

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

PART-A: Introduction			
Program: Bachelor in Science (Degree/Honors)		Semester -VI	Session: 2024-2025
1	Course Code	DSC-06T	
2	Course Title	ORGANIC AND PHYSICAL CHEMISTRY- II	
3	Course Type	DSC	
4	Pre-requisite(if,any)	As per Program	
5	Course Learning Outcomes(CLO)	<ul style="list-style-type: none"> ➤ To understand role of quantum mechanics in chemistry. ➤ To know the organic compound in biological system ➤ To know the polymers in chemistry their preparation and application of polymer. ➤ To learn the techniques for studying the structure of chemical molecule. 	
6	Credit Value	3 Credits	Credit = 15 Hours -learning & Observation
7	Total Marks	Max.Marks: 100	Min Passing Marks:40
PART -B: Content of the Course			
Total No.of Teaching-learning Periods(01 Hr. per period) - 45 Periods (45 Hours)			
Unit	Topics(Course contents)		No. of Periods
I	<p>Quantum Chemistry I:-Black body radiation ,plank's radiation law, photoelectric effect, Compton effect, de-Broglie's idea of matter and waves and its experimental verification. Heisenberg's uncertainty principle, operators: Hamiltonian operator, angular momentum operator, Laplacian operator, postulates of quantum mechanics, Eigen values, Eigen function, Schrodinger time independent wave equation, physical significance of Ψ and Ψ^2. Application of Schrodinger wave equation to Particle in one dimensional box.</p> <p>Quantum Chemistry II:-Quantum mechanical approach of molecular orbital theory basic idea, criteria of forming Molecular orbitals, LCAO(Linear combination of atomic orbital) approximation, formation of H_2^+ ion, calculation of energy of energy levels from wave functions, bonding and antibonding wave functions, concept of sigma bonding sigma antibonding, pi bonding and pi anti bonding M.Os. and their characteristics Comparison of M.O. theory and V.B. Model.</p>		12
II	<p>(A)Carbohydrate: Introduction and classification of carbohydrate, monosaccharide: open chain and cyclic structure of glucose and fructose, epimer and anomers of glucose. Relative and absolute configuration of carbohydrates, Specific rotation and mutarotation of glucose. Determination of ring size in glucose. Chemical properties of glucose: Osazone formation, oxidation, reduction, Reaction with HIO_4, Interconversion of Glucose and fructose, Chain lengthening and chain shortening. Structure of Disaccharide Sucrose, Lactose and Maltose. Structure of polysaccharide: Starch, Cellulose.</p> <p>(B) Amino Acid & Protein: amino acid types of amino acid, isoelectric point, structure of protein primary, secondary and tertiary structure.</p> <p>(C) Nucleic Acid: components of nucleic acid, types of nucleic acid, nucleoside, nucleotide, structure of nucleic acid.</p>		11
III	<p>(A)Organometallic compound: Preparation, Structure, and chemical reactions of organomagnesium(Grignard Reagent), Organozinc compound, Organolithium compound, Organosulphur compound</p> <p>(B) Synthesis of organic compound via enolates : Active methylene compound, Keto-enol tautomerism, Alkylation of diethyl malonate and acetoacetic ester. Claisen ester</p>		11

	condensation and Robinson anelation. Synthesis of monoalkyl and dialkyl derivative, fatty acids, dibasic acid, α, β unsaturated acid, valeric acid, monoketone, diketone, heterocyclic compounds etc.	
IV	<p>Spectroscopy II(Organic)</p> <p>(A) Infra red Spectroscopy: Basic principle and instrumentation, introduction, Modes of vibrations, fundamental band of different bond and functional groups, identification of band for compound and IR spectra of different compounds. Applications of IR spectroscopy.</p> <p>(B) Principle and instrumentation of UV-visible spectroscopy, Introduction, wavelength maxima, Beer Lambert's Law, Shifts in UV-visible spectra, Chromophore –Auxochrome theory, Effect of conjugation on wavelength maxima. Types of electronic transitions. Applications of UV-visible spectroscopy. Woodward Fischer rule for polyene wavelength maxima calculation.</p> <p>(C) NMR (Nuclear Magnetic Resonance): Introduction to NMR, Basic principle and instrumentation, No. of signal in PMR(proton Magnetic Resonance), Chemical shift, Sheilding and deshielding effect, Splitting of signal or spin-spin interaction, Intensity of Signal and peak height and peak ratio. Coupling Constant J. Proton NMR of some compound like ethanol, propanol, toluene, acetaldehyde, ketone, 1,2-dibromoethylene etc.</p>	11
Keywords	Particle in one Dimensional Box, Hydrogen atom, Proton NMR, UV Visible, Vibrational Spectra. Woodward Fischer Rule.	

Signature of Convener & Members (CBoS):

PART-C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. Tandon, M. M. N., & Agarwal, S. C. (2022). *Unified chemistry*. Shivalal and Company.
2. Sharma, B. K. (2010). *Spectroscopy comprehension*. Goel Publishing House.
3. Puri, B. R., Sharma, L. R., & Pathania, M. S. (2021). *Principles of physical chemistry*. Vishal Publications.
4. Gurtu, J. N., & Gurtu, R. (2015). *Advanced physical chemistry*. Pragati Prakashan.

Reference Books Recommended:

5. Atkins, P. W., de Paula, J., & Keeler, J. A. (2005). *Atkins' physical chemistry* Oxford University Press.
6. Pandya, A. J. (2010). *A textbook of biochemistry: Nucleic acids, proteins and carbohydrates*.
7. Korte, F., & Goto, M. (2009) *Nucleic acids, proteins and carbohydrates*, John Willy & Sons

Online Resources:

- https://onlinecourses.nptel.ac.in/noc23_cy09/preview
- <https://www.udemy.com/course/ochemnmr/?couponCode=LEADERSALE24A>
- https://en.wikipedia.org/wiki/Bioorganic_chemistry#:~:text=Biophysical%20organic%20chemistry%20is%20a,nature%20to%20determine%20their%20properties.
- https://onlinecourses.nptel.ac.in/noc21_cy38/preview

PART-D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 100 Marks

Continuous Internal Assessment(CIA): 30 Marks

End Semester Exam(ESE): 70 Marks

Continuous Internal Assessment(CIA): (By Course Teacher)	Internal Test / Quiz-(2): 20	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 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:

Dr. Ravi D. K. S.   

