ESE): 70 Marks

Continuous Internal Assessment (CIA): 30 (By Course Teacher)	Internal Test / Quiz-(2): **20 +20** Assignment / Seminar - **10** Total Marks - **30**	Better marks out of the two Test / Quiz **+** obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE): 70	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20 Marks** Section B: Descriptive answer type qts.,**1out of 2** from each unit-**4x10=40 Marks**	

Name and Signature of Convener & Members of CBoS:

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF BOTANY

COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Honors)*			**Semester - VII**	Session: **2024-2025**
1	**Course Code**	**BOSE-07 P**		
2	**Course Title**	**Lab. course -07(Instrumentation and Biochemical Technology)**		
3	**Course Type**	**Laboratory course**		
4	**Pre-requisite** (if, any)	***As per program***		
5	**Course Learning. Outcomes (CLO)**	At the end of this course,the students will be able to get. ➢ Knowledge about Bio Instruments. ➢ Understand different parameters of instrumentation. ➢ Operation and handing of latest equipments		
6	**Credit Value**	**1 Credits**	***Credit =30 Hours Laboratory or Field learning/Training***	
7	**Total Marks**	**Max. Marks: 50**	**Min Passing Marks: 20**	

PART -B: Content of the Course

Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)

Module	Topics (Course contents)	No. of Period
Lab./Field Training/ Experiment Contents of Course	1. Calibration of microscope. 2. Handling of microscope and other instruments. 3. Safety measures in laboratory 4. Principle and application of microscope 5. Principle and application of laboratory instruments-Autoclave, Oven, Laminar air flow,Centrifuge. Colorimetry and Spectrophotometry, Water bath,pH meter 6. Concept of pH and buffer formation 7. Separation of chlorophyll pigment by paper chromatography 8. Separation of chlorophyll pigment by thin layer chromatography (TLC) 9. Study of amino acid and calculation of Rf values bypaper chromatography. 10. SDS -PAGE analysis of proteins 11. Quantitative analysis of DNA using colorimeter 12. Preparation of different types of solutions normal,molal and molar. 13. Visit to a nearby well equipped Scientific lab and prepare report.	**30**
Keywords	microscope,pH,chromatography,solutions,Rf	

Signature of Convener & Members (CBoS) :

PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

–

1. ExperimentsInMicrobiology,PlantPathologyAndBiotechnologyByK.R.Aneja.Publisher New Age International

Reference book recommended

1. Bioinstrumentation: Research, Development and Applications Hardcover Import,31July 1990 by Donald L. Wise

Online Resources–

- **e-Resources / e-books and e-learning portals**
  1. https://www.lumentum.com/en/commercial-lasers/applications/biomedical-and-analytics-instrumentation
  2. **https://www.rgcb.res.in/instraining**
  3. **https://https://admin/uploads/3/PG_M.Sc._Botony_34631%20MICROBIOLOGY%20AND%20PLANT%20PATHOLOGY.pdf**

Online Resources–

- **e-Resources / e-books and e-learning portals**
- **www.swayam.ac.in**
- **www.ignou.ac.in**
- **www.egyankosh.ac.in**
- **www.iitm.ac.in**
- **www.eskillindia.org**
- **www.eshiksha.mp.gov.in**
- **www.vlab.co.in**
- **www.internshala.com**
- **www.ndl.iitkgp.ac.in**

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: **50 Marks**

Continuous Internal Assessment (CIA): **15 Marks**

End Semester Exam (ESE): **35 Marks**

Continuous Internal Assessment (CIA): 15 **(By Course Teacher)**	Internal Test / Quiz-(2): **10 & 10** Assignment/Seminar +Attendance - **05** Total Marks - **15**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE): 35	**Laboratory / Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work - 20 Marks** **B. Spotting based on tools & technology (written) – 10 Marks** **C. Viva-voce (based on principle/technology) - 05 Marks**	Managed by Course teacher as per lab. status

Name and Signature of Convener & Members of CBoS:

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF BOTANY
COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Honors)*		**Semester - VII**	Session: **2024-2025**	
1	**Course Code**	**BOSE -08 T**		
2	**Course Title**	**Growth and Stress Physiology**		
3	**Course Type**	**Discipline specific Elective (DSE)**		
4	**Pre-requisite** (if, any)	***As per program***		
5	**Course Learning. Outcomes (CLO)**	At the end of this course, the students will be able to 1. understand the role of Physiological and metabolic processes for plant growth and development under stress. 2. Assimilate about biochemical constitution of plant diversity. 3. Get acquired the students with complex interaction between organism and environment 4. Understand about the role of hormones in plant development.		
6	**Credit Value**	**3 Credits**	***Credit = 15 Hours - learning & Observation***	
7	**Total Marks**	**Max. Marks: 100**	**Min Passing Marks: 40**	

PART -B: Content of the Course

Total No. of Teaching–learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	**PlantGrowth and Phytohormone** ➢ Plant growth curve,sigmoid and J shaped growth.Lag,Log and steady stage. Developmental roles of phytohormones ➢ Auxins, ➢ Gibberellins, ➢ Cytokinins, ➢ ABA, ➢ Ethylene,	12
II	**Movements, Dormancy & Responses** ➢ Photoperiodism (SDP, LDP, Day neutral plants); ➢ Phytochrome (discovery,structure and functions), ➢ Seedand bud Dormancy causes and breaking, ➢ Vernalization ➢ Senescence, ➢ Plant movements	11
III	**Planteco-physiologyand Stress Physiology:** ➢ Concept of Planteco-physiology. ➢ Plant perception, ➢ physiology of ecological considerations. ❖ Hydrophytic, xerophytic morphological and anatomical adaptations in plants	11
IV	**StressPhysiology:** Plant responses to biotic and abiotic stress, mechanism of biotic and abiotic tolerance, HR (Hypersensitive Response) and SAR Systemic Acquired Resistance), water deficit and ❖ Drought resistance, ❖ Salinity stress, ❖ metal toxicity, ❖ freezing and heat stress, ❖ oxidative stress.	11
Keywords	Growth, Phytohormone, Eco-physiology, Vernalization.	

