

**DEPARTMENT OF CHEMISTRY**  
**COURSE CURRICULUM**

<b>PART- A: Introduction</b>			
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)	<i>As per Program</i>	
5	Course Learning Outcomes (CLO)	<ul style="list-style-type: none"> <li>➤ Study the formation, stability and electronic spectra of complexes</li> <li>➤ Analyze the chemistry of metal carbonyls and metal nitrosyls.</li> <li>➤ Solve the Schrodinger equation for the hydrogen atom and utilize Huckel theory for conjugated systems.</li> <li>➤ Analyze collision theory and transition state theory to understand chemical reactions.</li> </ul>	
6	Credit Value	3 Credits	<i>Credit = 15 Hours - learning &amp; Observation</i>
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40
<b>PART -B: Content of the Course</b>			
Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours)			
Unit	Topics (Course contents)		No. of Period
I	<b>MOT &amp; Electronic Spectra of Complexes</b> Electronic spectra and MO theory of Transition Metal complexes , M.O. Theory for octahedral, tetrahedral and square planar complexes with and without $\pi$ -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, $\beta$ parameters. Tanabe- Sugano Diagrams of octahedral complexes with d 2 and d8 configuration.		12
II	<b>Metal – Ligand Equilibria</b> 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) <b>Reaction Mechanism of Transition metal complexes-</b> : Energy Profile of a reaction, reactivity of metal complexes, Inert and Labile complexes, Kinetics of Octahedral substitution C) <b>Metal carbonyls</b> : 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) <b>Metal nitrosyls</b> : 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	<b>Advanced Quantum Mechanics</b> Discussion of solutions of the Schrodinger equation to three - dimensional box, concept of degeneracy, the harmonic oscillator, the rigid rotor, the hydrogen atom. <b>Approximate Methods</b>		11

	<p>The variation theorem and perturbation theory (first order and non-degenerate). Applications of variation method and perturbation theory to hydrogen and helium atom.</p> <p><b>Angular Momentum</b></p> <p>Ordinary angular momentum, eigen functions and eigen values of angular momentum, ladder operator, concept of spin, antisymmetry and Pauli's exclusion principle.</p> <p><b>Molecular Orbital Theory</b></p> <p>Huckel theory of conjugated systems, Applications to ethylene, butadiene and cyclobutadiene.</p>	
IV	<p><b>Advanced Chemical Dynamics</b></p> <p>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).</p> <p>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.</p>	11
Keywords	<p><i>Electronic spectra, MO theory, Complex stability, Spectrophotometry, Vibrational spectra, Bonding, Metal nitrosyls, Schrodinger equation, Huckel theory, Collision theory, Transition state theory</i></p>	

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://onlinecourses.nptel.ac.in/noc23_cy02/preview)
- <https://swayam.gov.in/>

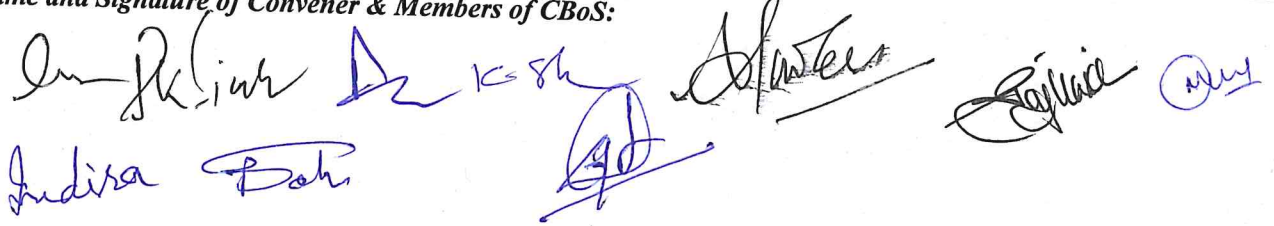
### PART -D: Assessment and Evaluation

#### Suggested Continuous Evaluation Methods:

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

<b>Continuous Internal Assessment (CIA):</b> (By Course Teacher)	Internal Test / Quiz-(2): 20 +20	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
	Assignment / Seminar - 10 Total Marks - 30	
<b>End Semester Exam (ESE):</b>	<b>Two section – A &amp; B</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:*


  
 The block contains five handwritten signatures in blue ink. The first signature is 'Dr. K. S. ...', the second is 'Indira ...', the third is '...', the fourth is '...', and the fifth is '...' with a circled 'M' next to it.

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

<b>PART- A: Introduction</b>			
Program: Bachelor in Science <i>(Honor/Honors with Research)</i>		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)	<i>As per Program</i>	
5	Course Learning Outcomes (CLO)	<ul style="list-style-type: none"> <li>➤ Master separating and estimating acidic and basic radicals in inorganic mixtures.</li> <li>➤ Apply qualitative and quantitative analysis skills to real samples. • Inorganic Synthesis &amp; Characterization</li> <li>➤ Gain hands-on experience synthesizing inorganic compounds and identify them using spectral analysis.</li> <li>➤ Grasp basic physical chemistry concepts through practical experiments and learn to operate basic equipment.</li> </ul>	
6	Credit Value	1 Credits	Credit =30 Hours Laboratory or Field learning/Training
7	Total Marks	Max. Marks: 50	Min Passing Marks: 20
<b>PART -B: Content of the Course</b>			
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	<p>Qualitative analysis of mixture containing eight radicals including two less common metals from among the following by semi micro method.</p> <p><b>Basic Radicals:</b> 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.</p> <p><b>Acidic Radicals:</b> Carbonate, Sulphite, Sulphide, Nitrite, Nitrate, Acetate, Fluoride, Chloride, Bromide, Iodide, Sulphate, Borate, Oxalate, Phosphate, Silicate, Thiosulphate, Ferricyanide, Sulphocyanide, Chromate, Arsinat and Permanganate.</p> <p><b>Separation and determination of two metal ions in ores, alloys, or mixtures in solution, one by volumetric and the other by gravimetric methods.</b></p> <p><b>Estimations</b></p> <p>(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.</p> <p><b>Preparations</b>            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</p>	<b>30</b>	

- |  |  |
|--|--|
| 1. VO (acac) <sub>2</sub>  | 2. TiO (C <sub>9</sub> H <sub>8</sub> NO) <sub>2</sub> 2H <sub>2</sub> O     |
| 3. Cis-K [Cr (C <sub>2</sub> O <sub>4</sub> ) <sub>2</sub> (H <sub>2</sub> O) <sub>2</sub> ] | 4. Na[Cr(NH <sub>3</sub> ) <sub>2</sub> (SCN) <sub>4</sub> ]                 |
| 5. Mn (acac) <sub>3</sub>  | 6. K <sub>3</sub> [Fe (C <sub>2</sub> O <sub>4</sub> ) <sub>3</sub> ]        |
| 7. Prussian Blue, Turnbull's Blue.   | 8. [Co (NH <sub>3</sub> ) <sub>6</sub> ][Co(NO <sub>2</sub> ) <sub>6</sub> ] |
| 9. Cis-[Co(trien)(NO <sub>2</sub> ) <sub>2</sub> ]Cl.H <sub>2</sub> O                        | 10. Hg[Co(SCN) <sub>4</sub> ]  |
| 11. [Co(Py) <sub>2</sub> Cl <sub>2</sub> ]   | 12. [Ni(NH <sub>3</sub> ) <sub>6</sub> ]Cl <sub>2</sub>                      |
| 13. Ni(DMG) <sub>2</sub>   | 14. [Cu(NH <sub>3</sub> ) <sub>4</sub> ]SO <sub>4</sub> .H <sub>2</sub> O    |

**Adsorption**

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

**Chemical Kinetics**

- 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.
- Determination of the rate constant for the oxidation of iodide ions by hydrogen peroxide studying the kinetics as an iodine clock reaction.

**Polarimetry**

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

**Solutions**

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

**Spectrophotometry**

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

**Potentiometry/pH metry**

- Determination of temperature dependence of EMF of a cell.
- To determine pK<sub>a</sub> of the given monobasic acid by pHmetric titration.
- 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	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
	Assignment/Seminar +Attendance - 05 Total Marks - 15	
End Semester Exam (ESE):	Laboratory / Field Skill Performance: On spot Assessment	
	S. Performed the Task based on lab. work - 20 Marks	Managed by Course teacher as per lab. status
	T. Spotting based on tools & technology (written) - 10 Marks	
U. Viva-voce (based on principle/technology) - 05 Marks		

Name and Signature of Convener & Members of CBoS:

Indira  
K. Sh  
D. S  
S. S  
S. S  
S. S

**FOUR YEAR UNDERGRADUATE PROGRAM(2024 – 28)**

**DEPARTMENT OF CHEMISTRY**

**COURSE CURRICULUM**

<b>PART-A: Introduction</b>			
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)	<ul style="list-style-type: none"> <li>➤ To study the photochemical reaction and pericyclic reaction</li> <li>➤ To gain knowledge about mechanism of light induced reaction.</li> <li>➤ To learn the mechanism of thermal reaction</li> <li>➤ To understand the difference between light and thermal reaction.</li> </ul>	
6	CreditValue	3 Credits	Credit = 15 Hours -learning & Observation
7	TotalMarks	Max.Marks: 100	Min Passing Marks:40
<b>PART -B: Content of the Course</b>			
TotalNo.of Teaching-learning Periods(01 Hr. per period) - 45 Periods (45 Hours)			
Unit	Topics(Coursecontents)		No.ofP eriod
I	<b>Photochemical reactions and Reaction Mechanism</b> 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	<b>Photochemistry of Alkenes</b> Intramolecular reactions of the olefinic bond - geometrical isomerism, cyclisation reactions, photochemical rearrangement of alkenes, rearrangement 1, 4- and 1,5-dienes.  <b>Photochemistry of Aromatic Compounds:</b> Photochemical isomerization of aromatic compounds, Photochemical addition and substitutions reactions shown by aromatic compounds.		11
III	<b>Photochemistry of Carbonyl Compounds</b> Photochemical reactions of carbonyl compounds: Norrish type I and II reactions Intramolecular reactions of carbonyl compounds - saturated cyclic and acyclic, $\beta$ , $\gamma$ - unsaturated and $\alpha$ , $\beta$ - unsaturated compounds. Cyclohexadienones. Intermolecular cycloaddition reactions –photo-dimerisation reaction and oxetane formation.  <b>Miscellaneous Photochemical Reactions</b> Photo-Fries reactions of anilides. Photo-Fries rearrangement. Barton reaction. Singlet molecular oxygen reactions. Photochemical formation of smog. Photodegradation of polymers. Photochemistry of vision.		11
IV	<b>Pericyclic Reactions</b> 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- conrotatory and		11

disrotatory motions,  $4n$ ,  $4n+2$  and allyl systems. Cycloadditions- antarafacial and 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,*

**Signature of Convener & 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 and Evaluation**

**Suggested Continuous Evaluation Methods:**

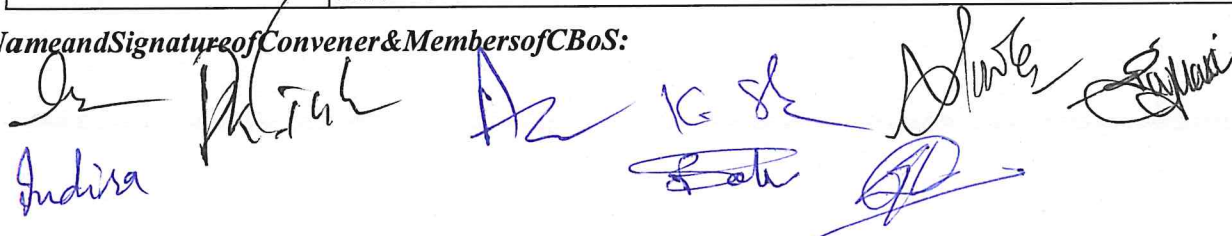
**Maximum Marks: 100 Marks**

**Continuous Internal Assessment (CIA): 30 Marks**

**End Semester Exam (ESE): 70 Marks**

<b>Continuous Internal Assessment (CIA):</b> (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
<b>End Semester Exam (ESE):</b>	Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20Marks Section B: Descriptive answer type qts., 1 out of 2 from each unit- 4x10=40Marks	

**Name and Signature of Convener & Members of CBoS:**

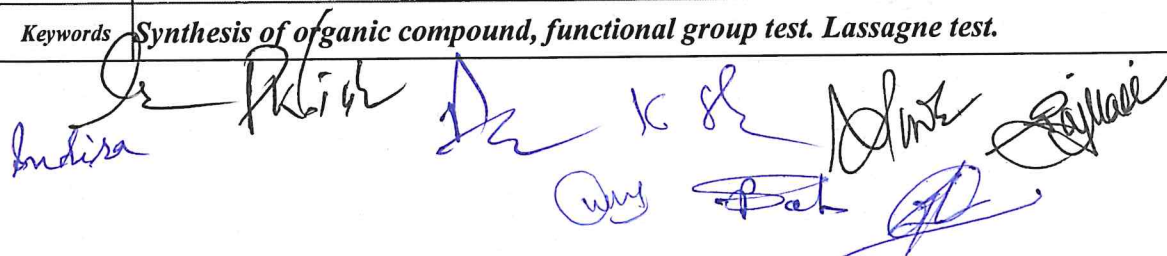

  
 Indira

**FOUR YEAR UNDERGRADUATE PROGRAM(2024 – 28)**

**DEPARTMENT OF CHEMISTRY**

**COURSE CURRICULUM**

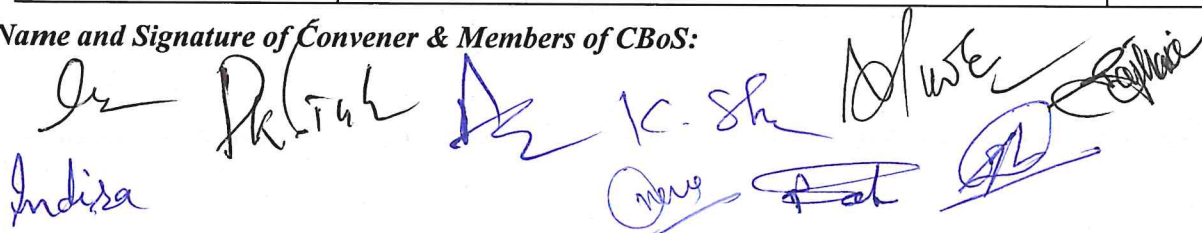
<b>PART-A: Introduction</b>			
Program: Bachelor in Science (Honors/Honors with Research)		Semester VII	Session: 2024-2025
1	CourseCode	CHSE-05P	
2	CourseTitle	PHOTOCHEMISTRY & PERICYCLIC REACTION LAB. COURSE	
3	CourseType	DSE	
4	Pre-requisite(if,any)	-	
5	Course Learning Outcomes(CLO)	<ul style="list-style-type: none"> <li>➤ To learn the advanced organic chemistry concept that will applied in solving their future chemistry problems.</li> <li>➤ To learn about arenium ion ,classical versus non classical carbonium ion ,different rearrangement reactions</li> <li>➤ To make student aware the level of basic organic chemistry to apply in different reaction mechanisms and organic transformations.</li> </ul>	
6	CreditValue	1 Credits	Credit =30 Hours Laboratory or Field learning/Training
7	TotalMarks	Max.Marks:50	Min Passing Marks:20
<b>PART -B: Content oftheCourse</b>			
TotalNo.of learning-Training/performancePeriods:30 Periods (30 Hours)			
Module	Topics(Coursecontents)		No.ofP eriod
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: Preparation 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 ofganic compound, functional group test. Lassagne test.		