Indira   

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

PART-A: Introduction			
Program: Bachelor in Science (Diploma / Degree)		Semester VI	Session: 2024-2025
1	CourseCode	CHSC-06P	
2	CourseTitle	CHEMISTRY LAB COURSE-VI	
3	CourseType	DSC	
4	Pre-requisite(if,any)	As per Program	
5	Course Learning Outcomes(CLO)	<ul style="list-style-type: none"> ➤ To understand the basic principles involved in separation and identification of organic compound. ➤ To apply the knowledge of qualitative and quantitative estimations in real sample analysis. ➤ To learn the synthesis of organic compounds ➤ To learn the use of conductometer and spectrophotometer in analysis. 	
6	CreditValue	1 Credits	Credit =30 Hours Laboratory or Field learning/Training
7	TotalMarks	Max.Marks:50	Min Passing Marks:20
PART -B: Content of the Course			
TotalNo.of learning-Training/performancePeriods:30 Periods (30 Hours)			
Module	Topics(Coursecontents)		No.ofPeriod
Lab./Field Training/ Experiment Contents of Course	1)To determine the solubility and solubility product of Sparingly soluble salt using conductometer. 2)To titrate potentiometrically the given ferrous sulphate solution using $KMnO_4$ / $K_2Cr_2O_7$ as titrant and calculate redox potential of Fe^{2+} / Fe^{3+} system on the hydrogen scale. Organic mixture analysis Separation and Identification of two solid organic compounds from given binary organic mixture by $H_2O, NaHCO_3, NaOH$ for separation and preparation of suitable derivative. Synthesis of one organic compound :- (a)synthesis of m-dinitrobenzene from nitrobenzene. (b) synthesis of acetanilide from aniline (c)Preparation of iodoform from ethanol and acetone (d)Preparation of p-bromoacetanilide (e)Preparation of 2,4,6-tribromophenol. (f)Preparation of methyl orange and methyl red. (g)Preparation of benzoic acid from toluene. (h)Preparation of aniline from nitrobenzene.		30
Keywords	Organic mixture analysis, synthesis of organic compound, solubility product, conductometer.		

Signature of Convener & Members (CBoS):

PART-C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. Tandon, M. M. N., & Shiva Lal Agarwal & Company. (2012). *BSc. Practical Chemistry*.
2. Pandey, O. P., Bajpai, D. N., Giri, S., & S. Chand. (2013). *Practical Chemistry*.

Reference Books Recommended:

1. Bassett, J., Denney, R. C., Jeffery, G. H., & Mendham, J. (2000). *Vogel's Text Book of Qualitative Analysis (revised)*. ELBS.
2. Das, R. C., & Behra, B. (2002). *Experimental Physical Chemistry*. Tata McGrawHill.

Online Resources:

- e-Resources / e-books and e-learning portals
- [https://chem.libretexts.org/Courses/University of California Davis/Chem 4C Lab%3A General Chemistry for Majors/Chem 4C%3A Laboratory Manual/05%3A Potentiometric Titrations \(Experiment\)](https://chem.libretexts.org/Courses/University_of_California_Davis/Chem_4C_Lab%3A_General_Chemistry_for_Majors/Chem_4C%3A_Laboratory_Manual/05%3A_Potentiometric_Titrations_(Experiment))
- <https://vlab.amrita.edu/?sub=2&brch=191>
- <https://www.orgsyn.org/>

PART-D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 50 Marks

Continuous Internal Assessment(CIA):15 Marks

End Semester Exam(ESE):35Marks

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

Name and Signature of Convener & Members of CBoS:

Dr. R. K. Singh
Indira
Kashu
D. K. Singh
Rajesh
Anurag

DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM

PART- A: Introduction			
Program: Bachelor in Science (Honors/Honors with research)		Semester - VII	Session: 2024-25
1	Course Code	CHSC-07T	
2	Course Title	INORGANIC & PHYSICAL CHEMISTRY-II	
3	Course Type	DSC	
4	Pre-requisite (if, any)	<i>As per Program</i>	
5	Course Learning Outcomes (CLO)	<ul style="list-style-type: none"> ➤ Study the formation, stability and electronic spectra of complexes ➤ Analyze the chemistry of metal carbonyls and metal nitrosyls. ➤ Solve the Schrodinger equation for the hydrogen atom and utilize Huckel theory for conjugated systems. ➤ Analyze collision theory and transition state theory to understand chemical reactions. 	
6	Credit Value	3 Credits	<i>Credit = 15 Hours - learning & Observation</i>
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40
PART -B: Content of the Course			
Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours)			
Unit	Topics (Course contents)		No. of Period
I	MOT & Electronic Spectra of Complexes Electronic spectra and MO theory of Transition Metal complexes , M.O. Theory for octahedral, tetrahedral and square planar complexes with and without π -bonding Determining the Energy terms, Spin-orbit (L-S) coupling scheme, Hund's rule for term symbol, Hole formalism, Determination of the term symbol (ground and excited states) for d 1 to d 9 configurations, Electronic spectra of transition metal complexes, Types of transitions, Laporte 'orbital' selection rule, spin selection rule. Orgel diagrams for octahedral metal complexes. Charge transfer spectra, Racah parameters, calculations of $10Dq$, B, β parameters. Tanabe- Sugano Diagrams of octahedral complexes with d 2 and d8 configuration.		12
II	Metal – Ligand Equilibria A) Metal – Ligand Equilibria in Solution: Stepwise and overall formation constants; trends in stepwise formation constants; factors affecting stability of metal complexes with reference to nature of metal ion, ligand, chelate effect and thermodynamic origin. Determination of formation constant by: (1) spectrophotometric method (Job's and Mole ratio method) (2) Potentiometric method (Irving-Rossotti Method) B) Reaction Mechanism of Transition metal complexes- : Energy Profile of a reaction, reactivity of metal complexes, Inert and Labile complexes, Kinetics of Octahedral substitution C) Metal carbonyls : vibrational spectra of metal carbonyls for bonding and structure elucidation, important reaction of metal carbonyls. Metal carbonyl clusters with reference to classification, synthesis and structures. D) Metal nitrosyls : Nitrosylating agents for synthesis of metal nitrosyls, vibrational spectra and X-ray diffraction studies of transition metal nitrosyls for bonding and structure elucidation.		11
III	Advanced Quantum Mechanics Discussion of solutions of the Schrodinger equation to three - dimensional box, concept of degeneracy, the harmonic oscillator, the rigid rotor, the hydrogen atom. Approximate Methods		11

	<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>Angular Momentum</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>Molecular Orbital Theory</p> <p>Huckel theory of conjugated systems, Applications to ethylene, butadiene and cyclobutadiene.</p>	
IV	<p>Advanced Chemical Dynamics</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://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