Signature of Convener & Members (CBoS) :

PART–C: Learning Resources

Text Books, Reference Books and Others

TextBooksRecommended-

1. Galston,A.W.,(1989)LifeProcessesinPlants,ScientificAmericanLibrary.Springer-Verlag,NewYork, USA.
2. Hopkins,W.G.,(1995)IntroductiontoPlantPhysiology,JohnWilleyandSons,Inc.NewYork,USA.
3. Salisbury,F.B.andRoss,C.W.,(1992)PlantPhysiology.WadsworthPublishingCo.,California,USA.
4. Denis,D.T.,Turpin,D.H.Lefebvre,D.D.&Layzell,D.B.(1997)PlantMetabolism.Longaman,Essex, England.

Reference Books Recommended –

1, Taiz,L.andZeiger,E.((1998) Plant Physiology.SinaverAssociations,Inc.Pub.,Masssachusetts, USA.
2. Rogers, P.P., Jalal, K.F. and Boyd, J.A. (2008). An Introduction to Sustainable Development. Prentice Hall of India Private Limited, New Delhi.

Online Resources–

- **e-Resources / e-books and e-learning portals**
  https://link.springer.com/book/10.1007/978-3-030-78420-1
  https://uou.ac.in/sites/default/files/slm/MSCBOT-601.pdf
  https://www.researchgate.net/publication/347908867_Stress_Physiology_in_Plants
- **https://www.esalq.usp.br/lepse/imgs/conteudo_thumb/Plant-stress-physiology.pdf**

Online Resources–

- **e-Resources / e-books and e-learning portals**
- **www.swayam.ac.in**
- **www.ignou.ac.in**
- **www.egyankosh.ac.in**
- **www.iitm.ac.in**
- **www.eskillindia.org**
- **www.eshiksha.mp.gov.in**
- **www.vlab.co.in**
- **www.internshala.com**
- **www.ndl.iitkgp.ac.in**

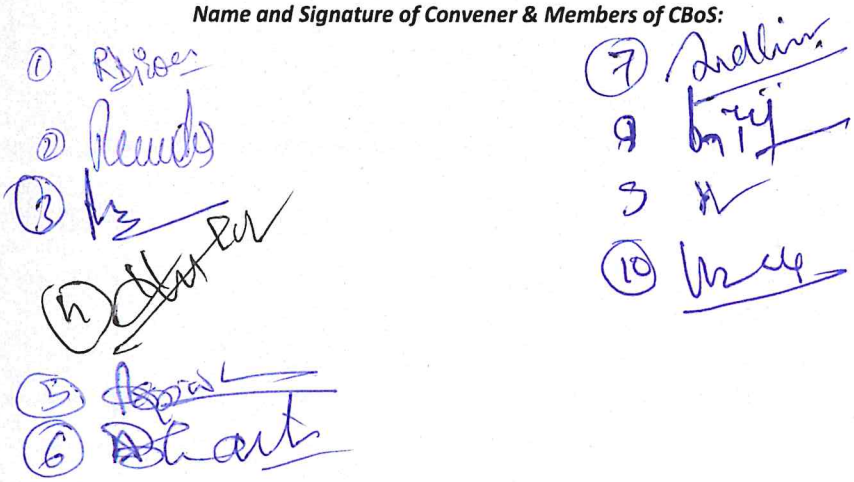
PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 100 Marks
Continuous Internal Assessment (CIA): 30 Marks
End Semester Exam (ESE): 70 Marks

Continuous Internal Assessment (CIA):70 (By Course Teacher)	Internal Test / Quiz-(2): **20 +20** Assignment / Seminar - **10** Total Marks - **30**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE): 30	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20 Marks** Section B: Descriptive answer type qts.,**1out of 2** from each unit-**4x10=40 Marks**	

Name and Signature of Convener & Members of CBoS:



FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF BOTANY

COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Honors)*			**Semester - VII**	Session: **2024-2025**
1	**Course Code**	**BOSE-08 P**		
2	**Course Title**	**Lab. Course -08 (Growth and stress physiology)**		
3	**Course Type**	**Laboratory course**		
4	**Pre-requisite** (if, any)	***As per program***		
5	**Course Learning. Outcomes (CLO)**	After the completion of the course the students will be able to: 1. Understandthe role of Physiological and metabolic processes for plant growth and development under stress. 2. Assimilate about biochemical constitution of plant diversity 3. Effect of phytohormones on plants. 4. Understand different physiological processes of plants.		
6	**Credit Value**	**1 Credits**	***Credit =30 Hours Laboratory or Field learning/Training***	
7	**Total Marks**	**Max. Marks: 50**	**Min Passing Marks: 20**	

PART -B: Content of the Course

Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)

Module	Topics (Course contents)	No. of Period
Lab./Field Training/ Experiment Contents of Course	1. *Avena* curvature test of Auxin. 2. Expression of bolting in cabbage. 3. Induction of lateral branches by cytokinin. 4. Demonstration of plasmolysis and deplasmolysis in plant cell. 5. Potato osmoscope for osmosis. 6. Demonstration of transpiration. 7. Measurement of transpiration rate by Farmers/ Ganong's potometer. 8. Extraction of seed proteins depending upon solubility. 9. Fractionation of proteins using gel filtration chromatography 10. Principle of colorimetry, spectrophotometry and fluorimetry.	**30**
Keywords	***Bolting, chlorophyll, osmosis, chromatography.***	

Signature of Convener & Members (CBoS) :

PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

1. Practical Plant Physiology Hardcover – 1 January 2015 by R. Sivakumar, Narendra Publishing
2. PRACTICALS IN PLANT PHYSIOLOGY AND BIOCHEMISTRY MANJU BALA, SUNITA GUPTA, N.K GUPTA & M.K. SANGHA Scientific Publishers
3. A Practical Manual on Fundamentals of Plant Physiology Paperback – 16 September 2022 by R. K. Samaiya Subrata Sharma, Gyanendra Tiwari, R. Shivraj krishnan, Sunil Pandey, Preeti Sagar Nayak (Author) BFC PUBLICATIONS PVT LTD