Signature of Convener & Members (CBoS):

<b>PART-C: Learning Resources</b>		
<b>Text Books, Reference Books and Others</b>		
<b>Text books Recommended:</b>		
<ol style="list-style-type: none"> <li>1. Bansal, R. K. (1994). <i>Laboratory manual of organic chemistry</i>. New Age International Publishers.</li> <li>2. Vogel Textbook of Practical Organic Chemistry 5<sup>th</sup> edition, Pearson Publication.</li> </ol>		
<b>Reference books Recommended:</b>		
<ol style="list-style-type: none"> <li>1. Vishnoi, N. K. (2010). <i>Advanced practical organic chemistry (3rd ed.)</i>. Vikas Publishing House.</li> <li>2. Saikia, B. (Year). <i>Organic chemistry-I with practical.</i></li> <li>3. Agrawal, O. P. (Year). <i>Advanced practical organic chemistry</i>. Krishna Publication.</li> </ol>		
<b>Online Resources:</b>		
<a href="https://www.organic-chemistry.org/synthesis/">https://www.organic-chemistry.org/synthesis/</a> <a href="https://www.orgsyn.org/">https://www.orgsyn.org/</a> <a href="https://vlab.amrita.edu/?sub=2&amp;brch=191&amp;sim=344&amp;cnt=1#:~:text=In%20order%20to%20detect%20them,detected%20by%20simple%20chemical%20tests.">https://vlab.amrita.edu/?sub=2&amp;brch=191&amp;sim=344&amp;cnt=1#:~:text=In%20order%20to%20detect%20them,detected%20by%20simple%20chemical%20tests.</a>		
<b>PART-D: Assessment and Evaluation</b>		
<b>Suggested Continuous Evaluation Methods:</b>		
<b>Maximum Marks: 50 Marks</b>		
<b>Continuous Internal Assessment (CIA): 15 Marks</b>		
<b>End Semester Exam (ESE): 35 Marks</b>		
<b>Continuous Internal Assessment (CIA):</b> (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
<b>End Semester Exam (ESE):</b>	<b>Laboratory / Field Skill Performance: On spot Assessment</b> 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	<b>Managed by Course teacher as per lab. status</b>

Name and Signature of Convener & Members of CBoS:


  
 Indira

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

<b>PART- A: Introduction</b>			
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)	<i>As per Program</i>	
5	Course Learning Outcomes (CLO)	<ul style="list-style-type: none"> <li>➤ To equips students with advanced spectroscopic techniques for in-depth molecular analysis.</li> <li>➤ To enable classification, isotope effect analysis, and vibrational energy calculations of techniques like microwave and infrared spectroscopy</li> <li>➤ To provide detailed information on structure, environment, and electronic configuration on advanced methods like NMR, NQR, and PES.</li> <li>➤ To allows students to probe chemical and surface properties of materials using Photoacoustic spectroscopy.</li> <li>➤</li> </ul>	
6	Credit Value	3 Credits	Credit = 15 Hours - learning & Observation
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40
<b>PART -B: Content of the Course</b>			
Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours)			
Unit	Topics (Course contents)		No. of Period
I	<b>Molecular Spectroscopy</b> 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. <b>Microwave Spectroscopy</b> 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	<b>Infrared spectroscopy</b> 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. <b>Raman Spectroscopy</b> 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	<b>Nuclear Magnetic Resonance Spectroscopy</b> Nuclear spin, nuclear resonance, saturation, shielding of magnetic nuclei, chemical shift and its measurements, factors influencing chemical shift,		11

	<p>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.</p> <p><b>Nuclear Quadrupole Resonance Spectroscopy</b>          Quadrupole nuclei, Quadrupole moments, electric field gradient, coupling constant, splitting, applications.</p>	
<b>IV</b>	<p><b>Photoelectron Spectroscopy</b>          Basic principle: photo-electric effect, ionization process, Koopmans theorem, photoelectron spectra of simple molecules, ESCA, chemical information from ESCA.</p> <p><b>Photo acoustic Spectroscopy</b>          Basic principles of photo acoustic spectroscopy (PAS), PAS gases and condensed systems, chemical and surface applications.</p> <p><b>Electron Spin Resonance Spectroscopy</b>          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.</p>	11
<b>Keywords</b>	<p><i>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</i></p>	

**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:**

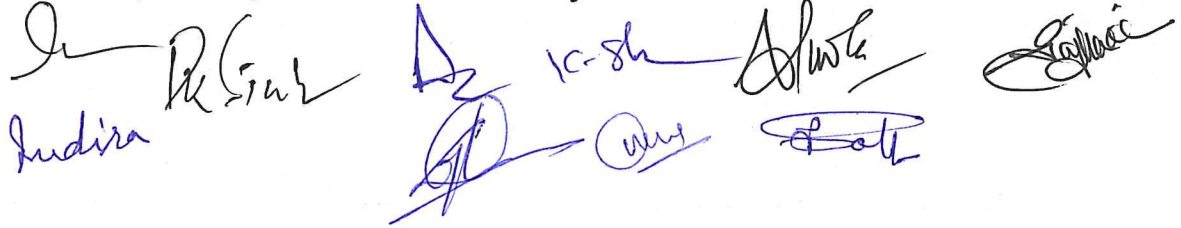
**Maximum Marks: 100 Marks**

**Continuous Internal Assessment (CIA): 30 Marks**

**End Semester Exam (ESE): 70 Marks**

<b>Continuous Internal Assessment (CIA):</b> (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
<b>End Semester Exam (ESE):</b>	<b>Two section – A &amp; B</b> Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20 Marks Section B: Descriptive answer type qts., 1 out of 2 from each unit-4x10=40 Marks	

*Name and Signature of Convener & Members of CBoS:*


  
 The signatures are written in blue ink. From left to right, there are seven distinct signatures. The first signature is 'Indira' written vertically. The second signature is 'R. S. ...'. The third signature is 'D. ...'. The fourth signature is 'K. S. ...'. The fifth signature is 'S. ...'. The sixth signature is 'S. ...'. The seventh signature is 'S. ...'.

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

<b>PART- A: Introduction</b>			
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)	<ul style="list-style-type: none"> <li>➤ Understand the fundamental principles of different spectroscopic techniques (Microwave, Infrared, Raman, NMR, UV-Vis (optional) and interpret the data obtained from various spectroscopic experiments.</li> <li>➤ Relate the observed spectroscopic features to the structure, bonding, and dynamics of molecules.</li> <li>➤ Develop practical skills in operating spectroscopic instrumentation and analyzing data.</li> <li>➤ Enhance critical thinking and problem-solving skills in a laboratory setting.</li> </ul>	
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	<p><b>Rotational Spectroscopy of a Diatomic Molecule (Microwave Spectroscopy):</b> Analyze the rotational spectrum of simple molecules and calculate its moment of inertia.</p> <p><b>Infrared (IR) Spectroscopy of a Simple Molecule:</b> Record and interpret the IR spectrum of a molecule, identifying functional groups based on characteristic frequencies.</p> <p><b>Raman Spectroscopy of a Liquid Sample:</b> Compare the Raman spectrum of a liquid to its IR spectrum and explore the concept of mutual exclusion principle.</p> <p><b>Nuclear Magnetic Resonance (NMR) Spectroscopy of Simple Molecules:</b> Analyze the <sup>1</sup>H NMR spectrum of simple organic molecule, understanding the effects of chemical environment and spin-spin coupling.</p> <p><b>(Ultraviolet-Visible (UV-Vis) Spectroscopy of a Conjugated System: Concentration Determination of Using Lambert Beer's Law,</b> 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 <math>\lambda_{max}</math> (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.</p> <p><b>ESR:</b> Common examples include studying free radicals generated during chemical reactions or analyzing organic radicals in biological systems.</p>	30

<b>Keywords</b>	<i>Electronic Transitions, Emission Spectra, Raman Spectroscopy, Nuclear Magnetic Resonance (NMR), Electron Spin Spectroscopy (ESR), UV-Visible Spectroscopy</i>
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*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:**

<b>Maximum Marks:</b>	<b>50 Marks</b>
<b>Continuous Internal Assessment (CIA):</b>	<b>15 Marks</b>
<b>End Semester Exam (ESE):</b>	<b>35 Marks</b>

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

*Name and Signature of Convener & Members of CBoS:*

*Indira Kumar, Dr. R. Sharma, Anurag Rajni, [Signature]*

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

<b>PART-A: Introduction</b>			
<b>Program: Bachelors in Science</b> <i>(Honors/Honors with Research)</i>		<b>Semester-VII</b>	
Session:2024-25			
1	CourseCode	CHSE-07T	
2	CourseTitle	CHEMICAL KINETICS AND NUCLEAR CHEMISTRY	
3	CourseType	DSE	
4	Pre-requisite(if,any)	<i>As per Program</i>	
5	CourseLearning Outcomes(CLO)	<ul style="list-style-type: none"> <li>➤ <i>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.</i></li> <li>➤ <i>To explain the concept of acidity functions and illustrate the various rate correlations, isotopic effect and solvent effect.</i></li> <li>➤ <i>To discuss various aspects of nuclear models, nuclear reactions and nuclear reactors.</i></li> <li>➤ <i>To understand the principles of radioactivity, its measurements, counters, apply in determining reaction mechanism, structures, physicochemical properties and in chemical analysis.</i></li> </ul>	
6	CreditValue	03Credits	<i>Credit = 15 Hours - learning &amp; Observation</i>
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
<b>I</b>	<p><b>Kinetics of CompositeReactions</b>  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.</p> <p><b>Kinetics of Catalytic Reactions</b>  Kinetics of acid-base catalysis: general and specific, hydrolysis of ester and amide; Enzyme catalysis, Micellar catalysis.</p> <p><b>Activation Parameters</b>  Activation parameters from experimental results- Arrhenius factor, standard free energy of activation, standard enthalpy of activation, entropy of activation and their physical significance.</p>	<b>12</b>
<b>II</b>	<p><b>Acidity function and various rate correlations</b>  Hammett acidity function, various treatments of rate correlation, Linear Free Energy Relationship (LFER), The Hammett equation, Zucker-Hammett-hypothesis, Bunnett-Olsen parameter.</p> <p><b>Isotopic Effect</b>  Theory of isotopic effects; Primary and secondary kinetic isotope effects. Heavy atom isotope effects, Tunneling effect. Kinetic solventeffects.</p> <p><b>Solvent Effect</b>  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 - Palm-treatment.</p>	<b>11</b>

<b>III</b>	<p><b>Nuclear Models</b> 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 optical model.</p> <p><b>Nuclear Reactions</b> Nuclear fusion and fission; Nuclear fission – mass, energy and charge distribution of fission products; fission neutrons; liquid drop model.</p> <p><b>Nuclear Reactors</b> Natural uranium reactors, classification of reactors – typical reactors, Breeder reactor.</p>	<b>11</b>
<b>IV</b>	<p><b>Radioactivity</b> 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.</p> <p><b>Applications of Radioactivity</b> 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 dilution analysis and neutron activation analysis; age determination and medical applications.</p>	<b>11</b>
<i>Keywords</i>	<i>Kinetics, composite reactions, catalytic reactions, activation parameters, acidity function, isotopic effect, nuclear models, radioactivity.</i>	

*Signature of Convener & Members (CBoS):*

<b>PART-C</b>
<b>Learning Resources: Textbooks, Reference Books and Others</b>
<p><i>Textbooks Recommended–</i> 1. Arnikar, H. J. (1995). <i>Essentials of nuclear chemistry</i> (No. 1653). New Age International.</p> <p><i>Reference Books Recommended–</i> 1. Laidler, K. J., &amp; Keith, J. (1965). <i>Chemical kinetics</i> (Vol. 2). New York: McGraw-Hill. 2. Chorkendorff, I., &amp; Niemantsverdriet, J. W. (2017). <i>Concepts of modern catalysis and kinetics</i>. John Wiley &amp; Sons. 3. Vannice, M. A., &amp; Joyce, W. H. (2005). <i>Kinetics of catalytic reactions</i> (Vol. 134). New York: Springer. Investigation of Reduction Rates and Mechanism of Reactions. Edward Lewis.</p>
<p><b>Online Resources – e-Resources/e-books and e-learning portals</b></p> <ul style="list-style-type: none"> <li>➤ <a href="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://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)</a></li> <li>➤ <a href="https://www.vssut.ac.in/lecture_notes/lecture1425072667.pdf">https://www.vssut.ac.in/lecture_notes/lecture1425072667.pdf</a></li> <li>➤ <a href="https://www.khanacademy.org/science/chemistry/chem-kinetics/arrhenius-equation/a/types-of-catalysts">https://www.khanacademy.org/science/chemistry/chem-kinetics/arrhenius-equation/a/types-of-catalysts</a></li> <li>➤ <a href="https://wou.edu/chemistry/courses/online-chemistry-textbooks/ch103-allied-health-chemistry/ch103-chapter-3-radioactivity/">https://wou.edu/chemistry/courses/online-chemistry-textbooks/ch103-allied-health-chemistry/ch103-chapter-3-radioactivity/</a></li> <li>➤ <a href="https://www.orano.group/en/unpacking-nuclear/all-about-radioactivity">https://www.orano.group/en/unpacking-nuclear/all-about-radioactivity</a></li> </ul>