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

PART- A: Introduction			
Program: Bachelor in Science (/ Degree/Honors)		Semester - VI	Session: 2024-2025
1	Course Code	CHSE-04T	
2	Course Title	HETEROCYCLIC CHEMISTRY	
3	Course Type	DSE	
4	Pre-requisite (if, any)	- As per Program	
5	Course Learning Outcomes (CLO)	<ul style="list-style-type: none"> ➤ To apply Hantzsch-Widman and IUPAC nomenclature for heterocyclic compounds. ➤ To understand the concept of tautomerism in aromatic heterocycles and to analyze the influence of strain on small ring heterocycles. ➤ To learn the synthesis and reactions of three-, four-, five- and six-membered heterocycles with one heteroatom. ➤ To learn the synthesis of important bicyclic heterocycles (indole, quinoline, and isoquinoline) and learn the mechanisms of reactions. 	
6	Credit Value	3 Credits	Credit = 15 Hours - learning & Observation
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40
PART -B: Content of the Course			
Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours)			
Unit	Topics (Course contents)		No. of Period
I	Nomenclature and Stereochemistry Introduction to heterocyclic compounds, Trivial names of common ring systems Hantzsch-Widman nomenclature for: Monocyclic heterocycles, Fused heterocycles Bridged heterocycles Replacement of Hantzsch-Widman nomenclature by IUPAC nomenclature		11
II	Tautomerism and Strain in Heterocycles Tautomerism in aromatic heterocycles The effect of strain: Bond angle strain Torsional strain Consequences of strain in small ring heterocycles Three- and Four-Membered Heterocycles Synthesis and reactions of: Aziridines, Oxiranes (epoxides), Thiiranes, Azetidines Oxetanes, Thietanes		11
III	Five- and Six-Membered Heterocycles with One Heteroatom Preparation and properties (chemical and physical) of: Pyrroles (including Paal-Knorr synthesis, Knorr pyrrole synthesis, and Hantzsch synthesis), Furan, Thiophene Pyridine (including Hantzsch synthesis) V. Five-Membered Heterocycles with Two Heteroatoms Preparation, properties, and Substitution reactions of: Pyrazoles, Imidazoles, Oxazoles		11
IV	Bicyclic Heterocycles: Reactions and Synthesis Indole (including Fischer indole synthesis and Madelung synthesis) Quinoline and isoquinoline (including Skraup synthesis, Friedlander's synthesis, Knorr quinoline synthesis, Doebner-Miller synthesis, Bischler-Napieralski reaction, Pictet-Spengler reaction, and Pomeranz-Fritsch reaction) Reactions of bicyclic heterocycles: Mechanisms of electrophilic and nucleophilic substitutions, Oxidation and reduction reactions		12
Keywords	<i>Heterocyclic Chemistry, Nomenclature, Tautomerism, Strain, Rings, Synthesis, Reactions, Bicyclic heterocycles,</i>		

Signature of Convener & Members (CBoS) :

PART-C: Learning Resources

Text Books Recommended

1. Gupta, R.R., Kumar, M., & Gupta, V. (Eds.) (1984). *Heterocyclic Chemistry (Vol. 1-3)*. Springer Verlag.
2. Arora, M. K. (2009). *Heterocyclic chemistry*. New Age International Publishers.

Reference Books Recommended

1. Acheson, R.M. (1961). *An Introduction to the Heterocyclic Compounds*. John Wiley.
2. Katritzky, A.R., & Rees, C.W. (Eds.) (1984). *Comprehensive Heterocyclic Chemistry*. Pergamon Press.
3. Joule, J.A., Mills, K., & Smith, G.F. (2010). *Heterocyclic Chemistry*. Wiley-Blackwell.
4. Gilchrist, T.L. (1992). *Heterocyclic Chemistry*. Pearson Education Limited.

Text Books Recommended -

Online Resources-

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

- <https://www.masterorganicchemistry.com/>
- <https://docs.chemaxon.com/display/lts-helium/functions-by-categories.md>
- <https://archive.catalog.arizona.edu/faculty/courses/001/chem.html>
- <https://www.organic-chemistry.org/>
- <https://www.sciencedirect.com/org/journal/journal-of-heterocyclic-chemistry>
- <https://www.wiley.com/en-us/Heterocyclic+Chemistry%2C+5th+Edition-p-9781405133005>
- <https://www.amazon.com/Chemistry-Heterocycles-Structures-Reactions-Applications/dp/3527327479>
- <https://www.wiley.com/en-us/Name+Reactions+in+Heterocyclic+Chemistry-p-9780471302155>

Online Resources-

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

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

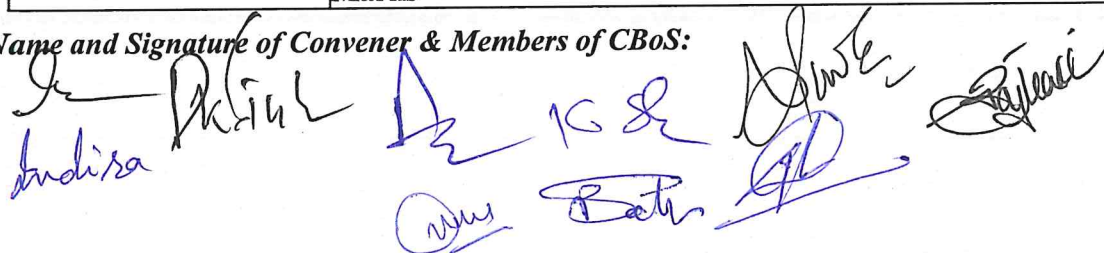
Maximum Marks: 100 Marks

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 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:

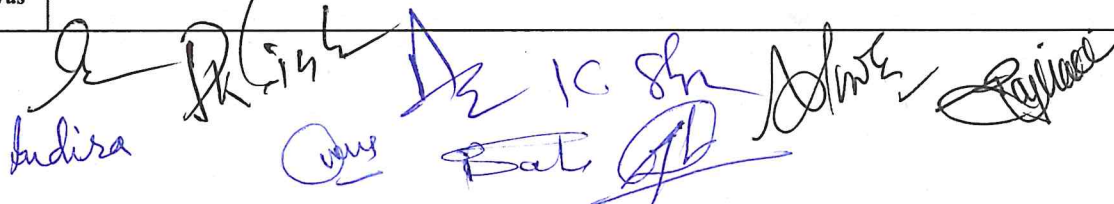
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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF CHEMISTRY

COURSE CURRICULUM

PART- A: Introduction			
Program: Bachelor in Science (Degree/Honors)		Semester - VI	Session: 2024-2025
1	Course Code	CHSE-04P	
2	Course Title	HETEROCYCLIC CHEMISTRY 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"> ➤ Proficient in basic laboratory techniques like distillation, extraction, crystallization, and chromatography. ➤ Skilled in the synthesis and purification of heterocyclic compounds. ➤ Adept at using various spectroscopic techniques (IR, NMR, MS) to characterize heterocyclic structures. ➤ Able to analyze reaction mechanisms and predict product formation in heterocyclic reactions. 	
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>Synthesis and Characterization of a Simple Pyridine Derivative: This experiment will involve the synthesis of a pyridine derivative (e.g., 2-aminopyridine, 2,6-dimethylpyridine(Hantzsch-synthesis) or nicotinamide) followed by purification (recrystallization/distillation) and characterization using melting point, thin-layer chromatography (TLC).</p> <p>Synthesis and Characterization of a Five-Membered Heterocycle (e.g., Imidazole, Pyrazole, Furan): Students will synthesize an 2,5 dimethyl pyrrole(Paal-Knorr synthesis) imidazole, pyrazole derivative using a condensation reaction. Purification (distillation/recrystallization) and characterization using techniques like melting point , TLC.</p> <p>Synthesis and Characterization of a Benzofused Heterocycle This experiment will involve the synthesis of Coumarins, Coumarone, 2-Phenylindole, Indigo(Dye)</p> <p>Isolation of Caffeine from Tea Leaves: This practical involves the extraction and purification of caffeine (a purine derivative) from tea leaves. Techniques like solvent extraction, filtration, and sublimation might be employed.</p> <p>Identification of Unknown Heterocycle: Students will be presented with an unknown heterocyclic compound and utilize various spectroscopic techniques (IR, NMR, mass spectrometry) to identify the functional groups and propose the structure of the unknown molecule.</p>		30
Keywords	Synthesis, Characterization, Heterocycles, Techniques, TLC, IR, Extraction, Isolation		