Reference Books Recommended –

1. **Practical Manual Experimental Plant Physiology and Biochemistry Manual** Paperback – 1 January 2023 by Rajesh Kumar Asok Kumar Bera, Bandana Bose (Author) Publisher- Science Technology

Online Resources–

- **e-Resources / e-books and e-learning portals**
- **https://www.britannica.com/science/transpiration**
- **https://www.frontiersin.org/articles/10.3389/fagro.2022.765068/full**
- **https://www.sciencedirect.com/science/article/abs/pii/S0176161796802872**

Online Resources–

- **e-Resources / e-books and e-learning portals**
- **www.swayam.ac.in**
- **www.ignou.ac.in**
- **www.egyankosh.ac.in**
- **www.iitm.ac.in**
- **www.eskillindia.org**
- **www.eshiksha.mp.gov.in**
- **www.vlab.co.in**
- **www.internshala.com**
- **www.ndl.iitkgp.ac.in**

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**50 Marks**
Continuous Internal Assessment (CIA):	**15 Marks**
End Semester Exam (ESE):	**35 Marks**

Continuous Internal Assessment (CIA): 35 **(By Course Teacher)**	Internal Test / Quiz-(2): **10 & 10** Assignment/Seminar +Attendance - **05** Total Marks - **15**	Better marks out of the two Test / Quiz **+** obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE): 15	**Laboratory / Field Skill Performance: On spot Assessment** A. **Performed the Task based on lab. work - 20 Marks** B. **Spotting based on tools & technology (written) – 10 Marks** C. **Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

Name and Signature of Convener & Members of CBoS:

Four Year Undergraduate Program (2024-28)
Department of Biotechnology
Course Curriculum

Part A: Introduction			
Program: Bachelor in Life Sciences (Honors)		Semester: **VII Sem**	Session:2024-2025
1	Course Code	**BTSC-07-T**	
2	Course Title	**Plant and Animal Biotechnology**	
3	Course Type	Discipline Specific Course (DSC)	
4	Pre-requisite (if any)	As per program	
5	Course Learning Outcomes (CLO)	After completing this course, the students will be able to - • Develop skills related to plant cell culture. • Develop competency for genetically modified plant products. • Understand the principles and factors of animal cell culture. • Develop skills for animal cell culture and application.	
6	Credit Value	03 Credits (Credit = 15 Hours - learning & observation)	
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40

Part B: Content of Course (Theory)		
Total No. of Teaching–learning Periods (01 Hr. per period)- 45 Periods (45 Hours)		
Unit	Topic (Course content)	No. of Period
I	**Basics of plant cell culture** 1. Callus & suspension cultures: Initiation and Maintenance of callus and suspension culture. 2. Single Cell Culture: Isolation and cloning of single cell & cell viability test 3. Shoot tip culture: Rapid clonal propagation & production of virus-free plant 4. Embryogenesis in Plant Tissue Culture: Somatic embryogenesis, Embryo culture & embryo rescue.	12 (12 Hrs)
II	**Advances in plant cell culture** 1. Haploid Plant Generation: Anther, Pollen, and ovary culture for production of hybrid plants. 2. Protoplast Culture: Protoplast isolation, fusion and its application in hybridization. 3. Plant transformation technology: Basis of tumor formation, Hairy root, Features of Ti &Ri plasmids, Use of Ti &Ri plasmids as vectors, Mechanism of DNA transfer. 4. Transgenic plants in crop improvement.	11 (11 Hrs)
III	**Basics of animal cell culture** 1. Aseptic technique: Objectives, elements of the aseptic environment, sterile handling, standard procedure, apparatus, and equipment. 2. Biology of cultured cell: Culture environment, cell adhesion, cell proliferation, differentiation, cell signaling, energy metabolism, origin of cultured cells. 3. Defined media and supplements: physicochemical properties, balanced salt solution, complete media, serum and its selection, and	11 (11 Hrs)

	other supplements. 4. Serum-free media: Disadvantages of serum, Advantages of serum-free media, Disadvantages, Replacement of serum, Development and preparation of serum-free media.	
IV	**Advances in animal cell culture** 1. Primary cell culture and mammalian cell culture. 2. Scaling up and cryopreservation of cultured cells. 3. Stem cell culture and applications. 4. Transformation in cultured cells.	11 (11 Hrs)
Keywords	Callus, Embryogenesis, Protoplast Culture, Scaling, Transformation.	

• Part C - **Learning Resource**
Text Books, Reference Books, Other Resources -
Text Book- **Textbook of Animal Biotechnology-** B Singh, S K Gautam and M S Chauhan **Textbook of Animal Biotechnology-** B Singh Introduction to plant biotechnology- H S Chawala. Plant Biotechnology- B D Singh.
• Animal cell culture – Freshney • Culture of Animal Cell – John Paul • Animal cell biotechnology, methods and protocol – Portner • H.S.Chawala: Biotechnology in crop improvement. • R.J. Henry: Practical application of plant molecular biology: Chapman & Hall. • B.D. Singh: Biotechnology, Expanding Horizons. • Kalyan Kumar De- Plant Tissue Culture. • M.K. Ragdan: Introduction to Plant Tissue Culture.
Online resources- https://archive.nptel.ac.in/courses/102/103/102103016/ https://onlinecourses.nptel.ac.in/noc24_ag08/preview

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: **Maximum Marks:** **100 Marks** **Continuous Internal Assessment (CIA):** **30 Marks** **End Semester Exam (ESE):** **70 Marks**		
Continuous Internal Assessment (CIA) (By course teacher):	Internal Test / Quiz-(2): **20 +20** Assignment / Seminar - **10** Total Marks - **30**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20 Marks** Section B: Descriptive answer type qts.,**1out of 2** from each unit-**4x10=40 Marks**	