### **PART -D: Assessment and Evaluation**

**Suggested Continuous Evaluation Methods:**

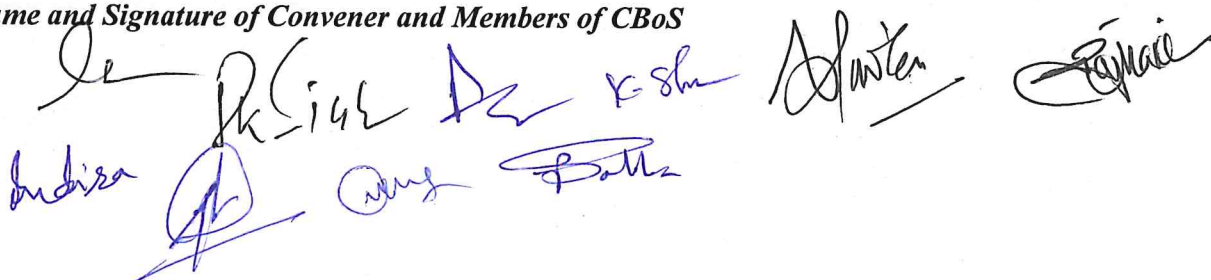
**Maximum Marks:** 100 Marks

**Continuous Internal Assessment (CIA):** 30 Marks

**End Semester Exam (ESE):** 70 Marks

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

*Name and Signature of Convener and Members of CBoS*



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

<b>PART- A: Introduction</b>			
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)	<ul style="list-style-type: none"> <li>➤ To understand basic concepts in Physical Chemistry through experiential learning.</li> <li>➤ To acquaint with the basic principles of equipment/instruments and its applications.</li> <li>➤ To determine the order of reaction with respect to various reactants and overall order and activation parameters using experimental data.</li> <li>➤ To acquire the knowledge of radioactive decay and GM counter.</li> </ul>	
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	<p><b>Chemical Kinetics</b></p> <ol style="list-style-type: none"> <li>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.</li> <li>Determination of the rate constant for the oxidation of iodide ions by hydrogen peroxide studying the kinetics as an iodine clock reaction.</li> </ol> <p><b>Polarimetry</b></p> <ol style="list-style-type: none"> <li>Determine the specific and molecular rotation of optically active substance.</li> <li>To determine the concentration of a solution of an optically active substance.</li> </ol> <p><b>Viscosity</b></p> <ol style="list-style-type: none"> <li>To determine viscosity of an organic liquid using Ostwald viscometer.</li> <li>To verify Kendall's equation.</li> <li>To study the variation of viscosity with temperature.</li> </ol> <ol style="list-style-type: none"> <li>To study the effect of concentration of the reactant and catalysts on the rate of hydrolysis of ester.</li> <li>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.</li> </ol>	30

	<ol style="list-style-type: none"> <li>3. To study the kinetics of saponification of ethyl acetate by (a) Volumetric method (b) Conductometric method</li> <li>4. To study the influence of ionic strength on the reaction between potassium persulphate and iodide.</li> <li>5. To study the Kinetics of reaction between H<sub>2</sub>O<sub>2</sub> and KI.</li> <li>6. To study the kinetics of reaction between sodium formate and iodine.</li> <li>7. To study the kinetics of reaction between acetone and iodine.</li> <li>8. To determine the rate constant of hydrolysis / inversion of sugar using polarimeter and factors effecting.</li> <li>9. To study some simple enzyme catalysed reaction.</li> <li>10. To determine plateau and optimal operating voltage of Geiger-Muller counter.</li> <li>1. To determine the dead time or resolving time of GM counter.</li> <li>2. Simulation of Radioactive decay using rolling of dice.</li> </ol>	
<b>Keywords</b>	<i>Chemical Kinetics, nuclear chemistry, Activation energy, GM counter, Decay kinetics</i>	

**Signature of Convener & Members (CBoS):**

<b>PART-C</b>
<b>Learning Resources: Text Books, Reference Books and Others</b>
<p><b>Textbook Recommended-</b></p> <ol style="list-style-type: none"> <li>1. Athawale, V. D., &amp; Oza, N. R. (2001). <i>Experimental physical chemistry</i>. New Age International Publishers.</li> <li>2. Bahl, B. S., Bahl, A., &amp; Tuli, G. D. (2018). <i>Essentials of physical chemistry (Vol. 2: Practical physical chemistry)</i>. S. Chand Publishing.</li> </ol> <p><b>Reference Books Recommended</b></p> <ol style="list-style-type: none"> <li>1. Friedlander, G., Kennedy, J. W., Miller, J. M., Seaborg, G. T., &amp; Nuclear Regulatory Commission. (2014). <i>Radiochemistry and nuclear chemistry (Vol. 2: Practical radiochemistry)</i>.</li> </ol>
<p><b>Online Resources-</b></p> <p><a href="https://www.mdpi.com/books/reprint/4856-synthesis-and-characterization-of-nanomaterials">https://www.mdpi.com/books/reprint/4856-synthesis-and-characterization-of-nanomaterials</a></p> <p><a href="https://swayam.gov.in">https://swayam.gov.in</a></p> <p><a href="https://epathshala.nic.in">https://epathshala.nic.in</a></p> <p><a href="http://as.wiley.com/WileyCDA/WileyTitle/productCd-EHEP000803.html">http://as.wiley.com/WileyCDA/WileyTitle/productCd-EHEP000803.html</a></p>

<b>PART -D: Assessment and Evaluation</b>		
<b>Suggested Continuous Evaluation Methods:</b>		
<b>Maximum Marks: 50 Marks</b>		
<b>Continuous Internal Assessment (CIA): 15 Marks</b>		
<b>End Semester Exam (ESE): 35 Marks</b>		
<b>Continuous Internal Assessment (CIA): (By Course Teacher)</b>	Internal Test / Quiz-(2): <b>10 &amp; 10</b> Assignment/Seminar + Attendance - <b>05</b> Total Marks - <b>15</b>	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against <b>15 Marks</b>
<b>End Semester Exam (ESE):</b>	<b>Laboratory/Field Skill Performance : on spot Assessment</b> <b>A: Perform task Based on the lab work- 20 Mark</b> <b>B: Spotting Based on tools and techniques- 10 marks</b> <b>C: Viva-voce (Based on principle/technology)-05 Marks</b>	<b>Managed by Course teacher as per Lab. Status.</b>

Name and Signature of Convener & Members of CBoS:

**FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)**

**DEPARTMENT OF CHEMISTRY**

**COURSE CURRICULUM**

<b>PART-A: Introduction</b>			
<b>Program: Bachelors in Science</b> <i>(Certificate/Diploma /Degree/Honors)</i>		<b>Semester-VII</b>	<b>Session:2024-2025</b>
1	<b>CourseCode</b>	<b>CHSE-08T</b>	
2	<b>CourseTitle</b>	<b>ELECTRO CHEMISTRY &amp; SURFACE CHEMISTRY</b>	
3	<b>CourseType</b>	<b>DSE</b>	
4	<b>Pre-requisite(if,any)</b>	<i>As per Program</i>	
5	<b>CourseLearning Outcomes(CLO)</b>	<ul style="list-style-type: none"> <li>➤ <i>Understand electrochemistry fundamentals, explain laws and industrial applications</i></li> <li>➤ <i>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.</i></li> <li>➤ <i>To describe and interpret various adsorption isotherms and its applications, concept and various aspects of micelles.</i></li> <li>➤ <i>To understand the fundamentals, types, and applications of surfactants and micelles.</i></li> </ul>	
6	<b>CreditValue</b>	<b>03Credits</b>	<i>Credit = 15 Hours - learning &amp; Observation</i>
7	<b>TotalMarks</b>	<b>Max.Marks:100</b>	<b>MinPassingMarks:40</b>
<b>PART-B: Content of the Course</b>			
<b>TotalNo.of Teaching-learning Periods(01 Hr. per period) - 45 Periods (45 Hours)</b>			
<b>Module /Unit</b>	<b>Topics(Coursecontents)</b>		<b>No.of Period</b>
<b>I</b>	<b>Electrochemistry-1</b> 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.		<b>12</b>
<b>II</b>	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 $\Delta G$ , $\Delta H$ and $\Delta S$ for cell reaction.		<b>11</b>
<b>III</b>	<b>Electrochemistry-2</b> 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		<b>11</b>

	potentials, exchange current density, derivation of Butler-Volmer equation. Tafel plot. Polarography theory - Ilkovic equation, half wave potential and its significance.	
IV	<b>Surface Chemistry</b> Adsorption Surface tension, capillary action, pressure difference across curved surface (Laplace equation), Gibbs adsorption isotherm, BET equation and estimation of surface area using BET equation. 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	<i>Electrochemistry, Kohlrausch law, electrode potential, standard electrode potential, electrochemical series, Debye-Huckel limiting law, surface chemistry, micelles, adsorption.</i>	

Signature of Convener & Members (CBoS):

<b>PART-C</b>		
<b>Learning Resources: Textbooks, Reference Books and Others</b>		
<b>Textbooks Recommended-</b>		
1. Soni, P. L., & Mahajan, S. N. (2013). <b>A textbook of physical chemistry</b> (Vol. 3: Electrochemistry and surface chemistry). Sultan Chand & Sons. 2. Rakshit, P. C. (2009). <b>A textbook of physical chemistry</b> (Vol. 2: States of matter). Tata McGraw-Hill Education.		
<b>Reference Books Recommended-</b>		
1. Moroi, Y. (2013). <i>Micelles: theoretical and applied aspects</i> . Springer Science & Business Media. 2. Glasstone, S. (2011). <i>An introduction to electrochemistry</i> . Read Books Ltd. 3. Plieth, W. (2008). <i>Electrochemistry for materials science</i> . Elsevier. 4. Bikerman, J. J. (2013). <i>Surface chemistry: theory and applications</i> . Elsevier. 5. Somorjai, G. A., & Li, Y. (2010). <i>Introduction to surface chemistry and catalysis</i> . John Wiley & Sons.		
<b>Online Resources - e-Resources/e-books and e-learning portals</b>		
<ul style="list-style-type: none"> <li>• <a href="https://ceramrtr.ceramika.agh.edu.pl/~szyszkin/eis/Modern%20Electrochemistry%20Vol%20B%20Electrode%20in%20Chemistry,%20Engineering.pdf">https://ceramrtr.ceramika.agh.edu.pl/~szyszkin/eis/Modern%20Electrochemistry%20Vol%20B%20Electrode%20in%20Chemistry,%20Engineering.pdf</a></li> <li>• <a href="https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SCYA5303.pdf">https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SCYA5303.pdf</a></li> <li>• <a href="https://www.genesis-tutorials.com/wp-content/uploads/2018/04/Surface-chemistry.pdf">https://www.genesis-tutorials.com/wp-content/uploads/2018/04/Surface-chemistry.pdf</a></li> <li>• <a href="https://study.com/academy/lesson/micelles-biology-structure-function.html">https://study.com/academy/lesson/micelles-biology-structure-function.html</a></li> </ul>		

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

Name and Signature of Convener and Members of CBoS

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

<b>PART- A: Introduction</b>			
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.O utcomes(CLO)	<ul style="list-style-type: none"> <li>➤ The consolidation of knowledge about the structure-property relationship of solids through the self-directed synthesis, structure and property determination</li> <li>➤ To apply the knowledge gained on the synthesis, structure and function of solid-state compounds.</li> <li>➤ To acquire knowledge to synthesize nanomaterials and interpret its characteristics.</li> <li>➤ To acquire the knowledge of basic sciences required to understand the fundamentals of nanomaterials</li> </ul>	
6	CreditValue	01Credit (Practical)	(Credit = 30Hrs laboratory or Field learning / training)
7	TotalMarks	Max.Marks:50	MinPassingMarks:20
<b>PART-B: Content oftheCourse</b>			
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 <sub>3</sub> O <sub>4</sub> 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, Nanomaterials, Characterization, 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

<b>Continuous Internal Assessment (CIA): (By Course Teacher)</b>	Internal Test / Quiz-(2): 20 / 20	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
	Assignment / Seminar - 10 Total Marks - 30	
<b>End Semester Exam (ESE):</b>	<b>Two section – A &amp; B</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**

<b>PART- A: Introduction</b>			
<b>Program: Bachelor in Life Sciences</b> <i>(Honors)</i>		<b>Semester - VII</b>	<b>Session: 2024-2025</b>
1	<b>Course Code</b>	<b>BOSC- 07 T</b>	
2	<b>Course Title</b>	<b>Ecology and Phytogeography</b>	
3	<b>Course Type</b>	<b>Discipline Specific course (DSC)</b>	
4	<b>Pre-requisite (if, any)</b>	<b>As per program</b>	
5	<b>Course Learning Outcomes (CLO)</b>	At the end of this course, students will be able to understand: <ul style="list-style-type: none"> <li>▪ The interrelationship between organisms and environment.</li> <li>▪ Methods to study vegetation, community patterns and processes, ecosystem functions, and principles of phytogeography.</li> <li>▪ Evolving strategies for sustainable natural resource management and biodiversity conservation.</li> <li>▪ Climatic changes and its restoration</li> <li>▪ Familiar with sustainable development</li> </ul>	
6	<b>Credit Value</b>	<b>3 Credits</b>	<b>Credit = 15 Hours - learning &amp; Observation</b>
7	<b>Total Marks</b>	<b>Max. Marks: 100</b>	<b>Min Passing Marks: 40</b>
<b>PART -B: Content of the Course</b>			
<b>Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours)</b>			
Unit	Topics (Course contents)		No. of Period
<b>I</b>	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
<b>II</b>	. 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
<b>III</b>	<b>Community and Eco-Stability</b> 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
<b>IV</b>	<b>Phytogeography Pollution, Climatic Changes</b> 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 <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O, CFCs) sources, trends and role, ozone layer and ozone hole, consequences of climate changes, (CO <sub>2</sub> fertilization, global warming, sea level rise, UV radiation).		11
<b>Keywords</b>	Ecological Factors community and continuum ecosystem ,Phytogeographical ,climate changes		
<b>Signature of Convener &amp; Members (CBoS) :</b>			
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Ecological factors & Management  
Ecosystem organisation