Signature of Convener & Members (CBoS) :

PART-C: Learning Resources		
Text Books, Reference Books and Others		
<i>Text Books Recommended –</i>		
1. Ahluwalia, V. K., & Aggarwal, R. (2000). <i>Comprehensive practical organic chemistry: Preparations and quantitative analysis</i> , Universities Press		
<i>Reference Books Recommended –</i>		
1. Miller, J. R., & Friswell, M. D. (2000). <i>Organic Chemistry Laboratory Techniques</i> . Pearson Education Limited.		
2. Mohrig, J., Garland, T. L., & Hammond, P. C. (2022). <i>Techniques and Experiments in Organic Chemistry</i> . W. H. Freeman and Company		
Online Resources–		
➤ e-Resources / e-books and e-learning portals		
➤ (https://www.cas.org/)		
➤ (https://www.youtube.com/channel/UCEWpbFLzoYGPfuWUMFPSaoA)		
➤ (https://ocw.mit.edu/courses/chemistry/)		
Online Resources–		
➤ e-Resources / e-books and e-learning portals		
PART -D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks: 50 Marks		
Continuous Internal Assessment (CIA): 15 Marks		
End Semester Exam (ESE): 35 Marks		
Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 10 & 10 Assignment/Seminar +Attendance - 05 Total Marks - 15	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
End Semester Exam (ESE):	Laboratory / Field Skill Performance: On spot Assessment J. Performed the Task based on lab. work - 20 Marks K. Spotting based on tools & technology (written) – 10 Marks L. Viva-voce (based on principle/technology) - 05 Marks	Managed by Course teacher as per lab. status

Name and Signature of Convener & Members of CBoS:

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

**DEPARTMENT OF BOTANY
COURSE CURRICULUM**

PART- A: Introduction			
Program: Bachelor in Life sciences <i>(Degree/Honors)</i>		Semester - VI	Session: 2024-2025
1	Course Code	BOSC-06 T	
2	Course Title	Plant Physiology and Economic Botany	
3	Course Type	Discipline Specific course (DSC)	
4	Pre-requisite (if, any)	As per program	
5	Course Learning Outcomes (CLO)	At the end of this course, the students will understand to <ul style="list-style-type: none"> ➤ Gain a deep understanding of the fundamental physiological processes in plants, including photosynthesis, respiration, transpiration, and nutrient uptake, and their regulation. ➤ Acquire practical skills in conducting experiments and using various techniques. ➤ Develop a comprehensive understanding of the economic value and utilization of plant resources. ➤ Acquire knowledge and skills to identify and classify economically important plant species. 	
6	Credit Value	3 Credits	<i>Credit = 15 Hours - learning & Observation</i>
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40
PART -B: Content of the Course			
Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours)			
Unit	Topics (Course contents)		No. of Period
I	Plant-water relations & Mineral nutrition Importance of water, water potential and its components; Transpiration and its significance; Factors affecting transpiration; Root pressure and guttation. Essential elements, macro and micronutrients; Criteria of essentiality of elements; Role of essential elements; Symptoms of mineral deficiency in major crops, Transport of ions across cell membrane, active and passive transport.		12
II	Photosynthesis and Lipid Metabolism Historical background, photosynthetic pigments and their role photochemical reactions, PSI, PSII, Q cycle, C ₄ pathways; Crassulacean acid metabolism; Factors affecting CO ₂ reduction. Synthesis and breakdown of triglycerides, β-oxidation, glyoxylate cycle, gluconeogenesis and its role in mobilization of lipids during seed germination, α oxidation		11
III	Respiration and Nitrogen Metabolism Glycolysis, anaerobic respiration, TCA cycle; Oxidative phosphorylation, Glyoxylate, Oxidative Pentose Phosphate Pathway. Electron transport and mechanism of ATP synthesis; C ₃ , C ₄ and CAM pathways of carbon fixation, Photorespiration. Nitrate assimilation, biological nitrogen fixation, Physiology and biochemistry of nitrogen fixation, Ammonia assimilation (GS-GOGAT), reductive amination and transamination, amino acid synthesis.		11
IV	Economic Botany: Origin of Cultivated Plants, Examples of major plant introductions; Crop domestication and loss of genetic diversity; evolution of new crops/varieties, importance of germplasm diversity. Brief account of crops, millets, legumes, spice, Beverages, oils, drug, fiber, and timber yielding plant.		11
Keywords	Osmosis, Transport, Hill reaction, Genetic diversity.		
Signature of Convener & Members (CBoS) :			

① Prof. ...
 ② ...
 ③ ...
 ④ ...
 ⑤ ...
 ⑥ ...

⑦ ...
 ⑧ ...
 ⑨ ...
 ⑩ ...

PART-C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

1. Taiz, L., Zeiger, E., Møller, I.M. and Murphy, A (2015). Plant Physiology and Development. Sinauer Associates Inc. USA. 6th edition.
2. B. P. Pandey (2017) Economic Botany. S. Chand Publication, New Delhi.
3. Kochhar, S.L. (2012). Economic Botany in Tropics, MacMillan & Co. New Delhi, India.
4. Bajracharya, D., (1999). Experiments in Plant Physiology- A Laboratory Manual. Narosa Publishing House, New Delhi.

Reference Books Recommended-

1. Wickens, G.E. (2001). Economic Botany: Principles & Practices. Kluwer Academic Publishers, The Netherlands.
2. Chrispeels, M.J. and Sadava, D.E. 1994 Plants, Genes and Agriculture. Jones & Bartlett Publishers.
3. Harborne, J.B. (1973). Phytochemical Methods. John Wiley & Sons. New York.
4. Hopkins, W.G., Huner, N.P., (2009). Introduction to Plant Physiology. John Wiley & Sons, U.S.A. 4th Edition.