Name and Signature of Convener and Members of CBoS:

(Keshav Kant Sahu) (Amita Pande) (Dr. Neha Behal) (Dr Shubha Diwan) Dr Pramod Mahor

Dr Shivani Sharma Dr. Ujjwala Supe Dr. Sanjay Bhagat (Dr. Anil Kr. Kashyap)

Four Year Undergraduate Program (2024-28)
Department of Biotechnology
Course Curriculum

Part A: Introduction			
Program: Bachelor in Life Sciences (Honors)		Semester: **VII Sem**	Session:**2024-2025**
1	Course Code	**BTSC-07-P**	
2	Course Title	**Plant and Animal Biotechnology**	
3	Course Type	Discipline Specific Course (DSC) - Practical	
4	Pre-requisite (if any)	As per program	
5	Course Learning Outcomes (CLO)	After completing this practical course, the students will be able to - • Perform primary culture and subculturing of cells. • Maintain conditions for animal and plant tissue culture. • Develop competency for media preparation. • Analyse viability and apoptosis of cells.	
6	Credit Value	01 Credits Credit =30 Hours Laboratory or Field learning/Training	
7	Total Marks	Max. Marks: 50	Min Passing Marks: 20

Part B: Content of Course		
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)		
Module	Topic (Course content)	No. of Period
Lab./Field Training/ Experiment Contents of Course	1 Sterilization of plant materials. 2 Preparation of tissue culture media. 3 Plant tissue culture by plant parts. 4 Preparation of different medium. 5 Culture of cells from hen's egg. 6 Cell counting by hemocytometer. 7 Estimation of viability by dye exclusion.	30
Keywords	Callus, Embryogenesis, Protoplast Culture, Scaling, Transformation.	

• Part C - **Learning Resource**
Text Books, Reference Books, Other Resources -
Text Book- **Textbook of Animal Biotechnology-** B Singh, S K Gautam and M S Chauhan **Textbook of Animal Biotechnology-** B Singh Introduction to plant biotechnology- H S Chawala. Plant Biotechnology- B D Singh.
• Animal cell culture – Freshney • Culture of Animal Cell – John Paul • Animal cell biotechnology, methods and protocol – Portner • H.S.Chawala: Biotechnology in crop improvement. • R.J. Henry: Practical application of plant molecular biology: Chapman & Hall. • B.D. Singh: Biotechnology, Expanding Horizons.

• Kalyan Kumar De- Plant Tissue Culture. • M.K. Ragdan: Introduction to Plant Tissue Culture.
Online resources- https://archive.nptel.ac.in/courses/102/103/102103016/ https://onlinecourses.nptel.ac.in/noc24_ag08/preview

Part D: **Assessment and Evaluation**			
Suggested Continuous Evaluation Methods: **Maximum Marks:** **50 Marks** **Continuous Internal Assessment (CIA):** **15 Marks** **End Semester Exam (ESE):** **35 Marks**			
Continuous Internal Assessment (CIA) (By course teacher):	Internal Test / Quiz-(2): 10 +10 Assignment / Seminar + Attendance- 05 Total Marks - **15**		Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory / Field Skill Performance:** **A. On spot Assessment - 20 Marks** **B. Spotting based on tools & technology (written) – 10 Marks** **C. Viva-voce (based on principle/technology) - 05 Marks**		Managed by course teacher as per lab status

Name and Signature of Convener and Members of CBoS:

Four-Year Undergraduate Program (2024-2028)
Department of Biotechnology
Course Curriculum

Part A: Introduction			
Program: Bachlor in Life Sciences (Honors)		Semester: **VII Sem**	Session:**2024-2025**
1	Course Code	**BTSE-05-T**	
2	Course Title	**Genomics**	
3	Course Type	Discipline Specific Elective course (DSE)	
4	Pre-requisite (if any)	As per program	
5	Course Learning Outcomes (CLO)	After completing this course, the students will be able to - • Analyse and interpret genomic data. • Develop competency related to genomic and epigenomic alteration. • Understand about gene expression and regulation. • Develop an understanding of various RNA interphases.	
6	Credit Value	03 Credits (Credit = 15 Hours - learning & observation)	
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40

Part B: Content of Course (Theory)		
Total No. of Teaching–learning Periods (01 Hr. per period)- 45 Periods (45 Hours)		
Unit	Topic (Course content)	No. of Period
I	**Concept of genomics** 1. Genomics- Introduction, comparative genomics, Cot and Rot value, forward and reverse genetics. 2. DNA sequence analysis methods: Sanger dideoxy method and fluorescence method. 3. Gene variation and Single Nucleotide Polymorphisms (SNPs); Expressed sequenced tags (ESTs). 4. Gene disease association.	12 (12 hrs)
II	**Epigenetics and genomic stability** 1. Epigenetic control of gene expression- DNA methylation and its role in gene expression. 2. Genome stability by DNA methylation. 3. Chromatin modifications implicated in gene silencing and activation. 4. Epitranscriptome- resetting the epigenome.	11 (11 hrs)
III	**Control and regulation of gene expression** 1. Transcriptional control of gene expression- Gene architecture, promoter architecture. 2. Regulation sequences, enhancers, and mechanism of their action. 3. Mediator complex and general transcription factors. 4. DNA binding and activation domains, activation of latent activators, and co-activators.	11 (11 hrs)
IV	**RNA regulated regulations**	11 (11 hrs)

	1. Post-transcriptional control of gene expression- Introns and exons, mechanism of RNA splicing. 2. Polyadenylation. 3. Small RNA and RNA interference. 4. Catalytic RNA.	
Keywords	DNA sequencing, Epitranscriptome, Transcriptional Control, RNA polyadenylation.	