## 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, Philadelphhia.
3. Odum, E. P. (1983) Basic Ecology. Saunders, Philasephia

#### Online Resources–

- e-Resources / e-learning portals
- [www.swayam.ac.in](http://www.swayam.ac.in)
- [www.ignou.ac.in](http://www.ignou.ac.in)
- [www.egyankosh.ac.in](http://www.egyankosh.ac.in)
- [www.iitm.ac.in](http://www.iitm.ac.in)
- [www.eskillindia.org](http://www.eskillindia.org)
- [www.eshiksha.mp.gov.in](http://www.eshiksha.mp.gov.in)
- [www.vlab.co.in](http://www.vlab.co.in)
- [www.internshala.com](http://www.internshala.com)
- [www.ndl.iitkgp.ac.in](http://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://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.nptel.ac.in/noc24_ce03/preview)
- [https://onlinecourses.swayam2.ac.in/nou24\\_ge10/preview](https://onlinecourses.swayam2.ac.in/nou24_ge10/preview)

## PART -D: Assessment and Evaluation

### Suggested Continuous Evaluation Methods:







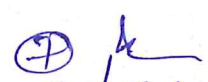
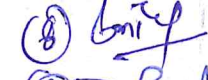


Maximum Marks: 100 Marks

Continuous Internal Assessment (CIA): 30 Marks

End Semester Exam (ESE): 70 Marks

<b>Continuous Internal Assessment (CIA): 30 (By Course Teacher)</b>	Internal Test / Quiz-(2): 20 +20	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
	Assignment / Seminar - 10	
	Total Marks - 30	
<b>End Semester Exam (ESE): 70</b>	<b>Two section – A &amp; B</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:

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

<b>PART- A: Introduction</b>			
<b>Program: Bachelor in Life Sciences (Honors)</b>		<b>Semester - VII</b>	<b>Session: 2024-2025</b>
1	<b>Course Code</b>	<b>BOSC-07</b>	
2	<b>Course Title</b>	<b>Lab. Course – 07 (Ecology and Phytogeography)</b>	
3	<b>Course Type</b>	<b>Laboratory course</b>	
4	<b>Pre-requisite (if, any)</b>	<b>As per program</b>	
5	<b>Course Learning Outcomes (CLO)</b>	<ul style="list-style-type: none"> <li>➤ Students will be able to determine frequency, abundance and density of any area.</li> <li>➤ Learn community relationships of plants.</li> <li>➤ Understand IVI and biomass.</li> <li>➤ Can determine diversity indices.</li> <li>➤ Biodiversity of different ecosystems</li> <li>➤ Interaction among different community</li> <li>➤ Pollution and its effect</li> </ul>	
6	<b>Credit Value</b>	<b>1 Credits</b>	<b>Credit =30 Hours Laboratory or Field learning/Training</b>
7	<b>Total Marks</b>	<b>Max. Marks: 50</b>	<b>Min Passing Marks: 20</b>
<b>PART -B: Content of the Course</b>			
<b>Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)</b>			
Module	Topics (Course contents)		No. of Period
<b>Lab./Field Training/ Experiment Contents of Course</b>	<ol style="list-style-type: none"> <li>1. to determine minimum size and number of quadrates required for reliable estimate of biomass in grass land ecosystem.</li> <li>2. To study the frequency, abundance and density of plants in the local ecosystem by quadrat method.</li> <li>3. To determine gross and net productivity by light and dark bottle method.</li> <li>4. To determine soil moisture content, porosity and bulk density of soil collected from different locations.</li> <li>5. To determine the water holding capacity of various soils.</li> <li>6. To determine the basal cover, or vegetational cover of one herbaceous community by quadrat method.</li> <li>7. To determine IVI of the grass land.</li> <li>8. To measure the above-ground plant biomass in a grassland.</li> <li>9. To determine diversity indices (richness, Simpson, Shannon-Wiener) in grazed and protected grassland.</li> <li>10. Experiment on Physico-Chemical Analysis of Water (pH, Temperature, etc.</li> <li>11. To determine transparency or turbidity of different water bodies.</li> <li>12. To measure the amount of dissolved oxygen in pond water.</li> <li>13. To determine the total dissolved solids (TDS) in water</li> <li>14. To measure the amount of BOD in different types of water.</li> <li>15. Ombrothermic diagram of your locality.</li> </ol>		<b>30</b>
<b>Keywords</b>	<b>Quadrat, Productivity, Turbidity ,TDS.</b>		
<b>Signature of Convener &amp; Members (CBoS) :</b>			

① *R. P. Rao*  
 ② *Neeraj*  
 ③ *Mohini*  
 ④ *M*  
 ⑤ *A. S. Rao*  
 ⑥ *A*  
 ⑦ *K*  
 ⑧ *Sanjay*  
 ⑨ *A. S. Rao*  
 ⑩ *U. S. Rao*

## 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 Wheeler , 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](http://www.swayam.ac.in)
- [www.ignou.ac.in](http://www.ignou.ac.in)
- [www.egyankosh.ac.in](http://www.egyankosh.ac.in)
- [www.iitm.ac.in](http://www.iitm.ac.in)
- [www.eskillindia.org](http://www.eskillindia.org)
- [www.eshiksha.mp.gov.in](http://www.eshiksha.mp.gov.in)
- [www.vlab.co.in](http://www.vlab.co.in)
- [www.internshala.com](http://www.internshala.com)
- [www.ndl.iitkgp.ac.in](http://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](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	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
	Assignment/Seminar +Attendance - 05 Total Marks - 15	
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:

① R. B. S. ...  
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## FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

### DEPARTMENT OF BOTANY COURSE CURRICULUM

<b>PART- A: Introduction</b>			
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)	<p><i>At the end of the course, the students will be able :</i></p> <ul style="list-style-type: none"> <li>➤ Understand different classification and nomenclature system in botany.</li> <li>➤ Learn plant collection and preservation techniques .</li> <li>➤ Get knowledge about the biodiversity and its importance.</li> <li>➤ Analyse the different conservation practices for nature.</li> </ul>	
6	Credit Value	3 Credits	Credit = 15 Hours - learning & Observation
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40
<b>PART -B: Content of the Course</b>			
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	Principles of Conservation: <i>In-situ</i> 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. <i>Ex-situ</i> Conservation: Strategies for <i>Ex-situ</i> conservation, Principles and practices, Botanical gardens, gene bank, seed in vitro repositories, cryo banks.	11	
Keywords	<b>Chemotaxonomy, Cladogram, Biodiversity, Conservation.</b>		
<b>Signature of Convener &amp; Members (CBoS) :</b>			

Biosystematics

Taxonomic Procedures

Biodiversity

Principles of conservation

① Rajeev

② Anand

③ Anurag

④ Anshu

⑤ Anshu

⑥ Anshu

⑦ Anshu

⑧ Anshu

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## 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. Anonymous (1997) National Gene Bank. Indian Heritage on Plant Genetic Resources (Booklet) NBPGER, New Delhi.
5. Swaminathan, M. S. And Kochhar (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 Development. 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. Pinstrip- 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://efaidnbmnnnibpcajpcglefindmkaj/https://egyankosh.ac.in/bitstream/123456789/66166/2/Unit4.pdf>
- [https://efaidnbmnnnibpcajpcglefindmkaj/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.](https://efaidnbmnnnibpcajpcglefindmkaj/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](http://www.swayam.ac.in)
- [www.ignou.ac.in](http://www.ignou.ac.in)
- [www.egyankosh.ac.in](http://www.egyankosh.ac.in)
- [www.iitm.ac.in](http://www.iitm.ac.in)
- [www.eskillindia.org](http://www.eskillindia.org)
- [www.eshiksha.mp.gov.in](http://www.eshiksha.mp.gov.in)
- [www.vlab.co.in](http://www.vlab.co.in)
- [www.internshala.com](http://www.internshala.com)
- [www.ndl.iitkgp.ac.in](http://www.ndl.iitkgp.ac.in)

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## 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	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
	Assignment / Seminar - 10	
	Total Marks - 30	
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., 1 out of 2 from each unit-4x10=40 Marks	

Name and Signature of Convener & Members of CBoS:

- ① Riswan
- ② Arundh
- ③ Ms
- ④ [Signature]
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**FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)**

**DEPARTMENT OF BOTANY**

**COURSE CURRICULUM**

<b>PART- A: Introduction</b>			
<b>Program: Bachelor in Life Science (Honours)</b>		<b>Semester - VII</b>	<b>Session: 2024-2025</b>
1	<b>Course Code</b>	<b>BOSE-05 P</b>	
2	<b>Course Title</b>	<b>Lab course -05 (Biosystematics and Biodiversity)</b>	
3	<b>Course Type</b>	<b>Laboratory course</b>	
4	<b>Pre-requisite (if, any)</b>	<b>As per program</b>	
5	<b>Course Learning Outcomes (CLO)</b>	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	<b>Credit Value</b>	<b>1 Credits</b>	<b>Credit =30 Hours Laboratory or Field learning/Training</b>
7	<b>Total Marks</b>	<b>Max. Marks: 50</b>	<b>Min Passing Marks: 20</b>
<b>PART -B: Content of the Course</b>			
<b>Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)</b>			
<b>Module</b>	<b>Topics (Course contents)</b>		<b>No. of Period</b>
<b>Lab./Field Training/ Experiment Contents of Course</b>	<ul style="list-style-type: none"> <li>• Herbarium technique.</li> <li>• Non destructive collection of plants</li> <li>• Preservation techniques for plants part .</li> <li>• Prepration of taxonomic keys</li> <li>• How to use flora and digital flora for plant identification.</li> <li>• Use of flora for identification of plants of college campus.</li> <li>• Cladogram and dendrogram</li> <li>• Visit of any botanical garden , national park/wildlife sanctuary/ protected area.</li> <li>• Learn about IUCN categories of threats.</li> <li>1) Evaluation of alfa, beta and gama biodiversity of college campus..</li> </ul>		<b>30</b>
<b>Keywords</b>	<b>Herbarium, Flora, Protected area, IUCN categories.</b>		
<b>Signature of Convener &amp; Members (CBoS) :</b>			

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## 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 Longman
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-A Phylogenetic 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=1pBOY7YTBC LSD2K>
- <https://eppp.inflibert.ac.in/Home/ViewSubjectPratid-100YJVTRCLSDKUBW>
- <https://www.inflibnet.ac.in/Home/ViewSubjectPratid-1pbbzy1BCS02E>
- <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](file:///C:/Users/user/Downloads/ajol-file-journals_452_articles_122070_submission_proof_122070-5365-335203-1-10-20150914%20(1).pdf)

#### Online Resources–

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

- [www.swayam.ac.in](http://www.swayam.ac.in)
- [www.ignou.ac.in](http://www.ignou.ac.in)
- [www.egvankosh.ac.in](http://www.egvankosh.ac.in)
- [www.iitm.ac.in](http://www.iitm.ac.in)
- [www.eskillindia.org](http://www.eskillindia.org)
- [www.eshiksha.mp.gov.in](http://www.eshiksha.mp.gov.in)
- [www.vlab.co.in](http://www.vlab.co.in)
- [www.internshala.com](http://www.internshala.com)
- [www.ndl.iitkgp.ac.in](http://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	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
	Assignment/Seminar + Attendance - 05 Total Marks - 15	
End Semester Exam (ESE): 35	Laboratory / Field Skill Performance: On spot Assessment	Managed by Course teacher as per lab. status
	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	

Name and Signature of Convener & Members of CBoS:

- ① *R. Bhowmik*
- ② *R. Kundu*
- ③ *M. S.*
- ④ *K. S.*
- ⑤ *S. S.*
- ⑥ *A. K.*
- ⑦ *P. S.*
- ⑧ *S. S.*
- ⑨ *S. S.*
- ⑩ *M. S.*

# FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

## DEPARTMENT OF BOTANY

### COURSE CURRICULUM

<b>PART- A: Introduction</b>			
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
<b>PART -B: Content of the Course</b>			
Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours)			
Unit	Topics (Course contents)	No. of Period	
I	<b>Plant breeding:</b> Introduction and objectives. Breeding systems: modes of reproduction in crop plants. Important achievements and undesirable consequences of plant breeding.	12	
II	<b>Methods of crop improvement:</b> Introduction: Centers of origin and domestication of crop plants, plant genetic resources; Acclimatization; Selection methods: For self pollinated, cross pollinated and vegetatively propagated 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	<b>Breeding Methods for Stress Resistance:</b> Breeding for drought, salinity, heat, cold, disease and insect resistance, breeding for protein and oil quality. Heterosis and inbreeding depression, hybrid and synthetic varieties. Hardy-Weinberg law, systems of mating.	11	
IV	<b>Seed Technology:</b> 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 production organizations- national and state seed corporations and private seed companies. Artificial seeds, terminator seeds.	11	
<b>Keywords</b> Breeding, Heterosis, Self incompatibility, Hybridization.			