Online Resources–

- e-Resources / e-books and e-learning portals
- <https://education.nationalgeographic.org/resource/photosynthesis/>
- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4242210/>
- <https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/nitrogen-metabolism>
- https://en.wikipedia.org/wiki/Lipid_metabolism

Online Resources–

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

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 100 Marks

Continuous Internal Assessment (CIA): 30 Marks

End Semester Exam (ESE): 70 Marks

Continuous Internal Assessment (CIA): 30 (By Course Teacher)	Internal Test / Quiz-(2): 20 +20	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. Jivran
- ② Ramesh
- ③ Anshu
- ④ M. S.
- ⑤ R. Jivran
- ⑥ R. Jivran
- ⑦ R. Jivran
- ⑧ R. Jivran
- ⑨ R. Jivran
- ⑩ R. Jivran

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF BOTANY

COURSE CURRICULUM

PART- A: Introduction			
Program: Bachelor in Life Sciences <i>(Degree/ Honors)</i>		Semester - VI	Session: 2024-2025
1	Course Code	BOSC-06	
2	Course Title	Lab. Course -06 (Plant Physiology and Economic Botany)	
3	Course Type	Laboratory course	
4	Pre-requisite (if, any)	As per program	
5	Course Learning Outcomes (CLO)	Acquire practical skills in conducting experiments and using various techniques to measure and analyze plant physiological parameters, enabling students to design and execute experiments in plant physiology research. ○ Acquire knowledge and skills to identify, and classify economically important plant species, and understand their ecological requirements, cultivation techniques, and potential for sustainable utilization. ○ Apply critical thinking and problem-solving skills to analyze and evaluate the impacts of human activities on plant resources, and develop strategies for the conservation, sustainable management, and utilization of plant biodiversity.	
6	Credit Value	1 Credits	Credit =30 Hours Laboratory or Field learning/Training
7	Total Marks	Max. Marks: 50	Min Passing Marks: 20
PART -B: Content of the Course			
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)			
Module	Topics (Course contents)		No. of Period
Lab./Field Training/ Experiment Contents of Course	1. Determination of osmosis and plasmolysis. 2. Determination of osmotic potential of plant cell sap by plasmolytic method. 3. Demonstration of the process of transpiration. 4. To find out rate of transpiration by potometer method. 5. To find out stomatal frequency and stomatal index. 6. Chemical separation of photosynthetic pigments. 7. To find out that oxygen evolved during the process of photosynthesis. 8. To study the effect of quality and intensity of light on photosynthesis. 9. To find out the effect of carbon dioxide concentration on the rate of photosynthesis. 10. To find out the Respiratory Quotient of different respiratory substrates by respirometer method. 11. To compare the rate of respiration in different parts of a plant. 12. Study of amylase and catalase enzymes. 13. Morphological features and economic importance of cereals, millets, legumes, oil, spices, drug, fiber, and timber yielding plant.		30
Keywords	Physiology, Economic Botany, Beverages, Enzyme.		

Signature of Convener & Members (CBoS) :

- ① R. Prasad
- ② Kundu
- ③ Adhikari
- ④ M. S.
- 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. . Bajracharya, D., (1999). Experiments in Plant Physiology- A Laboratory Manual. Narosa Publishing House, New Delhi.
2. Kochhar, S.L. (2012). Economic Botany in Tropics, MacMillan & Co. New Delhi, India.
3. Wickens, G.E. (2001). Economic Botany: Principles & Practices. Kluwer Academic

Reference Books Recommended –

1. Taiz, L., Zeiger, E., MØller, I.M. and Murphy, A (2015). Plant Physiology and Development. Sinauer Associates Inc. USA. 6th edition.
2. Hopkins, W.G., Huner, N.P., (2009). Introduction to Plant Physiology. John Wiley & Sons, U.S.A. 4th Edition.

Online Resources–

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

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

Online Resources–

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

- > <https://education.nationalgeographic.org/resource/photosynthesis/>
- > <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4242210/>
- > <https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/nitrogen-metabolism>
- > https://en.wikipedia.org/wiki/Lipid_metabolism

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	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. B. Roy
- ② R. B. Roy
- ③ R. B. Roy
- ④ M. K. Roy
- ⑤ R. B. Roy
- ⑥ R. B. Roy
- ⑦ R. B. Roy
- ⑧ R. B. Roy
- ⑨ R. B. Roy
- ⑩ R. B. Roy

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

PART- A: Introduction			
Program: Bachelor in Life Science (Degree/Honors)		Semester - VI	Session: 2024-2025
1	Course Code	BOSE-04 T	
2	Course Title	Ethnobotany and Medicinal plants	
3	Course Type	Discipline Specific Elective (DSE)	
4	Pre-requisite (if, any)	As per program	
5	Course Learning Outcomes (CLO)	<p>At the end of this course, the students will be able to</p> <ul style="list-style-type: none"> Develop a comprehensive understanding of the identification, cultivation, and processing of medicinal plants, and their chemical constituents responsible for therapeutic properties, enabling the evaluation of their potential for drug development and healthcare applications. Explore the integration of traditional medicine practices, ethnobotany, and pharmacological principles in the study of medicinal plants, enabling the critical evaluation of their efficacy, safety, and cultural significance in different healthcare systems. 	
6	Credit Value	3 Credits	Credit = 15 Hours - learning & Observation
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40
PART -B: Content of the Course			
Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours)			
Unit	Topics (Course contents)		No. of Period
I	Ethnobotany: <ul style="list-style-type: none"> Introduction, concept, scope and objectives; Ethnobotany as an interdisciplinary science. The relevance of ethnobotany in the present context; Major and minor ethnic groups or Tribals of India, and their life styles. Plants used by the tribals: a) Food plants b) intoxicants and beverages c) Resins and oils and miscellaneous uses. Role of ethnobotany in sustainable development 		12
II	Role of ethnobotany in modern Medicine: <ul style="list-style-type: none"> Medico-ethnobotanical sources in India; Significance of the locally available plants in ethno botanical practices (along with their habitat and morphology Role of ethnic groups in conservation of plant genetic resources. Endangered taxa and forest management (participatory in Chhattisgarh). Role of plant drugs in pharmaceutical industries Quality, safety and efficacy of herbal medicines. 		11
III	Medicinal Plants: <ul style="list-style-type: none"> History, Scope and Importance of Medicinal Plants. Indigenous Medicinal Sciences; Definition and Scope- Traditional system of medicine in India- concept principles and importance of Ayurveda, Shidha, Yunani and Homeopathy Concept of Herbalism and its significance Phytomedicines and herbal raw materials , local health traditions and traditional medicine 		11
IV	Conservation and Propagation of medicinal plants: <ul style="list-style-type: none"> Medicinal plants Conservation – issues and approaches IUCN criteria - Red list criteria; <i>In situ</i> conservation: Biosphere reserves, sacred groves, National Parks; <i>Ex situ</i> conservation: Botanical Gardens, Ethnomedicinal plant Gardens. Propagation of Medicinal Plants: Objectives of the nursery, its classification, important components of a nursery, sowing, pricking, use of green house for nursery production, propagation through cuttings, layering, grafting and budding 		11
Keywords		Ethnobotany, conservation, Medicinal Plants, Tribals	
Signature of Convener & Members (CBoS) :			

① P. Singh
 ② Kumar

③ M. S.

④

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PART-C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. S.K. Jain, Manual of Ethnobotany, Scientific Publishers, Jodhpur, 1995.
2. S.K. Jain (ed.) Glimpses of Indian. Ethnobotny, Oxford and I B H, New Delhi – 1981 Lone et al, Palaeo ethnobotany
3. S.K. Jain (ed.) 1989. Methods and approaches in ethnobotany. Society of ethnobotanists, Lucknow, India.
4. S.K. Jain, 1990. Contributions of Indian ethnobotny. Scientific publishers, Jodhpur.