• Part C - **Learning Resource**
Text Books, Reference Books, Other Resources -
➢ **Text books-Introduction to genomics- A M Lesk** ➢ **Genome analysis and bioinformatics- T R Sharma**
Reference book- ➢ Latchman DS (2015), Gene control, Garland Science, New York. • Krebs, JE, Goldstein ES, Kilpatrick SJ (2014) Lewins Genes XI, Jones Bartlett Publishers.
Online resources- https://onlinecourses.nptel.ac.in/noc21_bt39/preview https://nptel.ac.in/courses/102103017

Part D: **Assessment and Evaluation**		
Suggested Continuous Evaluation Methods: **Maximum Marks:** 100 **Marks** **Continuous Internal Assessment (CIA):** 30 **Marks** **End Semester Exam (ESE):** 70 **Marks**		
Continuous Internal Assessment (CIA) (By course teacher):	Internal Test / Quiz-(2): **20 +20** Assignment / Seminar - **10** Total Marks - **30**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
End Semester Exam (ESE):	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20 Marks** Section B: Descriptive answer type qts.,**1out of 2** from each unit-**4x10=40 Marks**	

Name and Signature of Convener and Members of CBoS:

Four-Year Undergraduate Program
Department of Biotechnology
Course Curriculum – 2027-2028

Part A: Introduction			
Program: Bachelor in Life Sciences (Honors)		Semester: **VII Sem**	Session:**2024-2025**
1	Course Code	**BTSE-06-T**	
2	Course Title	**Proteomics**	
3	Course Type	Discipline Specific Elective course (DSE)	
4	Pre-requisite (if any)	As per program	
5	Course Learning Outcomes (CLO)	After completing this course, the students will be able to - • Understanding protein structure and design of workflow. • Develop an understanding of technology related to proteomics. • Develop competency in protein sequencing and related methods. • Understand quantitative and high throughput methods related to proteomics.	
6	Credit Value	03 Credits (Credit = 15 Hours - learning & observation)	
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40

Part B: Content of Course (Theory)		
Total No. of Teaching–learning Periods (01 Hr. per period)- 45 Periods (45 Hours)		
Unit	Topic (Course content)	No. of Period
I	**Concept of proteomics** 1. Protein structure and folding basic concepts and techniques. 2. Proteome- Basics and workflow design of proteomics technology. 3. Comparative proteomics and importance of proteomics. 4. An overview of systems biology.	12 (12 hrs)
II	**Basic techniques in proteomics** 1. Tools and techniques in proteomics: Principle and application of separation of 1D and 2D polyacrylamide gel electrophoresis. 2. Workflow. 3. Two-dimensional fluorescence difference in-gel electrophoresis (DIGE). 4. Staining the gel of DIGE.	11 (11 hrs)
III	**Advanced techniques in proteomics** 1. Protein sequencing. 2. MS analysis and related techniques (LC-MS(MS). 3. Advanced methods in proteomics (microfluidic chips, ICAT, iTRAQ). 4. Advanced methods in proteomics (SILAC)	11 (11 hrs)
IV	**Application of proteomics** 1. Database search, relative quantification, analysis, and interpretation. 2. Quantitative proteomics. 3. Post-translational modification and their profiling. 4. High throughput methods for the interaction of proteins with other	11 (11 hrs)

	biomolecules.	
Keyword	Proteome, Protein Sequencing, Quantitative Proteomics, System Biology.	

• Part C - **Learning Resource**
Text Books, Reference Books, Other Resources -
• **Text Book-** Introduction to Proteomics: Tools for the New Biology, D.C. Liebler, Humana Press, 2002. • Principles of Proteomics, R.M. Twyman, Bios Scientific Pub., 2004
Reference Book- • Proteomics for Biological Discovery, T.D. Veenstra, J.R. Yates III, John-Wiley & Sons, Hoboken, New Jersey, USA; 2006. • Protein Biochemistry and Proteomics (The Experimenter Series), R. Hubert, Academic Press, 2006. • Proteomics in Practice: A Guide to Successful Experimental Design, R. Westermeier, T. Naven, H-R. HÃ¶pker, Wiley-VCH, 2008 • Proteomics: A Cold Spring Harbor Laboratory Course Manual, A.J. Link and J. LaBaer, Cold Spring Harbor Laboratory Press, 2009
Online resources- https://onlinecourses.nptel.ac.in/noc20_bt20/preview https://nptel.ac.in/courses/102101007

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: **Maximum Marks:** **50 Marks** **Continuous Internal Assessment (CIA):** **15 Marks** **End Semester Exam (ESE):** **35 Marks**		
Continuous Internal Assessment (CIA) (By course teacher):	Internal Test / Quiz-(2): 10 +10 Assignment / Seminar + Attendance- 05 Total Marks - **15**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory / Field Skill Performance:** **A. On spot Assessment - 20** **B. Spotting based on tools & technology (written) – 10 Marks** **C. Viva-voce (based on principle/technology) - 05 Marks**	Managed by course teacher as per lab status

Name and Signature of Convener and Members of CBoS:

Four Year Undergraduate Program (2024-28)
Department of Biotechnology
Course Curriculum

Part A: Introduction			
Program: Bachelor in Life Sciences (Honors)		Semester: VII Sem	Session:2024-2025
1	Course Code	**BTSE-07-T**	
2	Course Title	**Agricultural Biotechnology**	
3	Course Type	Discipline Specific Elective course (DSE)	
4	Pre-requisite (if any)	As per program	
5	Course Learning Outcomes (CLO)	After completing this course, the students will be able to - • Develop skills related to the use of microbes for the improvement of nitrogen fixation. • Develop skills related to the development of biofertilizers. • Understand about pathogens related to agriculture. • Develop skills related to biopesticides development.	
6	Credit Value	03 Credits (Credit = 15 Hours - learning & observation)	
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40