**Signature of Convener & Members (CBoS) :**

① Rajeev  
 ② Suresh  
 ③ Mr. ...  
 ④ ...  
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⑦ ...  
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## 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) Heatersis 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://efaidnbmnnnibpcajpcglefindmkaj/https://courseware.cutm.ac.in/wp-content/uploads/2020/05/Download-Notes-8.pdf>
2. <https://chrome-extension://efaidnbmnnnibpcajpcglefindmkaj/http://www.eagri.org/eagri50/GBPR211/lec16.pdf>
3. <https://efaidnbmnnnibpcajpcglefindmkaj/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](http://www.swayam.ac.in)
- [www.ignou.ac.in](http://www.ignou.ac.in)
- [www.egyankosh.ac.in](http://www.egyankosh.ac.in)
- [www.iitm.ac.in](http://www.iitm.ac.in)
- [www.eskillindia.org](http://www.eskillindia.org)
- [www.eshiksha.mp.gov.in](http://www.eshiksha.mp.gov.in)
- [www.vlab.co.in](http://www.vlab.co.in)
- [www.internshala.com](http://www.internshala.com)
- [www.ndl.iitkgp.ac.in](http://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	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
	Assignment / Seminar - 10	
	Total Marks - 30	

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 R. P. Singh  
② S. K. Singh  
③ M. Singh

④ S. K. Singh  
⑤ S. K. Singh  
⑥ S. K. Singh

⑦ S. K. Singh  
⑧ S. K. Singh  
⑨ S. K. Singh  
⑩ S. K. Singh

**FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)**

**DEPARTMENT OF BOTANY**

**COURSE CURRICULUM**

<b>PART- A: Introduction</b>			
<b>Program: Bachelor in Life Science (Honors)</b>		<b>Semester - VII</b>	<b>Session: 2024-2025</b>
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)	<i>As per program</i>	
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
<b>PART -B: Content of the Course</b>			
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.		<b>30</b>
Keywords	Seed, Emasculation, Bagging and tagging.		

**Signature of Convener & Members (CBoS) :**

**PART-C: Learning Resources**

- ① Shiver
- ② Kunda
- ③ Ms
- ④ [Signature]
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- ⑧ [Signature]
- ⑨ [Signature]
- ⑩ [Signature]

Text Books, Reference Books and Others		
<b>Text Books Recommended –</b>		
<ol style="list-style-type: none"> <li>Allard (1960) Principles of Plant Breeding. John Wiley and Sons, Inc. New York.</li> <li>Hayes, Immer and Smith (1955) Methods of Plant Breeding, MacGraw- Hil Book Co. Inc. New York.</li> <li>Plant breeding by B.D Singh</li> </ol>		
<b>Reference Books Recommended –</b>		
<ol style="list-style-type: none"> <li>Jonossy and Lupton (1976) Heatersis in Plant Breeding. Elsevier, Amsterdam.</li> <li>Poehlman and Borthakur (1969) Breeding Asian Field Crops With Special Reference To Crops I India. Oxford and IBH Publishing Company, New Delhi.</li> </ol>		
<b>Online Resources–</b>		
<ul style="list-style-type: none"> <li>➤ e-Resources / e-books and e-learning portals</li> <li>➤ <a href="https://www.merriam-webster.com/dictionary/emasculate">https://www.merriam-webster.com/dictionary/emasculate</a></li> <li>➤ <a href="https://agritech.tnau.ac.in/crop_improvement/crop_imprv_emasculation_cereals.html">https://agritech.tnau.ac.in/crop_improvement/crop_imprv_emasculation_cereals.html</a></li> <li>➤ <a href="https://www.toppr.com/guides/biology/reproduction-in-organisms/vegetative-propagation/#:~:text=Vegetative%20Propagation%20by%20Roots,example%2C%20Sweet%20potato%20and%20Dahlia.">https://www.toppr.com/guides/biology/reproduction-in-organisms/vegetative-propagation/#:~:text=Vegetative%20Propagation%20by%20Roots,example%2C%20Sweet%20potato%20and%20Dahlia.</a></li> </ul>		
<b>Online Resources–</b>		
<ul style="list-style-type: none"> <li>➤ e-Resources / e-books and e-learning portals</li> <li>➤ <a href="http://www.swayam.ac.in">www.swayam.ac.in</a></li> <li>➤ <a href="http://www.ignou.ac.in">www.ignou.ac.in</a></li> <li>➤ <a href="http://www.egyankosh.ac.in">www.egyankosh.ac.in</a></li> <li>➤ <a href="http://www.iitm.ac.in">www.iitm.ac.in</a></li> <li>➤ <a href="http://www.eskillindia.org">www.eskillindia.org</a></li> <li>➤ <a href="http://www.eshiksha.mp.gov.in">www.eshiksha.mp.gov.in</a></li> <li>➤ <a href="http://www.vlab.co.in">www.vlab.co.in</a></li> <li>➤ <a href="http://www.internshala.com">www.internshala.com</a></li> <li>➤ <a href="http://www.ndl.iitkgp.ac.in">www.ndl.iitkgp.ac.in</a></li> </ul>		
PART -D: Assessment and Evaluation		
<b>Suggested Continuous Evaluation Methods:</b>		
Maximum Marks: 50 Marks		
Continuous Internal Assessment (CIA): 15 Marks		
End Semester Exam (ESE): 35 Marks		
<b>Continuous Internal Assessment (CIA): 15 (By Course Teacher)</b>	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
<b>End Semester Exam (ESE): 35</b>	<b>Laboratory / Field Skill Performance: On spot Assessment</b> 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	<b>Managed by Course teacher as per lab. status</b>

Name and Signature of Convener & Members of CBOS:

① Rishwan  
② Anand  
③ Ms. [Signature]  
④ [Signature]  
⑤ [Signature]  
⑥ [Signature]

⑦ [Signature]  
⑧ [Signature]  
⑨ [Signature]  
⑩ [Signature]

**FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)**

**DEPARTMENT OF BOTANY  
COURSE CURRICULUM**

<b>PART- A: Introduction</b>			
<b>Program: Bachelor in Life Science (Honors)</b>		<b>Semester - VII</b>	<b>Session: 2024-2025</b>
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
<b>PART -B: Content of the Course</b>			
Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours)			
Unit	Topics (Course contents)		No. of Period
I	<ul style="list-style-type: none"> <li>Principles of microscopy; Light microscopy; Fluorescence microscopy; Confocal microscopy;</li> <li>Use of fluorochromes in : (a) Flow cytometry (b) fluorescence microscopy: for Chromosome banding</li> <li>Phase contrast, electron, scanning and transmission electron microscopy,</li> <li>Single and double staining techniques for light microscopy for temporary and permanent slides</li> <li>Stain techniques: Single and double staining.</li> </ul>		12
II	Instruments: Salient features, Principle and applications. <ul style="list-style-type: none"> <li>Autoclave,</li> <li>Oven,</li> <li>Laminar air flow,</li> <li>Centrifuge.</li> <li>Colorimetry</li> <li>Spectrophotometry,</li> <li>Fermenters.,</li> <li>Water bath,</li> <li>pH meter</li> </ul>		11
III	<ul style="list-style-type: none"> <li>Chromatography: Principle and its application in biological research: Paper chromatography, Column chromatography, Affinity chromatography, TLC, GLC, HPLC.</li> <li>Electrophoresis: AGE, PAGE, SDS-PAGE.</li> <li>Radioisotopes: Principles and its application in biological research.</li> <li>ELISA test</li> </ul>		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		

Microscopy

Instrumentation

Chromatography & Advance Techniques

Biochemical Technology & Genetic Engineering

Signature of Convener & Members (CBs) :

① Ramesh  
 ② Ramesh  
 ③ Mr.  
 ④  
 ⑤  
 ⑥  
 ⑦  
 ⑧  
 ⑨  
 ⑩

## 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](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](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](http://www.swayam.ac.in)
- [www.ignou.ac.in](http://www.ignou.ac.in)
- [www.egyankosh.ac.in](http://www.egyankosh.ac.in)
- [www.iitm.ac.in](http://www.iitm.ac.in)
- [www.eskillindia.org](http://www.eskillindia.org)
- [www.eshiksha.mp.gov.in](http://www.eshiksha.mp.gov.in)
- [www.vlab.co.in](http://www.vlab.co.in)
- [www.internshala.com](http://www.internshala.com)
- [www.ndl.iitkgp.ac.in](http://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	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
	Assignment / Seminar - 10 Total Marks - 30	
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., 1 out of 2 from each unit-4x10=40 Marks	

Name and Signature of Convener & Members of CBoS:

① R. S. Rao

② K. S. Reddy

③ M. S. Rao

④ S. S. Rao

⑤ S. S. Rao

⑥ S. S. Rao

⑦ S. S. Rao

⑧ S. S. Rao

⑨ S. S. Rao

⑩ S. S. Rao

**FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)**

**DEPARTMENT OF BOTANY**

**COURSE CURRICULUM**

<b>PART- A: Introduction</b>			
<b>Program: Bachelor in Life Science (Honors)</b>		<b>Semester - VII</b>	<b>Session: 2024-2025</b>
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 handling 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
<b>PART -B: Content of the Course</b>			
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 by paper 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) :**

① P. P. P. P.  
 ② H. H. H. H.  
 ③ K. K. K. K.  
 ④ A. A. A. A.  
 ⑤ S. S. S. S.  
 ⑥ B. B. B. B.

⑦ A. A. A. A.  
 ⑧ B. B. B. B.  
 ⑨ C. C. C. C.  
 ⑩ D. D. D. D.

## 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 Impert,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://admin/uploads/3/PG M.Sc. Botony 34631%20MICROBIOLOGY%20AND%20PLANT%20PATHOLOGY.pdf](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](http://www.swayam.ac.in)
- [www.ignou.ac.in](http://www.ignou.ac.in)
- [www.egyankosh.ac.in](http://www.egyankosh.ac.in)
- [www.iitm.ac.in](http://www.iitm.ac.in)
- [www.eskillindia.org](http://www.eskillindia.org)
- [www.eshiksha.mp.gov.in](http://www.eshiksha.mp.gov.in)
- [www.vlab.co.in](http://www.vlab.co.in)
- [www.internshala.com](http://www.internshala.com)
- [www.ndl.iitkgp.ac.in](http://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	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
	Assignment/Seminar +Attendance - 05 Total Marks - 15	

End Semester Exam (ESE): 35	Laboratory / Field Skill Performance: On spot Assessment	Managed by Course teacher as per lab. status
	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	

Name and Signature of Convener & Members of CBoS:

① *[Signature]*  
② *[Signature]*  
③ *[Signature]*  
④ *[Signature]*  
⑤ *[Signature]*  
⑥ *[Signature]*

⑦ *[Signature]*  
⑧ *[Signature]*  
⑨ *[Signature]*  
⑩ *[Signature]*

## FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

### DEPARTMENT OF BOTANY COURSE CURRICULUM

<b>PART- A: Introduction</b>			
<b>Program: Bachelor in Life Science (Honors)</b>		<b>Semester - VII</b>	<b>Session: 2024-2025</b>
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	<b>3 Credits</b>	<i>Credit = 15 Hours - learning &amp; Observation</i>
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40
<b>PART -B: Content of the Course</b>			
Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours)			
Unit	Topics (Course contents)		No. of Period
<b>I</b>	<b>Plant Growth and Phytohormone</b> ➤ Plant growth curve, sigmoid and J shaped growth. Lag, Log and steady stage. Developmental roles of phytohormones ➤ Auxins, ➤ Gibberellins, ➤ Cytokinins, ➤ ABA, ➤ Ethylene,		12
<b>II</b>	<b>Movements, Dormancy &amp; Responses</b> ➤ Photoperiodism (SDP, LDP, Day neutral plants); ➤ Phytochrome (discovery, structure and functions), ➤ Seed and bud Dormancy causes and breaking, ➤ Vernalization ➤ Senescence, ➤ Plant movements		11
<b>III</b>	<b>Planteco-physiology and Stress Physiology:</b> ➤ Concept of Planteco-physiology. ➤ Plant perception, ➤ physiology of ecological considerations. ❖ Hydrophytic, xerophytic morphological and anatomical adaptations in plants		11
<b>IV</b>	<b>Stress Physiology:</b> 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
<b>Keywords</b>		Growth, Phytohormone, Eco-physiology, Vernalization.	
<b>Signature of Convener &amp; Members (CBOS) :</b>			

① R. Sivas  
 ② S. Sundar  
 ③ M. S.

④ S. S.  
 ⑤ S. S.  
 ⑥ S. S.

⑦ S. S.  
 ⑧ S. S.  
 ⑨ S. S.  
 ⑩ S. S.

## PART-C: Learning Resources

### Text Books, Reference Books and Others

#### Text Books Recommended-

1. Galston, A.W., (1989) Life Processes in Plants, Scientific American Library. Springer-Verlag, New York, USA.
2. Hopkins, W.G., (1995) Introduction to Plant Physiology, John Wiley and Sons, Inc. New York, USA.
3. Salisbury, F.B. and Ross, C.W., (1992) Plant Physiology. Wadsworth Publishing Co., California, USA.
4. Denis, D.T., Turpin, D.H. Lefebvre, D.D. & Layzell, D.B. (1997) Plant Metabolism. Longman, Essex, England.

#### Reference Books Recommended -

- 1, Taiz, L. and Zeiger, E. (1998) Plant Physiology. Sinauer Associates, Inc. Pub., Massachusetts, 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](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](http://www.swayam.ac.in)

➤ [www.ignou.ac.in](http://www.ignou.ac.in)

➤ [www.egvankosh.ac.in](http://www.egvankosh.ac.in)

➤ [www.iitm.ac.in](http://www.iitm.ac.in)

➤ [www.eskillindia.org](http://www.eskillindia.org)

➤ [www.eshiksha.mp.gov.in](http://www.eshiksha.mp.gov.in)

➤ [www.vlab.co.in](http://www.vlab.co.in)

➤ [www.internshala.com](http://www.internshala.com)

➤ [www.ndl.iitkcp.ac.in](http://www.ndl.iitkcp.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	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
	Assignment / Seminar - 10 Total Marks - 30	
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., 1 out of 2 from each unit-4x10=40 Marks	

### Name and Signature of Convener & Members of CBoS:

① R. B. S. / R. B. S.  
② R. B. S. / R. B. S.  
③ R. B. S. / R. B. S.  
④ R. B. S. / R. B. S.

⑤ R. B. S. / R. B. S.  
⑥ R. B. S. / R. B. S.

⑦ R. B. S. / R. B. S.  
⑧ R. B. S. / R. B. S.  
⑨ R. B. S. / R. B. S.  
⑩ R. B. S. / R. B. S.

**FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)**

**DEPARTMENT OF BOTANY**

**COURSE CURRICULUM**

<b>PART- A: Introduction</b>			
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: <ol style="list-style-type: none"> <li>1. Understand the role of Physiological and metabolic processes for plant growth and development under stress.</li> <li>2. Assimilate about biochemical constitution of plant diversity</li> <li>3. Effect of phytohormones on plants.</li> <li>4. Understand different physiological processes of plants.</li> </ol>	
6	Credit Value	1 Credits	Credit =30 Hours Laboratory or Field learning/Training
7	Total Marks	Max. Marks: 50	Min Passing Marks: 20
<b>PART -B: Content of the Course</b>			
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	<ol style="list-style-type: none"> <li>1. <i>Avena</i> curvature test of Auxin.</li> <li>2. Expression of bolting in cabbage.</li> <li>3. Induction of lateral branches by cytokinin.</li> <li>4. Demonstration of plasmolysis and deplasmolysis in plant cell.</li> <li>5. Potato osmoscope for osmosis.</li> <li>6. Demonstration of transpiration.</li> <li>7. Measurement of transpiration rate by Farmers/ Ganong's potometer.</li> <li>8. Extraction of seed proteins depending upon solubility.</li> <li>9. Fractionation of proteins using gel filtration chromatography</li> <li>10. Principle of colorimetry, spectrophotometry and fluorimetry.</li> </ol>		30
Keywords	Bolting, chlorophyll, osmosis, chromatography.		

Signature of Convener & Members (CBOS) :

① RD Pooja  
 ② Anurag  
 ③ [Signature]  
 ④ [Signature]  
 ⑤ [Signature]  
 ⑥ [Signature]

⑦ [Signature]  
 ⑧ [Signature]  
 ⑨ [Signature]  
 ⑩ [Signature]

## 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](http://www.swayam.ac.in)
- [www.ignou.ac.in](http://www.ignou.ac.in)
- [www.egyankosh.ac.in](http://www.egyankosh.ac.in)
- [www.iitm.ac.in](http://www.iitm.ac.in)
- [www.eskillindia.org](http://www.eskillindia.org)
- [www.eshiksha.mp.gov.in](http://www.eshiksha.mp.gov.in)
- [www.vlab.co.in](http://www.vlab.co.in)
- [www.internshala.com](http://www.internshala.com)
- [www.ndl.iitkgp.ac.in](http://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	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
	Assignment/Seminar +Attendance - 05	
	Total Marks - 15	
End Semester Exam (ESE): 15	Laboratory / Field Skill Performance: On spot Assessment	
	A. Performed the Task based on lab. work - 20 Marks	Managed by Course teacher as per lab. status
	B. Spotting based on tools & technology (written) – 10 Marks	
C. Viva-voce (based on principle/technology) - 05 Marks		

Name and Signature of Convener & Members of CBoS:

① R. Dinesh  
② R. Dinesh  
③ R. Dinesh  
④ R. Dinesh  
⑤ R. Dinesh  
⑥ R. Dinesh

⑦ R. Dinesh  
⑧ R. Dinesh  
⑨ R. Dinesh  
⑩ R. Dinesh

**FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)**

**DEPARTMENT OF MICROBIOLOGY**

**COURSE CURRICULUM**

<b>PART – A: Introduction</b>			
<b>Program: Bachelor in Life Science (Honors/ Honors with Research)</b>		<b>Semester - VII</b>	
		<b>Session: 2024-25</b>	
<b>1</b>	<b>Course Code</b>	MBSC-07 T	
<b>2</b>	<b>Course Title</b>	Immunology	
<b>3</b>	<b>Course Type</b>	DSC	
<b>4</b>	<b>Prerequisite (If Any)</b>	As per Program	
<b>5</b>	<b>Course Learning Outcomes (CLO)</b>	<b>At the end of this course, students will be able to –</b> <ul style="list-style-type: none"> <li>➤ define the functions of the immune system</li> <li>➤ distinguish innate immunity and acquired immunity</li> <li>➤ relate the structure and function of the molecules, cells, and organs involved in Immunity</li> <li>➤ discuss cell mediated and antibody-mediated immunity</li> <li>➤ explain immunological techniques</li> </ul>	
<b>6</b>	<b>Credit Value</b>	<b>03 Credits</b>	<b>Credit = 15 Hours - Learning &amp; Observation</b>
<b>7</b>	<b>Total Marks</b>	<b>Max. Marks: 100</b>	<b>Minimum Passing marks: 40</b>
<b>PART – B: Content of the Course</b>			
<b>Total No. of Teaching-Learning Periods (01 Hr. per period) - 45 Periods (45 Hours)</b>			
<b>Unit</b>	<b>Topics (Course contents)</b>		<b>No. of Period</b>
<b>I</b>	<b>Immunity and Immune system</b> – History: Contribution of G.P. Talwar, M.C. Vaidya and Indira Nath; Concept of Innate and acquired immunity, Host defense mechanism- First, second and third line of host defense. Hematopoiesis, structure, functions and properties of Immune Cells – Stem cell, T cell, B cell, NK cell, Macrophage, Neutrophil, Eosinophil, Basophil, Mast cell, Dendritic cell; Organs of Immune; Bone Marrow, Thymus, Lymph Node, Spleen.		<b>12</b>
<b>II</b>	<b>Antigens and Antibodies-</b> Characteristics of an antigen (Foreignness, Molecular size and Heterogeneity); Epitopes, Haptens, Adjuvants. Structure, Types, Functions and Properties of Immunoglobulins (Antibody); Antigenic determinants on antibodies (Isotypic, allotypic, idiotypic).		<b>11</b>
<b>III</b>	<b>Immune Response</b> - Primary and Secondary Immune Response; Generation of Humoral Immune Response; Generation of Cell Mediated Immune Response; Killing Mechanisms by CTL (Cytotoxic T lymphocytes) and NK cells. Structure and Functions of MHC I & II molecules, Components and biological activities of Complement.		<b>11</b>
<b>IV</b>	<b>Antigen and Antibody Reactions and Immunological Techniques-</b> Principles of Agglutination, precipitation, Complement Fixation test, Immunodiffusion, Immuno electrophoresis, Hemagglutination, Immunofluorescence, ELISA, RIA, Coombs test.		<b>11</b>
<b>Key Words</b>	<b>Immunity, Antigens and Antibodies, Agglutination, precipitation, Innate immunity</b>		

**Name and Signature of Convener and Members of CBoS**

## Part – C: Learning Resources

### Text Books, Reference Books and Others

#### Text Books Recommended:

1. Text book of Microbiology; R. Anantharayanan, C.K. Jayaram Panikar, Orient Longman.
2. Medical microbiology; Chrakraborty P.
3. A text book of Microbiology; Dubey & Maheshwari.
4. Immunology, A Textbook; C.V. Rao.
5. Immunology; J. Kubly.

#### Reference Books:

1. Fundamental Immunology; W.E. Paul.
2. Essentials of Immunology; Roitt, I.M.

### Online Resources – e-Resources/ e-Books and e- learning portals

- [https://repository.stikesbcm.ac.id/id/eprint/168/1/books\\_5453\\_0.pdf](https://repository.stikesbcm.ac.id/id/eprint/168/1/books_5453_0.pdf)
- <https://www.mbbcollege.in/db/notes/474.pdf>
- <http://www.helmberg.at/immunology.pdf>
- <https://www.utep.edu/eerael/immunology.htm>
- <https://conursing.uobaghdad.edu.iq/wp-content/uploads/sites/20/2019/09/Microbiology-L10-Immunity-and-immune-system.pdf>

## 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

<b>Continuous Internal Assessment (CIA):</b> (By Course Teacher)	Internal Test / Quiz – (2): 20+20	Better marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against 30 Marks
	Assignment/ Seminar – 10	
	Total Marks – 30	

<b>End Semester Exam (ESE):</b>	<b>Two Section – A &amp; B</b> Section A: Q1. Objective 10 X 1 = 10 Mark; Q2. Short answer type – 5X4= 20 Marks Section B: Descriptive answer type qts., 1 out of 2 from each unit – 4X10 = 40 Marks
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Name and Signature of Convener and Members of CBoS

*[Signature]*  
10.6.24

*[Signature]*  
10.6.24

*[Signature]*  
10.6.24

*[Signature]*  
Dr. K.K. Patel

*[Signature]*  
Dr. Nelson Kere

*[Signature]*  
10/6/24

*[Signature]*  
10.6.24

*[Signature]*  
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**FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)**  
**DEPARTMENT OF MICROBIOLOGY**  
**COURSE CURRICULUM**

<b>PART – A: Introduction</b>			
<b>Program: Bachelor in Life Science (Honors/ Honors with Research)</b>		<b>Semester VII</b>	<b>Session: 2024-25</b>
<b>1</b>	<b>Course Code</b>	<b>MBSC-07 P</b>	
<b>2</b>	<b>Course Title</b>	<b>Lab. Course - MBSC-07</b>	
<b>3</b>	<b>Course Type</b>	<b>Laboratory Course</b>	
<b>4</b>	<b>Prerequisite (If Any)</b>	<b>As per Program</b>	
<b>5</b>	<b>Course Learning Outcomes (CLO)</b>	<b>At the end of this course, the student will be able to –</b> <ul style="list-style-type: none"> <li>➤ identify blood group and estimate of haemoglobin</li> <li>➤ perform Gel Diffusion assays used to examine antigen-antibody reactions</li> <li>➤ perform DOT ELISA test</li> <li>➤ understand the Flocculation and Agglutination reaction</li> </ul>	
<b>6</b>	<b>Credit Value</b>	<b>1 Credit</b>	<b>Credit = 30 Hours. Laboratory or Field learning/ Training</b>
<b>7</b>	<b>Total Marks</b>	<b>Max. Marks: 50</b>	<b>Min. Passing marks: 20</b>

**PART – B: Content of the Course**

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

<b>Module</b>	<b>Topics (Course contents)</b>	<b>No. of Period</b>
<b>Lab./ Field Training/ Experiment contents of Course</b>	1. Identification of human blood groups. 2. Estimation of haemoglobin. 3. Perform Total Leukocyte Count of the given blood sample. 4. Separate serum from the blood sample. 5. Flocculation reactions - VDRL Agglutination, Widal test, Blood Grouping. 7. Immuno-diffusion techniques- ODD and RID. 8. To Perform DOT ELISA. 9. Examination of skin microflora.	<b>30</b>

**Key Words**      **Blood group, Hemoglobin, Serum, Agglutination, ELISA**

**PART – C: Learning Resources**

**Text Books, Reference Books and Others**

**Text Books Recommended:**

1. Practical Immunology, Frank C. Hay, Olwyn M.R. Westwood & Paul N. Nelson. 4<sup>th</sup> Edition, 1 January
2. Handbook of Practical and Clinical Immunology, 2e, Vol. II 2nd Edition, Kindle Edition
3. Immunological Techniques Interpretations Validation and Safety Measures; Ankita Joshi & R S Chauhan

**Online Resources:**

- <https://doi.org/10.1002/9780470757475.index>
- <http://www.lucp.net/books-pdf/Lab%20Manual%20Dr.%20Iris%20Adewale%20Ahmed/15.%20BASIC%20IMMUNOLOGY.pdf>
- [https://webstor.srmist.edu.in/web\\_assets/downloads/2021/18BTC106J-lab-manual.pdf](https://webstor.srmist.edu.in/web_assets/downloads/2021/18BTC106J-lab-manual.pdf)

**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**

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

**Name and Signature of Convener and Members of CBoS**

**FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)**

**DEPARTMENT OF MICROBIOLOGY**

**COURSE CURRICULUM**

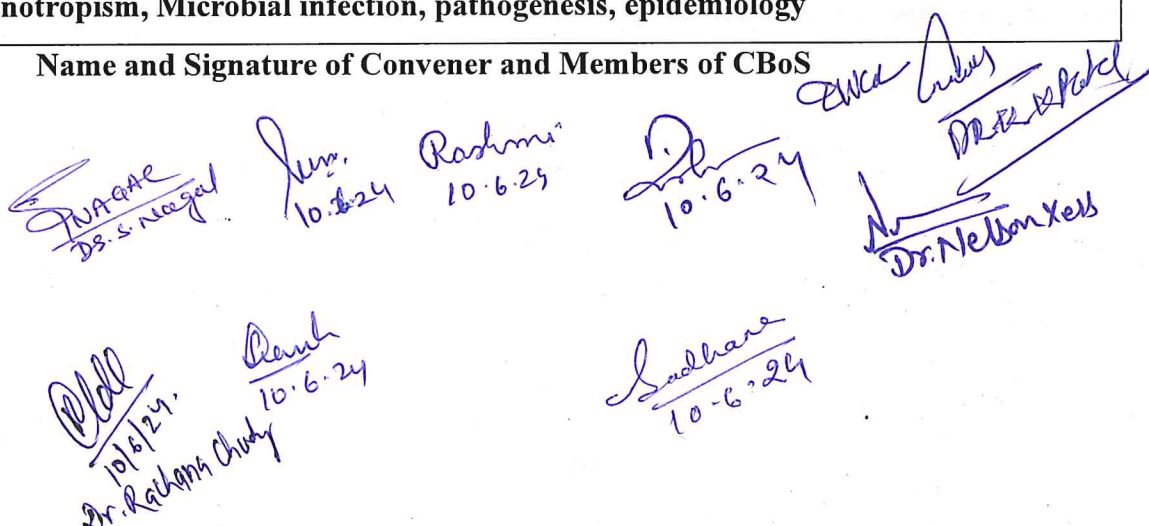
<b>PART – A: Introduction</b>			
<b>Program: Bachelor in Life Science (Honors/ Honors with Research)</b>		<b>Semester - VII</b>	
		<b>Session: 2024-25</b>	
1	<b>Course Code</b>	MBSE-05 T	
2	<b>Course Title</b>	Medical Microbiology	
3	<b>Course Type</b>	Discipline Specific Elective (DSE)	
4	<b>Prerequisite (If Any)</b>	As per Program	
5	<b>Course Learning Outcomes (CLO)</b>	At the end of this course, the students will be able to – <ul style="list-style-type: none"> <li>➤ define the history of medical microbiology</li> <li>➤ identify medically important microorganisms</li> <li>➤ explain the mechanism of infection</li> <li>➤ examine bacterial diseases</li> <li>➤ examine fungal diseases</li> </ul>	
6	<b>Credit Value</b>	03 Credits	Credit = 15 Hours - Learning & Observation
7	<b>Total Marks</b>	Max. Marks: 100	Minimum 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	<b>Introduction of medical microbiology and concept of infection:</b> Historical development, Koch & River's postulates, role of microbiology in medicine of medically important microbes; microbial flora of human body.	12
II	<b>Pathogenesis:</b> Microbial infection-types, stages and process. Mechanism of bacterial adhesion, colonization and invasion of mucous membranes of respiratory, enteric and urogenital tracts. Role of agresins, depolymerizing enzymes, organotropism, variation and virulence.	11
III	<b>Clinical Bacteriology:</b> Pathogenic bacteria-morphological characteristics, epidemiology, pathogenesis, laboratory diagnosis and treatment of pathogenic bacteria; <i>Staphylococcus aureus</i> , group A <i>Streptococcus</i> , <i>Pneumococci</i> , <i>E. coli</i> , <i>Salmonella</i> , <i>Corynebacterium Mycobacterium</i> and drug resistance.	11
IV	<b>Clinical Mycology:</b> Superficial, subcutaneous, cutaneous and systemic mycoses. General description of mycotic pathogens, the diagnosis and prevention. Pathogenic fungi: <i>Microsporium</i> , <i>Trichophyton</i> , <i>Histoplasma capsulatum</i> , <i>Blastomyces dermatitidis</i> , <i>Candida albicans</i> , <i>Cryptococcus neoformans</i> .	11
<b>Key Words</b>	<b>Organotropism, Microbial infection, pathogenesis, epidemiology</b>	