Reference Books Recommended:

1. Colton C.M. 1997. Ethnobotany – Principles and applications. John Wiley and sons – Chichester
2. Rama Ro, N and A.N. Henry (1996). The Ethnobotany of Eastern Ghats in Andhra Pradesh, India. Botanical Survey of India. Howrah
3. .Rajiv K. Sinha – Ethnobotany The Renaissance of Traditional Herbal Medicine – INA –SHREE Publishers, Jaipur-1996
4. Trivedi P C, 2006. Medicinal Plants: Ethnobotanical Approach, Agrobios, India.
5. Purohit and Vyas, 2008. Medicinal Plant Cultivation: A Scientific Approach, 2nd edn. Agrobios, India. Approach, 2nd edn. Agrobios, India.
6. Medicinal Plants of India" by C.P. Khare
7. "Handbook of Medicinal Plants" by L.D. Kapoor 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://www.fs.usda.gov/wildflowers/ethnobotany/index.shtml>
- https://www.researchgate.net/publication/333017295_Role_of_ethnobotany_in_modern_medicines_with_special_reference_to_Rauvolfia_serpentina_Trichopus_zeylanicus_Artemisia_sp_and_Withania_somnifera
- <https://www.sciencedirect.com/science/article/abs/pii/S0738081X18300415>
- https://www.mdpi.com/journal/diversity/special_issues/ethnobotany_biodiversity

Online Resources–

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

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

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

Continuous Internal Assessment (CIA): 30 (By Course Teacher)	Internal Test / Quiz-(2): 20 +20	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. D. S. Rao
② S. D. S. Rao
③ K. 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

PART- A: Introduction			
Program: Bachelor in Life Science (Degree/ honors)		Semester - VI	Session: 2024-2025
1	Course Code	BOSE-04 P	
2	Course Title	Lab. Course 04 (Ethnobotany and Medicinal plants)	
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 ➤ Acquire practical skills about the connection between plants and human society. ➤ Acquire knowledge of ethnobotanical research methods. ➤ Apply critical thinking and problem-solving skills of traditional plant uses. ➤ Idea about protection and conservation of medicinal and ethnobotanical plants. ➤ Documentation of cultural knowledge about healing.	
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	<ol style="list-style-type: none"> Identify and collect medicinal plant specimens from various habitats. Documentation for relevant information such as plant parts used, traditional uses, and ecological characteristics. Preparation of herbarium of the collected plants To study the distribution of tribals / ethnic peoples of a selected area. Collection of locally used plants of ethnobotanically important plants To study morphological description and identification of various medicinal plants. Engage with local communities and traditional healers to document their knowledge of medicinal plants. Record their uses, preparation methods, and cultural significance, emphasizing the importance of preserving traditional knowledge. To study common name, botanical name, important varieties and commercially important parts of medicinal and aromatic plants. To study different methods of plant extraction to obtain bioactive compounds Phytochemical and secondary metabolites analysis to determine the chemical potential therapeutic properties of collected specimens of local area. Tribal knowledge towards disease diagnosis, treatment for different medicinal plants and its cultivation and conservation. To find out antimicrobial potential of medicinal plant extracts. 	30
Keywords	1. Therapeutic, antimicrobial, medicinal plants. herbarium	

Signature of Convener & Members (CBoS) :

① P. Praveen
 ② P. Suresh
 ③ M. S. Srinivas
 ④ S. Srinivas
 ⑤ S. Srinivas
 ⑥ P. Srinivas
 ⑦ P. Srinivas
 ⑧ S. Srinivas
 ⑨ S. Srinivas
 ⑩ S. Srinivas

PART-C: Learning Resources	
Text Books, Reference Books and Others	
Text Books Recommended –	
1. S.K. Jain, Manual of Ethnobotany, Scientific Publishers, Jodhpur, 1995. 2. Jain, S. K. and V. Mudgal. 1999. A Handbook of Ethnobotany. Bishen Singh Mahendra Pal Singh, Dehradun	
Reference Books Recommended –	
1. "Handbook of Medicinal Plants" by L.D. Kapoor. 2. "Indian Medicinal Plants: An Illustrated Dictionary" by C.P. Khare.	
Online Resources–	
➤ e-Resources / e-books and e-learning portals 1) https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9526633/ 2) https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9922502/ 3) https://bnrc.springeropen.com/articles/10.1186/s42269-022-00770-8 4) https://cmjournal.biomedcentral.com/articles/10.1186/s13020-016-0108-7	
Online Resources–	
➤ e-Resources / e-books and e-learning portals ➤ www.swayam.ac.in ➤ www.ignou.ac.in ➤ www.egyankosh.ac.in ➤ www.iitm.ac.in ➤ www.eskillindia.org ➤ www.eshiksha.mp.gov.in ➤ www.vlab.co.in ➤ www.internshala.com ➤ www.ndl.iitkgp.ac.in	

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

Name and Signature of Convener & Members of CBOS:

① R Shree
 ② Khande
 ③ Mr
 ④
 ⑤ Anil
 ⑥ Bhat

⑦ Anshu
 ⑧
 ⑨
 ⑩

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

PART- A: Introduction			
Program: Bachelor in Life Science (Degree / Honors)		Semester - VI	Session: 2024-2025
1	Course Code	ZOSC-06T	
2	Course Title	Genetics	
3	Course Type	Discipline Specific Course	
4	Pre-requisite (if, any)	As per Program	
5	Course Learning Outcomes (CLO)	<p>After successfully completing this course, the students will be able to:</p> <ul style="list-style-type: none"> ➤ Understand and grasp the principles of Mendelian inheritance and interaction of genes. ➤ Understand the sources and consequences of genetic variation, including mutations, genetic recombination, and gene flow. ➤ Know various methods of sex determination in animal kingdom. ➤ Analyse the cause and effect of alterations in chromosome number and structure ➤ Understand DNA structure and function, gene expression, and genetic inheritance patterns ➤ Know the Recent Assisted Reproductive Techniques 	
6	Credit Value	3 Credits	Credit = 15 Hours - learning & Observation
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40
PART -B: Content of the Course			
Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours)			
Unit	Topics (Course contents)		No. of Period
I	<p>Concept of Genes and Genomics: Scope and importance. Elements of heredity and variation: Classical and Modern concept of Gene (Cistron, Muton, Recon), Alleles. Mendel's laws of inheritance, Chromosomal basis of inheritance and its applications. Exceptions to Mendelian Inheritance: Incomplete dominance, Codominance, Multiple allelism. Interaction of Gene-Lethal alleles, Pleiotropy, Epistasis- Dominant and Recessive, Supplementary, Complementary, Inhibitory gene and polygene. Define Penetrance, Expressivity and Phenocopy.</p>		12
II	<p>The recombination and interaction of Genes: Linkage and crossing over, cytological basis of crossing over. Organelle inheritance (Mitochondrial), Sex Chromosomes and sexlinked Gene X-linked dominant and X-linked recessive. Sex determination: Theories of sex determination: Chromosomal Theory (XX/XO, XX/XY, ZZ/ZW, ZZ/ZO), Genetic balance theory, intersex, Haplodiploidy, Gynandromorphs. Hormonal influence on sex determination- Freemartin and sex reversal. Role of environmental factors- Bonellia and Crocodile. Eugenics. Mutation, Chromosomal and Gene Mutation, Structural and numerical alterations of chromosomes.</p>		11
III	<p>Regulation of Gene expression, regulation and mapping: Gene Expressions and regulation: One gene-one enzyme hypothesis /one polypeptide hypothesis. Concept of operon of bacteria (Lac Operon) and bacteriophages. Bacterial transposons. Vertical and horizontal gene transfer. Transformation, transfection and transduction. Genetic mapping. RNA-inheritance, FLP-FRT. Utility of the model organisms: Escherichia coli, <i>Drosophila melanogaster</i> & <i>Mus musculus</i></p>		11
IV	<p>Population Genetics and Genetic Counselling: Human Genetics: Pedigree analysis; Karyotype, Genetic disorders: chromosomal aneuploidy (Down, Edward, Patau, Turner and Klinefelter syndromes), chromosome translocation (Chronic Myeloid Leukemia) and deletion ("cry of cat" syndrome). Single Gene Disorder: gene mutation (sickle cell anemia,) and Genetic counselling, Gene isolation Manipulation and techniques. Basic concept of Polymerase Chain Reaction. DNA Sequencing; Southern, Western & Northern Blots. In situ Hybridization, FISH, RFLPs and Oligonucleotide arrays. Gene Cloning vs Animal Cloning, Nuclear transplantation,</p>		11
Keywords	Genetics, Mendel's law, Interaction of Gene, Sex Linkage, Sex Determination, Operon, Genetic Screening, Pedigree Analysis, Aneuploidy		
Signature of Convener & Members (CBoS) :			

PART-C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- Arora M.P. and Sandhu G.S. Genetics, Himalayan Publishing House
- Winter P.C. Et al, Genetics Viva Publication
- Gupta P.K., Cell and Molecular Biology Rastogi Publication

Reference Books Recommended –

- Gardner, E.J. *et al.* (2006) Principles of Genetics (John Wiley).
- Russell, P.J. (2010) Genetics (Benjamin Cummings).
- Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). Principles of Genetics. (VIII edition) Wiley India.
- Snustad, D.P. and Simmons, M.J. (2009). Principles of Genetics. (V edition) John Wiley and Sons Inc.
- Klug, W.S., Cummings, M.R. and Spencer, C.A. (2012). Concepts of Genetics. (X edition) Benjamin Cummings.
- Carroll S.B.; Doebley J.; Griffiths, A.J.F. and Wessler, S.R. (2018) An Introduction to Genetic Analysis. W. H. Freeman and Co. Ltd.
- Campbell, N. and Reece, J. (2014) Biology (10th edition). Benjamin Cummings

Online Resources–

- National digital Library.
- <http://ndl.iitkgp.ac.in/document/Rm5qb3lqRngwWDZ2Tnl6UXI4VU9YR201R0cwYXJHV25HSHFacGxtS1h3REZGd1ByL28xcmlleEFFZU5najlCZl1HdXBBTzBlTBVVRGIDSFhkMEtuUkE9PQ>
- E-PG Pathshala.
- <https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=2rAs1Puvga4LW93zMe83aA>
- eGyankosh- Genetics and Evolutionary Biology
- eGyanKosh: BZYCT-137 Genetics and Evolutionary Biology

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 100 Marks

Continuous Internal Assessment (CIA): 30 Marks

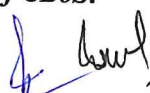
End Semester Exam (ESE): 70 Marks

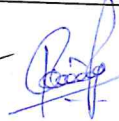
Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 20 +20	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
	Assignment / Seminar - 10 Total Marks - 30	
End Semester Exam (ESE):	Two section – A & B Section A: Q1. Objective – 10 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	

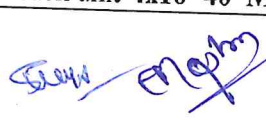
Name and Signature of Convener & Members of CBoS:











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

PART- A: Introduction			
Program: Bachelor in Life Science <i>(Degree / Honors)</i>		Semester - VI	Session: 2024-2025
1	Course Code	ZOSC- 06P	
2	Course Title	Genetics	
3	Course Type	Discipline Specific Lab Course	
4	Pre-requisite (if, any)	<i>As per Program</i>	
5	Course Learning Outcomes (CLO)	After successfully completing this course, the students will be able to- <ul style="list-style-type: none"> ➤ Able to understand and explain Mendel's Law of Inheritance ➤ Capable to analyze inheritance of gene by pedigree analysis. ➤ Know laboratory culture of <i>Drosophila</i>. ➤ Understand and configuration for animal life. ➤ Capable to understand Human karyotype and Numerical alteration in chromosomes 	
6	Credit Value	1 Credits	<i>Credit =30 Hours Laboratory or Field learning/Training</i>
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	<ul style="list-style-type: none"> ➤ Application of probability in the law of segregation with coin tossing. ➤ Study of mode of inheritance of the following traits by pedigree charts – attached ear lobe, widow's peak. ➤ Familiarization with techniques of handling <i>Drosophila</i>, identifying males and females; observing wild type and mutant (white eye, wing less) flies, and setting up cultures. ➤ Study of human karyotypes and numerical alterations (Down syndrome, Klinefelter syndrome and Turner syndrome). ➤ Demonstration of law of segregation (monohybrid and test cross) sex-linked inheritance in <i>Drosophila</i> making a cross between white eye dumpy winged or sepia eyed and wild type flies (criss-cross inheritance) Explain with Model ➤ Study of structural chromosome aberrations (dicentric, ring chromosomes and inversions in polytene chromosomes) from prepared slides/photograph ➤ Extraction of Genomic DNA from bacteria. ➤ Group discussion/ Seminar/ Quiz presentation on one or two related topics 		30
Keywords	Mendel's Law, Human Karyotype, <i>Drosophila</i> Culture, Pedigree		
Signature of Convener & Members (CBoS) :			

S. K. Kulkarni

by

Prof. [Signature]

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PART-C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- Practical Hand Book of Genetics: Vikas Pali Kalyani Publication
- Essential Practical Handbook of Cell Biology & Genetics, Biometry & Microbiology, A Laboratory Manual Debarati Das, Academic Publishers.
- Cytogenetics: Mohan P Arora, Himalayan Publishing House

Reference Books Recommended –

- Klug, W.S., Cummings, M.R. and Spencer, C.A. (2012). Concepts of Genetics. (X edition) Benjamin Cummings.
- Carroll S.B.; Doebley J.; Griffiths, A.J.F. and Wessler, S.R. (2018) An Introduction to Genetic Analysis. W. H. Freeman and Co. Ltd.

Online Resources–

- <https://jru.edu.in/studentcorner/lab-manual/agriculture/Fundamentals%20of%20Genetics.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

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	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:









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

PART- A: Introduction			
Program: Bachelor in Life Science <i>(Degree/Honors)</i>		Semester - VI	Session: 2024-2025
1	Course Code	ZOSE-04T	
2	Course Title	Evolutionary Biology	
3	Course Type	Discipline Specific Elective	
4	Pre-requisite (if, any)	<i>As per Program</i>	
5	Course Learning Outcomes (CLO)	<p>After successfully completing this course the students will be able to-</p> <ul style="list-style-type: none"> ➤ Understanding the historical concept of Evolution. ➤ Develop an understanding on the Evolutionary Concept and theories in evolution. ➤ Understanding on the different interacting evolutionary process by various examples. ➤ Learn animal phylogeny and adaptations. ➤ Develop an interest in the debates and discussion taking place in the field of evolutionary biology. 	
6	Credit Value	3 Credits	<i>Credit = 15 Hours - learning & Observation</i>
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40
PART -B: Content of the Course			
Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours)			
Unit	Topics (Course contents)		No. of Period
I	Historical review of evolutionary concept: Evidences in favor of Evolution: Evidences from morphology and comparative anatomy (Homology, Analogy and Vestigial organs), Evidences from Paleontology, Connecting Links, Embryology, Taxonomy, Cytology, Biochemistry & physiology and from Genetics. Theories of Evolution: Lamarckism, Neo-Lamarckism and Darwinism (Basic Postulates of Darwinism, Supplementary theories of Darwin, Support & Criticism of Darwinism) Modern Synthetic theory of Evolution: Gene and Chromosomal Mutation.		12
II	Evolutionary forces: Natural Selection, Genetic variation, Genetic drift (mechanism, founder's effect, bottleneck phenomenon), Gene Migration. Hardy-Weinberg Law, Molecular clock (example of globin gene family) rRNA/cyt c). Isolation: Pattern & mechanism of isolation.		11
III	Products of evolution: speciation mechanisms: Quantitative traits, Species Concept: Morphological, Biological, Genetical and phylogenetic species concept. Species Categories: Geographical races, Demes, Clines, Ecological races, Semi species, Speciation: Phyletic speciation, Gradual speciation: Allopatric, sympatric, peripatric, parapatric, Alloparapatric. Theories of speciation: Classical theory of Gradualism, Founder flush speciation theory. Mimicry: Protective, Aggressive, Batesian & Mullerian mimicry and significance of mimicry, Aposematic coloration, Thanatosis, Extinctions: massextinctions (causes and effects), detailed example of K-T extinction.		11
IV	Basic patterns of Evolution: Micro & Macro Evolution. Phylogenetic Tree: Its construction and Interpretation. Fossils and fossilization, dating and significance of fossil. Geological Time Scale, Evolution of Man and Evolution of Horse.		11
Keywords	<i>Homology, Analogy, Natural Selection, Genetic variation, Genetic drift, Speciation, Mimicry.</i>		
Signature of Convener & Members (CBoS) :			

PART-C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- Rastogi, Veerbala, Organic Evolution (2018). Third Revised Edition. MEDTECH.
- Singh, S.P., Tomar, B.S., Evolutionary Biology, Rastogi Publication
- Verma P.S., Agrawal V.K., Cell Biology, Genetics, Evolution & Ecology, S.Chand Publication

Reference Books Recommended –

- Ridley, M. (2004). *Evolution*. III Edition. Blackwell Publishing
- Barton, N. H., Briggs, D. E. G., Eisen, J. A., Goldstein, D. B. and Patel, N. H. (2007). *Evolution*. Cold Spring, Harbour Laboratory Press.
- Hall, B. K. and Hallgrímsson, B. (2008). *Evolution*. IV Edition. Jones and Bartlett Publishers.
- Douglas, J. Futuyma (1997). *Evolutionary Biology*. Sinauer Associates.
- Campbell, N.A. and Reece J.B (2011) *Biology* (9th edition) Pearson, Benjamin, Cummings
- De Robertis, E.D.P. and De Robertis, E.M.F. (2006) *Cell and Molecular Biology* (8th edition) Lippincott Williams and Wilkins, Philadelphia.

Online Resources–

- Egyankosh-
- <https://egyankosh.ac.in/bitstream/123456789/16425/1/Unit-10.pdf>
- National Digital Library
- http://ndl.iitkgp.ac.in/he_document/libretexts/libretexts/2f661e95fc3f32dd7204f7188addec22?e=17|EVOLUTION|||
- http://ndl.iitkgp.ac.in/he_document/swayamprabha/swayam_prabha/1o8mxiahue8?e=1*|||

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 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:















FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
ZOOLOGY
COURSE CURRICULUM

PART- A: Introduction			
Program: Bachelor in Life Science (Degree/Honors)		Semester - VI	Session: 2024-2025
1	Course Code	ZOSE-04P	
2	Course Title	Evolutionary Biology	
3	Course Type	Discipline Specific Elective Lab Course	
4	Pre-requisite (if, any)	<i>As per Program</i>	
5	Course Learning Outcomes (CLO)	<p>After successfully completing lab course the students will be able to-</p> <ul style="list-style-type: none"> ➤ Understanding on the process evolutionary biology by the study of some animals. ➤ Learn the different interacting evolutionary process by various examples. ➤ Understand evolution through fossils Acquire an in-depth knowledge on the diversity and relationships in animal world through evolutionary process. 	
6	Credit Value	1 Credits	<i>Credit =30 Hours Laboratory or Field learning/Training</i>
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	<ul style="list-style-type: none"> • Study of homology (forelimbs, heart, brain in vertebrates) through models and charts. • Study of Analogy (wings of insect, birds and bat) through models and charts. • Study of Serial homology in appendages of <i>Palaemon</i>. • Study of Virus, Euglena, Peripatus, Balanoglossus, Chimaera, Lung fish, Archeopteryx, and Echidna on the basis of Evolution (connecting link). • Study of adaptive radiations in vertebrates and mouth parts of insects. • Exercise based on Hardy-Weinberg Law. • Demonstration of role of natural selection and genetic drift in changing allele frequencies using simulation studies. • Construction of phylogenetic trees and its interpretation. • Phylogenetic tree of Man and Horse • Study of fossils from models/pictures • Preparation of Practical Record • Group Discussion/Quiz/Seminar/Project on related topics. 		
Keywords	<i>Evolution, Homology, Analogy, Phylogenetic tree, Adaptive radiation</i>		
Signature of Convener & Members (CBoS) :			

PART-C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- Rastogi, Veerbala, Organic Evolution (2018). Third Revised Edition. MEDTECH.
- S.S. Lal, Practical Zoology, Invertebrate. 12th Edition Rastogi Publications, Meerut, New Delhi.
- A manual of practical Zoology. Dr. P.S Verma, S. Chand Publication, New Delhi

Reference Books Recommended –

- Ridley, M. (2004). Evolution. III Edition. Blackwell Publishing
- Barton, N. H., Briggs, D. E. G., Eisen, J. A., Goldstein, D. B. and Patel, N. H. (2007).
- Evolution. Cold Spring, Harbour Laboratory Press.

Online Resources–

National Digital Library

- http://ndl.iitkgp.ac.in/he_document/libretexts/3d7e9973648c332bee5336b05c6cf84f

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		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:

Shabir Khan

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