Part B: Content of Course (Theory)		
Total No. of Teaching–learning Periods (01 Hr. per period)- 45 Periods (45 Hours)		
Unit	Topic (Course content)	No. of Period
I	**Basic biotechnological need** 1. Symbiotic nitrogen fixation. 2. Non symbiotic nitrogen fixation. 3. Nitrate assimilation and nitrification. 4. Phytohormones.	12 (12 hrs)
II	**Production of agrobiotics** 1. Concept and types of biofertilizers. 2. Microbial inoculum. 3. Sulfur and phosphate solubilizing biofertilizers 4. Applications of biofertilisers.	11 (11 hrs)
III	**Biotechnological control of pathology** 1. Concept of plant pathology. 2. Classification of plant diseases. 3. Causative agent, symptoms, mechanism of action, and control majors of plant diseases. 4. Pathogenesis mechanism related to enzymes, toxins, and nutrition.	11 (11 hrs)
IV	**Biotechnological control of pests** 1. Definition and types of biopesticides 2. Advantages of biopesticides. 3. Composition and types of biomasses and their conversion and neutralization.	11 (11 hrs)

	4. Single-cell proteins and their nutritive values.	
Keywords	Nitrogen Fixation, Inoculum, Pathology, Single Cell Protein.	

Text Books, Reference Books, Other Resources -
➢ **Text** Book- Agricultural Biotechnology- A Singh ➢ Agricultural Biotechnology at a Glance- A K Thakur
Reference book- • Bilgrami KS and Dubey HG- Textbook of modern plant pathology, Vikas publication. • Guptal PK ad genetics and biotechnology in crop improvement- Rastogi Publication • Pathak VN Khatri, Pwathak M- Fundamentals of plant pathology- Arobotanoical publication. • Vyas S and Modi HA- Biofertisers and organic farming- AKTA Prakashan.
Online resources- https://onlinecourses.nptel.ac.in/noc24_ag08/preview https://archive.nptel.ac.in/courses/102/103/102103016/

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: **Maximum Marks: 100 Marks** **Continuous Internal Assessment (CIA): 30 Marks** **End Semester Exam (ESE): 70 Marks**		
Continuous Internal Assessment (CIA) (By course teacher):	Internal Test / Quiz-(2): **20 +20** Assignment / Seminar - **10** Total Marks - **30**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20 Marks** Section B: Descriptive answer type qts.,**1out of 2** from each unit-**4x10=40 Marks**	

Name and Signature of Convener and Members of CBoS:

Four Year Undergraduate Program (2024-28)
Department of Biotechnology
Course Curriculum

Part A: Introduction			
Program: Bachelor in Life Sciences (Honors)		Semester: **VII Sem**	Session:**2024-2025**
1	Course Code	**BTSE-08-T**	
2	Course Title	**Pharmaceutical Biotechnology**	
3	Course Type	Discipline Specific Elective course (DSE)	
4	Pre-requisite (if any)	As per program	
5	Course Learning Outcomes (CLO)	After completing this course, the students will be able to - • Understand about secondary metabolite production and applications. • Understand about antibiotics and their antimicrobial applications. • Understand the mechanism of disease-based drug action. • Develop concepts of pharmacokinetics and pharmacodynamics.	
6	Credit Value	03 Credits (Credit = 15 Hours - learning & observation)	
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40

Part B: Content of Course (Theory)		
Total No. of Teaching–learning Periods (01 Hr. per period)- 45 Periods (45 Hours)		
Unit	Topic (Course content)	No. of Period
I	**Secondary metabolites** 1. Introduction to secondary metabolites. 2. Types and Medicinal Applications of Secondary Metabolites. 3. Production of Secondary metabolites in Plants through hairy Root Culture. 4. Factors affecting Secondary metabolite production (Precursors, Growth Factors, and Nutrients.	12 (12 hrs)
II	**Microbial exploitation** 1. Types and classification of antibiotics. 2. General characteristics of an Antimicrobial Drug. 3. Mechanism of action of antimicrobial agent. 4. Microbial Resistance to antibiotics and antimicrobial agents.	11 (11 hrs)
III	**Drug action** 1. Structure, and Applications of Antibacterial Drug. 3. Mechanism of Action. 4. Mechanism of action of Anticancer drugs. 4. . Mechanism of action of Antidiabetic drugs and Antihypertensive drugs.	11 (11 hrs)
IV	**Regulatory mechanism of drugs** 1. Protein engineering: Principles and Application. 2. Molecular Biology and Combinatorial drug discovery. 3. Concept of Pharmacokinetics, Pharmacodynamics. 4. Drug delivery systems.	11 (11 hrs)

Keywords	Pharmacokinetics, Pharmacodynamics, Secondary Metabolites, Combinatorial Drugs.	

• Part C - **Learning Resource**
Text Books, Reference Books, Other Resources -
• **Text book-** FSK Barar- Pharmaceutical- Essentials of Pharmaceuticals- S.Chand ➢ S.P. Vyas, Dixit- Pharmaceutical Biotechnology-CBS Gupta P.K. - Biotechnology and Genomics, Rastogi Publication
Reference book- • Hugo W. B. and Russell A. D. - Pharmaceutical Microbiology -Wiley India • B.Razdan-Medicinal Chemistry-CBS • Satoskar, Bhandarkar- Pharmacology and Pharmacotherapeutics- Popular • Purohit, Saluja- Pharmaceutical Biotechnology-Student Edition
Online resources- https://nptel.ac.in/courses/104102113 https://onlinecourses.nptel.ac.in/noc19_bt23/preview

Part D: **Assessment and Evaluation**		
Suggested Continuous Evaluation Methods: **Maximum Marks: 100 Marks** **Continuous Internal Assessment (CIA): 30 Marks** **End Semester Exam (ESE): 70 Marks**		
Continuous Internal Assessment (CIA) (By course teacher):	Internal Test / Quiz-(2): **20 +20** Assignment / Seminar - **10** Total Marks - **30**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20 Marks** Section B: Descriptive answer type qts.,**1out of 2** from each unit-**4x10=40 Marks**	

Name and Signature of Convener and Members of CBoS:

Four-Year Undergraduate Program (2024-2028)
Department of Biotechnology
Course Curriculum

Part A: Introduction			
Program: Bachelor in Life Sciences (Degree/Honors)		Semester: **VII Sem**	Session:**2024-2025**
1	Course Code	**BTSE-05-P**	
2	Course Title	**Genomics**	
3	Course Type	Discipline-Specific Elective (DSE)--Practical	
4	Pre-requisite (if any)	As per program.	
5	Course Learning Outcomes (CLO)	After completing this course, the students will be able to - • Be competent for isolation and estimation of nucleic acids. • Develop skill for pathogenic alteration and nucleic acids in cells. • Explain and estimate nucleic acid alterations. • Correlate nucleic acid base pair and database.	
6	Credit Value	01 Credits Credit =30 Hours Laboratory or Field learning/Training	
7	Total Marks	Max. Marks: 50	Min Passing Marks: 20

Part B: Content of Course (Theory)		
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)		
Module	Topic (Course content)	No. of Period
Lab./Field Training/ Experiment Contents of Course	1. Isolation of DNA from plants. 2. Isolation of DNA from blood. 3. DNA molecular size determination. 4. Preparation of slide to observe micronuclei. 5. Banding pattern study of DNA through electrophoresis. 6. Genetic variation study by RAPD. 7. Genetic variation study by RFLP. 8. Use of NCBI database for homology study.	30
Keywords	DNA sequencing, Epitranscriptome, Transcriptional Control, RNA polyadenylation.	

• Part C - **Learning Resource**
Text Books, Reference Books, Other Resources -
➢ **Text books-Introduction to genomics- A M Lesk** ➢ **Genome analysis and bioinformatics- T R Sharma**
Reference book- ➢ Latchman DS (2015), Gene control, Garland Science, New York. • Krebs, JE, Goldstein ES, Kilpatrick SJ (2014) Lewins Genes XI, Jones Bartlett Publishers.
Online resources- https://onlinecourses.nptel.ac.in/noc21_bt39/preview https://nptel.ac.in/courses/102103017

Part D: Assessment and Evaluation			
Suggested Continuous Evaluation Methods: **Maximum Marks:** **50 Marks** **Continuous Internal Assessment (CIA):** **15 Marks** **End Semester Exam (ESE):** **35 Marks**			
Continuous Internal Assessment (CIA) (By course teacher):	Internal Test / Quiz-(2): **10 +10** Assignment / Seminar + Attendance- 05 Total Marks - **15**		Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory / Field Skill Performance:** **A. On spot Assessment - 20** **B. Spotting based on tools & technology (written) – 10 Marks** **C. Viva-voce (based on principle/technology) - 05 Marks**		Managed by course teacher as per lab status

Name and Signature of Convener and Members of CBoS:

Four-Year Undergraduate Program (2024-2028)
Department of Biotechnology
Course Curriculum

Part A: Introduction			
Program: Bachelor in Life Sciences (Degree/Honors)		Semester: VII Sem	Session:2024-2025
1	Course Code	**BTSE-06-P**	
2	Course Title	**Proteomics**	
3	Course Type	Discipline-Specific Elective (DSE)--Practical	
4	Pre-requisite (if any)	As per program.	
5	Course Learning Outcomes (CLO)	After completing this course, the students will be able to - • Isolate and purify proteins. • Quantify and elucidate protein. • Perform mining of protein database. • Analyze structural domains of proteins.	
6	Credit Value	01 Credits Credit =30 Hours Laboratory or Field learning/Training	
7	Total Marks	Max. Marks: 50	Min Passing Marks: 20

Part B: Content of Course (Theory)		
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)		
Module	Topic (Course content)	No. of Period
Lab./Field Training/ Experiment Contents of Course	1. Isolation of protein. 2. Purification of protein. 3. Quantification of protein. 4. Electrophoretic observation of protein. 5. Protein database mining. 6. Homology study of protein by using the database. 7. Structural elucidation of protein by using the database. 8. Analysis of protein domains using the database.	30
Keyword	Proteome, Protein Sequencing, Quantitative Proteomics, System Biology.	

• Part C - **Learning Resource**
Text Books, Reference Books, Other Resources -
• **Text Book-** Introduction to Proteomics: Tools for the New Biology, D.C. Liebler, Humana Press, 2002. • Principles of Proteomics, R.M. Twyman, Bios Scientific Pub., 2004
Reference Book- • Proteomics for Biological Discovery, T.D. Veenstra, J.R. Yates III, John-Wiley & Sons, Hoboken, New Jersey, USA; 2006. • Protein Biochemistry and Proteomics (The Experimenter Series), R. Hubert, Academic Press, 2006. • Proteomics in Practice: A Guide to Successful Experimental Design, R. Westermeier, T. Naven, H-R. HÃ¶pker, Wiley-VCH, 2008 • Proteomics: A Cold Spring Harbor Laboratory Course Manual, A.J. Link and J. LaBaer, Cold Spring Harbor Laboratory Press, 2009

Online resources- https://onlinecourses.nptel.ac.in/noc20_bt20/preview https://nptel.ac.in/courses/102101007

Part D: **Assessment and Evaluation**		
Suggested Continuous Evaluation Methods: **Maximum Marks:** **50 Marks** **Continuous Internal Assessment (CIA):** **15 Marks** **End Semester Exam (ESE):** **35 Marks**		
Continuous Internal Assessment (CIA) (By course teacher):	Internal Test / Quiz-(2): 10 +10 Assignment / Seminar + Attendance- 05 Total Marks - **15**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory / Field Skill Performance:** **A. On spot Assessment - 20** **B. Spotting based on tools & technology (written) – 10 Marks** **C. Viva-voce (based on principle/technology) - 05 Marks**	Managed by course teacher as per lab status

Name and Signature of Convener and Members of CBoS:

Four Year Undergraduate Program (2024-28)
Department of Biotechnology
Course Curriculum