**Name and Signature of Convener and Members of CBoS**


  
 Dr. S. Nagal 10.6.24  
 Rashmi 10.6.24  
 Dr. Nelson Xes  
 Dr. Raghav Choudhary 10.6.24  
 Sudhakar 10.6.24

## Part – C: Learning Resources

### Text Books, Reference Books and Others

#### Text Books Recommended:

1. Text book of Microbiology; R. Anantharayanan, C. K. Jayaram Panikar, Orient Longman, Mumbai.
2. Medical microbiology; P. Chakraborty
3. A Text Book of Microbiology: R. C. Dubey & D. K. Maheshwari

#### Reference Books:

1. Medical Microbiology; N. C. Dey and T. K. Dey, Allied agency, Calcutta.
2. Microbiology; Davis, Dulbecco, Eisen Harper and Row Maryland.

### Online Resources – e-Resources/ e-Books and e-learning portals

- <https://microbiologysociety.org/static/uploaded/23cbf9c5-f8c8-4f91-b092a4ad819e6357.pdf>
- [https://books.google.co.in/books?id=RLpEDwAAQBAJ&pg=PA46&source=gbs\\_toc\\_r&cad=2#v=onepage&q&f=false](https://books.google.co.in/books?id=RLpEDwAAQBAJ&pg=PA46&source=gbs_toc_r&cad=2#v=onepage&q&f=false)
- [https://sist.sathyabama.ac.in/sist\\_coursematerial/uploads/SMB3101.pdf](https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SMB3101.pdf)
- <https://repository.poltekkes-kaltim.ac.id/1153/1/medical%20microbiology.pdf>

## 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	Better marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against 30 Marks
	Assignment/ Seminar –	10	
	Total Marks –	30	

End Semester Exam (ESE):	Two Section – A & B
	Section A: Q1. Objective 10 X 1 = 10 Mark; Q2. Short answer type – 5X4= 20 Marks
	Section B: Descriptive answer type qts., 1 out of 2 from each unit – 4X10 = 40 Marks

Name and Signature of Convener and Members of CBoS

*Sum* 10.6.24  
*Rashmi* 10.6.24  
*Dr. S. Nagal*  
*Dr. K. K. Patil*  
*Dr. Nelson Kers*  
*Sodhane* 10.6.24  
*Dr. D.* 10.6.24  
*Dr. A.* 10.6.24  
*Dr. C.* 10.6.24

**FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)**

**DEPARTMENT OF MICROBIOLOGY**

**COURSE CURRICULUM**

<b>PART – A: Introduction</b>	
<b>Program: Bachelor in Life Science (Honors/ Honors with Research)</b>	<b>Semester -VII</b>
	<b>Session: 2024-25</b>
<b>1</b>	<b>Course Code</b> MBSE-05 P
<b>2</b>	<b>Course Title</b> Lab. Course MBSE-05
<b>3</b>	<b>Course Type</b> Laboratory Course
<b>4</b>	<b>Prerequisite (If Any)</b> As per Program
<b>5</b>	<b>Course Learning Outcomes (CLO)</b> At the end of this course, the students will be able to – ➤ prepare culture media and examine of different pathological samples ➤ compare various staining techniques ➤ relate serological tests for disease diagnosis ➤ justify antibiotic sensitivity tests
<b>6</b>	<b>Credit Value</b> 1 Credit <i>Credit = 30 Hours. Laboratory or Field learning/ Training</i>
<b>7</b>	<b>Total Marks</b> Max. Marks: 50 Min. Passing marks: 20

**PART: B CONTENT OF THE COURSE**

**Total No. of Teaching-Learning Periods: 30Hours**

Module	Topics (Course contents)	No. of Period
<b>Lab./ Field Training/ Experiment contents of Course</b>	1. Preparation of culture media: Blood agar, Chocolate agar, MacConkey agar. 2. Isolation of bacteria from tooth crevices. 3. Staining techniques: Gram staining, Acid fast staining, metachromatic granule staining. 4. Demonstration of hemolysis on blood agar. 5. Perform microscopic examination of urine. 6. Isolation and identification of bacteria from pathological samples. 7. Perform serological tests: WIDAL, VDRL. 8. Perform antibiotic sensitivity test by disc diffusion method.	<b>30</b>
<b>Key Words</b>	<b>Culture media, Staining Techniques, Pathological samples, Antibiotic sensitivity test</b>	

**PART – C: Learning Resources**

**Text Books, Reference Books and Others**

**Text Books Recommended:**

- Laboratory Manual of Microbiology and Biotechnology: Aneja K. R
- Practical Microbiology: R. C. Dubey and D. K. Maheshwari.
- Laboratory Manual in Microbiology: P. Gunasekaran.

**Online Resources:**

- <https://books.google.co.in/books?id=Wh9OTbjcsfUC&printsec=age&q&f=false>
- <https://microbiologysociety.org/static/uploaded/23cbf9c5-f8c8-4f91-b092a4ad819e6357.pdf>
- [https://books.google.co.in/books?id=RLpEDwAAQBAJ&pg=PA46&source=gbs\\_toc\\_r&cad=2#v=onepage&q&f=false](https://books.google.co.in/books?id=RLpEDwAAQBAJ&pg=PA46&source=gbs_toc_r&cad=2#v=onepage&q&f=false)

**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**

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

**Name and Signature of Convener and Members of CBoS**

The bottom of the page contains several handwritten signatures in blue ink, each accompanied by a date. From left to right, the signatures are: 1. A signature with the date 10/6/24. 2. A signature with the date 10/6/24. 3. A signature with the date 10.6.24. 4. A signature with the date 10.6.24. 5. A signature with the date 10.6.24. 6. A signature with the date 10.6.24. 7. A signature with the date 10.6.24.

**FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)**

**DEPARTMENT OF MICROBIOLOGY**

**COURSE CURRICULUM**

<b>PART – A: Introduction</b>			
<b>Program: Bachelor in Life Science (Honors/ Honors with Research)</b>		<b>Semester - VII</b>	
		<b>Session: 2024-25</b>	
<b>1</b>	<b>Course Code</b>	<b>MBSE- 06 T</b>	
<b>2</b>	<b>Course Title</b>	<b>Mycology and Plant Pathology</b>	
<b>3</b>	<b>Course Type</b>	<b>Discipline Specific Elective (DSE)</b>	
<b>4</b>	<b>Prerequisite (If Any)</b>	<b>As per Program</b>	
<b>5</b>	<b>Course Learning Outcomes (CLO)</b>	<b>At the end of this course, the students will be able to –</b> <ul style="list-style-type: none"> <li>➤ classify and distinguish different types of fungi</li> <li>➤ relate some special phenomenon in fungi</li> <li>➤ examine the important genera of fungi</li> <li>➤ determine applied aspects of fungi</li> <li>➤ explain basic concepts of plants diseases and their management</li> </ul>	
<b>6</b>	<b>Credit Value</b>	<b>03 Credits</b>	<b>Credit = 15 Hours - Learning &amp; Observation</b>
<b>7</b>	<b>Total Marks</b>	<b>Max. Marks: 100</b>	<b>Minimum Passing marks: 40</b>

**PART: B CONTENT OF THE COURSE**

**Total No. of Teaching-Learning Periods: 45Hours/ 45 Periods**

<b>Unit</b>	<b>Topics (Course contents)</b>	<b>No. of Period</b>
<b>I</b>	<b>Mycology:</b> Characteristics, cellular and thallus organization in fungi, Classification, general features, structure, nutrition and reproduction in Phycomycetes, Ascomycetes, Basidiomycetes and Deuteromycetes; Heterothallism and Para sexuality, Physiological specialization, Sex hormones in fungi	<b>12</b>
<b>II</b>	<b>Important Fungal Genera:</b> General features, taxonomic status and economic importance of <i>Mucor</i> , <i>Aspergillus</i> , <i>Penicillium</i> , <i>Saccharomyces</i> , <i>Neurospora</i> , <i>Agaricus</i> , <i>Fusarium</i> , <i>Alternaria</i> , <i>Curvularia</i> , <i>Cladosporium</i> ; General account and importance of Lichens.	<b>11</b>
<b>III</b>	<b>Fungal Biotechnology:</b> Role of fungi in biotechnology, Applications of fungi in food industry (Flavor, texture, fermentation, organic acids, enzymes, Mycoproteins) fungal secondary metabolites, Fungal biofertilizers, Mycotoxins, Mushroom cultivation.	<b>11</b>
<b>IV</b>	<b>Concept of plant disease:</b> Definition of disease, symptoms associated with plant disease, Methods of infection and dissemination of pathogens, forecasting of plant diseases and its relevance in Indian context, Defence Mechanisms in Plant, Principles and practices involved in the management of plant diseases, Koch's postulates, Contributions of eminent Indian plant pathologists.	<b>11</b>
<b>Key Words</b>	<b>Classification of fungi, Fungal biotechnology, Concept of plant disease, Mycotoxins, Mycoproteins</b>	

**Name and Signature of Convener and Members of CBoS**

## Part – C: Learning Resources

### Text Books, Reference Books and Others

#### Text Books Recommended:

1. Introductory Mycology; Alexopoulos, C.J., Mims, C.W. and Blackwell, M., John Wiley, New York.
2. An Introduction to Mycology; Mehrotra, R.S. and K.R. Aneja. New Age International
3. Plant Pathology; Mehrotra R S and Ashok Agrawal. Tata Mc Graw Hill ,6th reprint (2006).

#### Reference Books:

1. Introduction to fungi; Webster, J. Cambridge University Press. Cambridge, U.K. (1985).
2. Morphology and Taxonomy of fungi; Bessey E.A. Vikas Publishing House Pvt. Ltd., New Delhi.

### Online Resources – e-Resources/ e-Books and e- learning portals

- Text Book of Modern Plant Pathology
- <https://yeastwonderfulworld.files.wordpress.com/2016/10/fungal-biology.pdf>
- <http://www.deskuervis.nic.in/pdf/WEBSTER30521807395.pdf>
- <https://www.rvskvv.net/images/I-Year-II-Sem Principles Plantpathology ANGRAU 20.04.2020.pdf>
- [https://agri-bsc.kkwagh.edu.in/uploads/department\\_course/PATH-121\\_FUNDAMENTALS\\_OF\\_PLANT\\_PATHOLOGY.pdf](https://agri-bsc.kkwagh.edu.in/uploads/department_course/PATH-121_FUNDAMENTALS_OF_PLANT_PATHOLOGY.pdf)

## 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

<b>Continuous Internal Assessment (CIA):</b> (By Course Teacher)	Internal Test / Quiz – (2): 20+20	Better marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against 30 Marks
	Assignment/ Seminar – 10	
	Total Marks – 30	

<b>End Semester Exam (ESE):</b>	<b>Two Section – A &amp; B</b>
	Section A: Q1. Objective 10 X 1 = 10 Mark; Q2. Short answer type – 5X4= 20 Marks
	Section B: Descriptive answer type qts., 1 out of 2 from each unit – 4X10 = 40 Marks

Name and Signature of Convener and Members of CBoS

*Sum*  
10.6.24

*Rashmi*  
10.6.24

*D*  
10.6.24

*Dr. K. K. Patel*

*Dr. Nelson*

*Dr. Nelson*

*Dr. Nelson*

*Dr. Nelson*

*Dr. Nelson*

*Dr. Nelson*

**FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)**

**DEPARTMENT OF MICROBIOLOGY**

**COURSE CURRICULUM**

<b>PART – A: Introduction</b>		
<b>Program: Bachelor in Life Science (Honors/ Honors with Research)</b>		<b>Semester -VII</b>
		<b>Session: 2024-25</b>
1	<b>Course Code</b>	<b>MBSE-06 P</b>
2	<b>Course Title</b>	<b>Laboratory exercises in Mycology and Plant Pathology</b>
3	<b>Course Type</b>	<b>Laboratory Course</b>
4	<b>Prerequisite (If Any)</b>	<b>As per Program</b>
5	<b>Course Learning Outcomes (CLO)</b>	<b>At the end of this course, the students will be able to –</b> <ul style="list-style-type: none"> <li>➤ distinguish pathogenic and non-pathogenic fungi</li> <li>➤ demonstrate fungal preservation under laboratory conditions</li> <li>➤ identify the life cycle of disease-causing fungi</li> <li>➤ examine plant disease symptoms in the laboratory</li> </ul>
6	<b>Credit Value</b>	<b>1 Credit</b>   <i>Credit = 30 Hours. Laboratory or Field learning/ Training</i>
7	<b>Total Marks</b>	<b>Max. Marks: 50</b>   <b>Min. Passing marks: 20</b>

**PART: B CONTENT OF THE COURSE**

**Total No. of Teaching-Learning Periods: 30Hours**

Module	Topics (Course contents)	No. of Period
<b>Lab./ Field Training/ Experiment contents of Course</b>	<ol style="list-style-type: none"> <li>Isolation of fungi from different sources.</li> <li>Preservation of pure cultures of common fungi.</li> <li>Study of the vegetative and reproductive structures through temporary and permanent slides: <i>Mucor, Rhizopus, Saccharomyces, Aspergillus, Penicillium, Erysiphe, Agaricus, Fusarium, Cercospora, Colletotrichum, Cladosporium and Alternaria.</i></li> <li>Study of common plant diseases on the basis of causal agent, symptoms, epidemiology and control; White rust of crucifers; Downy mildew; Late blight of potato; Powdery mildew, Ergot of rye; Black stem rust of wheat; Loose smut of wheat; Wilt of tomato.</li> </ol>	<b>30</b>

**Key Words** | Pathogenic fungi, Disease symptoms, Pure Culture, Plant Diseases

**PART – C: Learning Resources**

**Text Books, Reference Books and Others**

**Text Books Recommended:**

- Laboratory Manual of Microbiology and Biotechnology; K. R Aneja
- Practical Microbiology; R. C. Dubey and D. K. Maheshwari.
- Laboratory Manual in Microbiology; P. Gunasekaran.
- Experiments in Microbiology, Plant Pathology and Biotechnology; K.R. Aneja. New Age Pub. 2017

**Online Resources:**

- <https://nikolaussucher.github.io/bio-two/fungi.html>
- [Practical manual of Plant pathology](#)
- [Plant Pathology Concepts and Laboratory Exercises 240131\\_100459.pdf \(tnau.ac.in\)](#)

**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**

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

**Name and Signature of Convener and Members of CBoS**

**FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)**

**DEPARTMENT OF MICROBIOLOGY**

**COURSE CURRICULUM**

<b>PART – A: Introduction</b>			
<b>Program: Bachelor in Life Science (Honors/ Honors with Research)</b>		<b>Semester - VII</b>	
		<b>Session: 2024-25</b>	
<b>1</b>	<b>Course Code</b>	<b>MBSE-07 T</b>	
<b>2</b>	<b>Course Title</b>	<b>Agriculture and Veterinary Microbiology</b>	
<b>3</b>	<b>Course Type</b>	<b>Discipline Specific Elective (DSE)</b>	
<b>4</b>	<b>Prerequisite (If Any)</b>	<b>As per Program</b>	
<b>5</b>	<b>Course Learning Outcomes (CLO)</b>	<b>At the end of this course, the students will be able to –</b> <ul style="list-style-type: none"> <li>➤ find the multifarious roles of microorganisms in agriculture</li> <li>➤ illustrate microbial damages to plants</li> <li>➤ explain harmful effects fungal toxins on human</li> <li>➤ examine biological control measures of plant diseases</li> <li>➤ relate animal diseases due to microorganisms</li> </ul>	
<b>6</b>	<b>Credit Value</b>	<b>03 Credits</b>	<b>Credit = 15 Hours - Learning &amp; Observation</b>
<b>7</b>	<b>Total Marks</b>	<b>Max. Marks: 100</b>	<b>Minimum Passing marks: 40</b>

**PART – B: Content of the Course**

**Total No. of Teaching-Learning Periods (01 Hr. per period) - 45 Periods (45 Hours)**

<b>Unit</b>	<b>Topics (Course contents)</b>	<b>No. of Period</b>
<b>I</b>	<b>Agricultural Microbiology:</b> History, Contributions of Subba Rao, Dr. M. Swaminathan in Indian agriculture. Microbes and their importance in agriculture. <b>Bio fertilizers:</b> classification of biofertilizers, Nitrogen fixers, Phosphate solubilizers, PGPR, biofertilizers. Phyllosphere microflora.	<b>12</b>
<b>II</b>	<b>Plant Diseases:</b> Fungal diseases of plants: Rusts of wheat, late blight of potato, red rot of sugarcane; Bacterial diseases of plants: Citrus canker, blight of rice; Viral diseases of plants: Leaf curl of Papaya, vein clearing of lady's finger <b>Storage fungi:</b> Categories of storage fungi, conditions during storage in relation to damage of seeds, harmful effects. Role of Enzymes and toxins in plant pathogenesis, Mycotoxins and their effect on human	<b>11</b>
<b>III</b>	<b>Biological Control of plant diseases:</b> Bacterial control of insect pests: <i>Bacillus thuringiensis</i> as bacterial insecticide; Viral control of insect pests: Nuclear polyhedrosis viruses (NPV) and cytoplasmic polyhedrosis viruses (CPV); Fungal control of insect pests: Entomopathogenic fungi: <i>Beauveria bassiana</i> , <i>Verticillium lecani</i> .	<b>11</b>
<b>IV</b>	<b>Veterinary Microbiology:</b> Introduction, history and scope, Sources and routes of infection, Zoonoses, Study of following animal diseases with respect to etiology, symptoms, mode of transmission, prophylaxis and control: FMD, swine flu, bird flu, Rabies, bovine tuberculosis, Marek's, Ranikhet disease, brucellosis, distemper, transgenic animals.	<b>11</b>
<b>Key Words</b>	<b>Biofertilizers, Biopesticides, Plant diseases, Storage fungi, biological control, Animal diseases</b>	

**Name and Signature of Convener and Members of CBoS**

Convener: *[Signature]* 10-6-24  
 Member 1: *[Signature]* 10.6.24  
 Member 2: *[Signature]* 10.6.24  
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**FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)**

**DEPARTMENT OF MICROBIOLOGY**

**COURSE CURRICULUM**

<b>PART – A: Introduction</b>		
<b>Program: Bachelor in Life Science (Honors/ Honors with Research)</b>		<b>Semester -VII</b>
		<b>Session: 2024-25</b>
<b>1</b>	<b>Course Code</b>	<b>MBSE-07 P</b>
<b>2</b>	<b>Course Title</b>	<b>Lab. Course - MBSE-07</b>
<b>3</b>	<b>Course Type</b>	<b>Laboratory Course</b>
<b>4</b>	<b>Prerequisite (If Any)</b>	<b>As per Program</b>
<b>5</b>	<b>Course Learning Outcomes (CLO)</b>	<b>At the end of this course, the students will be able to –</b> > examine microbial population of soil and their role > demonstrate role of microorganisms for plant growth > identify specific plant diseases > identify specific animal diseases
<b>6</b>	<b>Credit Value</b>	<b>1 Credit</b> <i>Credit = 30 Hours. Laboratory or Field learning/ Training</i>
<b>7</b>	<b>Total Marks</b>	<b>Max. Marks: 50</b> <b>Min. Passing marks: 20</b>

**PART: B CONTENT OF THE COURSE**

**Total No. of Teaching-Learning Periods: 30Hours**

<b>Module</b>	<b>Topics (Course contents)</b>	<b>No. of Period</b>
<b>Lab./ Field Training/ Experiment contents of Course</b>	1. Enumeration of microbial population in soil- bacteria, fungi, actinomycetes. 2. Isolation of <i>Rhizobium</i> from legume root nodule and seed treatment studies. 3. Isolation of <i>Azotobacter/ Azospirillum</i> and study their effects. 4. Isolation of BGA from water/soil and its mass cultivation. 5. Isolation of PGPR from soil. 6. Study of storage fungi. 7. Symptomatic study of plant diseases and causal organism. 8. Symptomatic study of animal diseases and causal organism.	<b>30</b>

**Key Words**     **Soil Microflora, Beneficial Microbes for plants, Plant diseases, Animal diseases**

**PART – C: Learning Resources**

**Text Books, Reference Books and Others**

**Text Books Recommended:**

- Laboratory Manual of Microbiology and Biotechnology; Aneja K. R
- Practical Microbiology, R. C. Dubey and D. K. Maheshwari.
- Laboratory Manual in Microbiology. By P. Gunasekaran.

**Online Resources:**

- <https://nishat2013.files.wordpress.com/2013/11/laboratory-exercises-in-microbiology-book.pdf>
- <https://books.google.co.in/books?id=Wh9OTbjcsfUC&printsec=age&q&f=false>

**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**

<b>Continuous Internal Assessment (CIA): (By Course Teacher)</b>	<b>Internal Test/ Quiz – (2): 10 &amp; 10</b> <b>Assignment/ Seminar + Attendance: 05</b> <b>Total Marks: 15</b>	Better Marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against 15 Marks
<b>End Semester Exam (ESE):</b>	<b>Laboratory/ Field Skill Performance: On spot Assessment</b> 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	<b>Managed by course teacher as per lab. status</b>

**Name and Signature of Convener and Members of CBoS**

The bottom of the page contains several handwritten signatures in blue ink, each accompanied by a date, likely '10.6.24'. The signatures are for the Convener and members of the CBoS.





**FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)**

**DEPARTMENT OF MICROBIOLOGY**

**COURSE CURRICULUM**

<b>PART – A: Introduction</b>			
<b>Program: Bachelor in Life Science (Honors/ Honors with Research)</b>		<b>Semester -VII</b>	
		<b>Session: 2024-25</b>	
<b>1</b>	<b>Course Code</b>	<b>MBSE-08 P</b>	
<b>2</b>	<b>Course Title</b>	<b>Lab. Course - MBSE-08</b>	
<b>3</b>	<b>Course Type</b>	<b>Laboratory course</b>	
<b>4</b>	<b>Prerequisite (If Any)</b>	<b>As per Govt. norms</b>	
<b>5</b>	<b>Course Learning Outcomes (CLO)</b>	<b>At the end of this course, the students will be able to –</b> <ul style="list-style-type: none"> <li>➤ examine the role of microorganisms in fermentations</li> <li>➤ experiment with fermenter design</li> <li>➤ demonstrate production of fermented products</li> <li>➤ identify method of food preservation</li> </ul>	
<b>6</b>	<b>Credit Value</b>	<b>1 Credit</b>	<i>Credit = 30 Hours. Laboratory or Field learning/ Training</i>
<b>7</b>	<b>Total Marks</b>	<b>Max. Marks: 50</b>	<b>Min. Passing marks: 20</b>
<b>PART: B CONTENT OF THE COURSE</b>			
<b>Total No. of Teaching-Learning Periods: 30Hours</b>			
<b>Module</b>	<b>Topics (Course contents)</b>		<b>No. of Period</b>
<b>Lab./ Field Training/ Experiment contents of Course</b>	<ol style="list-style-type: none"> <li>1. Demonstration of Shake flask fermentation (Study of the effect of agitation)</li> <li>2. Fermentative production of wine.</li> <li>3. Isolation of organic acid producing microorganisms from soil.</li> <li>4. Isolation of antibiotic producing microorganisms from soil. Isolation of enzyme producing microorganisms from soil.</li> <li>5. Demonstration of production of Alcohol and Citric acid</li> <li>6. Determination of Titrable acidity test.</li> <li>7. Examination of preserved food and method of preservation</li> </ol>		<b>30</b>
<b>Key Words</b>	<b>Bacterial fermentation, Organic acid, Antibiotic, Titrable acidity, phosphatase test</b>		
<b>PART – C: Learning Resources</b>			
<b>Text Books, Reference Books and Others</b>			
<b>Text Books Recommended:</b>			
<ol style="list-style-type: none"> <li>1. Industrial Microbiology; AH Patel. Macmillan Publisher India.</li> <li>2. Biology of Industrial microorganism; Arnold L. Domain, Benjamin/ cummings Pub. Co.</li> <li>3. Practical Fermentation Technology; Brain McNeil &amp; Harvey (2008), John Wiley &amp; Sons Ltd.</li> <li>4. Industrial Microbiology; Casida LE, New age International(P) Ltd.</li> </ol>			
<b>Online Resources:</b>			
<ul style="list-style-type: none"> <li>• <a href="http://asm.org/articles/2020/december/virtual-resources-to-teach-microiology-techniques">http://asm.org/articles/2020/december/virtual-resources-to-teach-microiology-techniques</a></li> <li>• <a href="https://www.tandfonline.com/doi/full/10.1080/13102818.2018.1440974">https://www.tandfonline.com/doi/full/10.1080/13102818.2018.1440974</a></li> <li>• <a href="https://user.eng.umd.edu/~nsw/ench485/lab8.htm">https://user.eng.umd.edu/~nsw/ench485/lab8.htm</a></li> <li>• <a href="https://lib.dr.iastate.edu/cgi/viewcontent.cgi?article=1333&amp;context=farms_reports">https://lib.dr.iastate.edu/cgi/viewcontent.cgi?article=1333&amp;context=farms_reports</a></li> </ul>			
<b>PART – D: Assessment and Evaluation</b>			
<b>Suggested Continuous Evaluation Methods:</b>			
<b>Maximum Marks:</b>		<b>50 Marks</b>	
<b>Continuous Internal Assessment (CIA):</b>		<b>15 Marks</b>	
<b>End Semester Exam (ESE):</b>		<b>35 Marks</b>	
<b>Continuous Internal Assessment (CIA): (By Course Teacher)</b>	<b>Internal Test/ Quiz – (2):</b>	<b>10 &amp; 10</b>	Better Marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against <b>15 Marks</b>
	<b>Assignment/ Seminar + Attendance:</b>	<b>05</b>	
	<b>Total Marks:</b>	<b>15</b>	
<b>End Semester Exam (ESE):</b>	<b>Laboratory/ Field Skill Performance: On spot Assessment</b>		<b>Managed by course teacher as per lab. status</b>
	<b>A. Performed the Task based on lab. work –</b>	<b>20 Marks</b>	
	<b>B. Spotting based on tools &amp; technology (written) -</b>	<b>10 Marks</b>	
	<b>C. Viva-voce (based on principle/ technology) –</b>	<b>05 Marks</b>	

Name and Signature of Convener and Members of CBoS

Convener: *[Signature]* 10.6.24  
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