Part A: Introduction			
Program: Bachelor in Life Sciences (Degree/Honors)		Semester: **VII Sem**	Session:**2024-2025**
1	Course Code	**BTSE-07-P**	
2	Course Title	**Agricultural Biotechnology**	
3	Course Type	Discipline-Specific Elective (DSE)--Practical	
4	Pre-requisite (if any)	As per program.	
5	Course Learning Outcomes (CLO)	After completing this course, the students will be able to - • Isolate and maintain symbiotic and non-symbiotic microbes for agricultural applications. • To apply leghemoglobin and oxidase to enhance agricultural prodcutin • To develop skill for economically viable microbes. • To develop skill for estimation of agriculturally significant community.	
6	Credit Value	01 Credits Credit =30 Hours Laboratory or Field learning/Training	
7	Total Marks	Max. Marks: 50	Min Passing Marks: 20

Part B: Content of Course (Theory)		
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)		
Module	Topic (Course content)	No. of Period
Lab./Field Training/ Experiment Contents of Course	1. Isolation of Rhizobium sp. from root nodule of leguminous plant. 2. Isolation & Study of nonsymbiotic nitrogen-fixing organisms 3. Isolation and study of PSBs. 4. Estimation of leg hemoglobin from root nodule of leguminous plant. 5. Determination of IAA Oxidase activity. 6. Cultivation and study of Spirulina algae, Mushrooms 7. Study of community by quadrate method (Frequency, Density, and Abundance of Species)	30
Keywords	Nitrogen Fixation, Inoculum, Pathology, Single Cell Protein.	

Text Books, Reference Books, Other Resources -

- **Text** Book- Agricultural Biotechnology- A Singh
- Agricultural Biotechnology at a Glance- A K Thakur

Reference book-

- Bilgrami KS and Dubey HG- Textbook of modern plant pathology, Vikas publication.
- Guptal PK ad genetics and biotechnology in crop improvement- Rastogi Publication
- Pathak VN Khatri, Pwathak M- Fundamentals of plant pathology- Arobotanoical publication.
- Vyas S and Modi HA- Biofertisers and organic farming- AKTA Prakashan.

Online resources- https://onlinecourses.nptel.ac.in/noc24_ag08/preview
https://archive.nptel.ac.in/courses/102/103/102103016/

Part D: Assessment and Evaluation			
Suggested Continuous Evaluation Methods: **Maximum Marks:** **50 Marks** **Continuous Internal Assessment (CIA):** **15 Marks** **End Semester Exam (ESE):** **35 Marks**			
Continuous Internal Assessment (CIA) (By course teacher):	Internal Test / Quiz-(2): 10 +10 Assignment / Seminar + Attendance- 05 Total Marks - 15		Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory / Field Skill Performance:** **A. On spot Assessment - 20** **B. Spotting based on tools & technology (written) – 10 Marks** **C. Viva-voce (based on principle/technology) - 05 Marks**		Managed by course teacher as per lab status

Name and Signature of Convener and Members of CBoS:

Four Year Undergraduate Program (2024-28)
Department of Biotechnology
Course Curriculum

Part A: Introduction			
Program: Bachelor in Life Sciences (Degree/Honors)		Semester: **VII Sem**	Session:**2024-2025**
1	Course Code	**BTSE-08-P**	
2	Course Title	**Pharmaceutical Biotechnology**	
3	Course Type	Discipline-Specific Elective (DSE)--Practical	
4	Pre-requisite (if any)	As per program.	
5	Course Learning Outcomes (CLO)	After completing this course, the students will be able to - • Develop skill for antibiotic production • Develop skill for maintenance of pharmaceuticals. • Develop skill for regulation of pharmaceutical products. • Develop sill for determination of side effects of pharmaceuticals.	
6	Credit Value	01 Credits Credit =30 Hours Laboratory or Field learning/Training	
7	Total Marks	Max. Marks: 50	Min Passing Marks: 20

Part B: Content of Course (Theory)		
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)		
Module	Topic (Course content)	No. of Period
Lab./Field Training/ Experiment Contents of Course	1. Assay of antimicrobial activity of penicillin, streptomycin, and ciprofloxacin. 2. Antibiotic-resistant technique. 3. Microbial spoilage testing of pharmaceuticals. 4. Bioassay of antifungal compound. 5. Self-life determination of expired antibiotics. 6. Sterility testing for commercial pharmaceuticals. 7. Determination of minimum inhibitory concentration (mic) of antibiotics.	30
Keywords	Pharmacokinetics, Pharmacodynamics, Secondary Metabolites, Combinatorial Drugs.	

• Part C - **Learning Resource**
Text Books, Reference Books, Other Resources -
• **Text book**- FSK Barar- Pharmaceutical- Essentials of Pharmaceuticals- S.Chand ➢ S.P. Vyas, Dixit- Pharmaceutical Biotechnology-CBS Gupta P.K. - Biotechnology and Genomics, Rastogi Publication
Reference book- • Hugo W. B. and Russell A. D. - Pharmaceutical Microbiology -Wiley India • B.Razdan-Medicinal Chemistry-CBS • Satoskar, Bhandarkar- Pharmacology and Pharmacotherapeutics- Popular • Purohit, Saluja- Pharmaceutical Biotechnology-Student Edition
Online resources- https://nptel.ac.in/courses/104102113 https://onlinecourses.nptel.ac.in/noc19_bt23/preview

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: **Maximum Marks:** **50 Marks** **Continuous Internal Assessment (CIA):** **15 Marks** **End Semester Exam (ESE):** **35 Marks**		
Continuous Internal Assessment (CIA) (By course teacher):	Internal Test / Quiz-(2): **10 +10** Assignment / Seminar + Attendance- 05 Total Marks - **15**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory / Field Skill Performance:** **A. On spot Assessment - 20** **B. Spotting based on tools & technology (written) – 10 Marks** **C. Viva-voce (based on principle/technology) - 05 Marks**	Managed by course teacher as per lab status

Name and Signature of Convener and Members of CBoS: