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)**	➢ *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	**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. **Quantum Chemistry II:**-Quantum mechanical approach of molecular orbital theory basic idea, criteria of forming Molecular orbitals, LCAO(Linear combination of atomi orbital) approximation, formation of H_2^+ ion, calculation of energy of energy levels fron 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.	12
II	**(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 gluose: 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. **(B) Amino Acid & Protein**: amino acid types of amino acid, isoelectric point, structure of protein primary, secondary and tertiary structure. **(C) Nucleic Acid:** components of nucleic acid, types of nucleic acid, nucleoside, nucleotide, structure of nucleic acid.	11
III	**(A)Organometallic compound:** Preparation, Structure, and chemical reactions of organomagnesium(Grignard Reagent), Organozinc compound, Organolithium compound, Organosulphur compound **(B) Synthesis of organic compound via enolates :** Active methylene compound, Keto-enol tautomerism, Alkylation of diethyl malonate and acetoacetic ester. Claisen ester	11

	condensation and Robinson anealation. Synthesis of monoalkyl and dialkyl derivative, fatty acids, dibasic acid, α, β unsaturated acid, valeric acid, monoketone, diketone, heterocyclic compounds etc.	
IV	Spectroscopy II(Organic) (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. (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. (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.	**11**
Keywords	***Particle in one Dimensional Box, Hydrogen atom, Proton NMR, UV Visible, Vibrational Spectra. Woodward Fischer Rule.***	

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

Name and Signature of Convener & Members ofCBoS:

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)**	➢ ***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 oftheCourse

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 KMnO4 / $K_2Cr_2O_7$ 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://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 thetwo 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:

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DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM

PART- A: Introduction			
Program: Bachelor in Science *(Honors/Honors with research)*		**Semester - VII**	Session: **2024-25**
1	**Course Code**	**CHSC-07T**	
2	**Course Title**	**INORGANIC & PHYSICAL CHEMISTRY-II**	
3	**Course Type**	**DSC**	
4	**Pre-requisite** (if, any)	***As per Program***	
5	**Course Learning. Outcomes (CLO)**	➢ *Study the formation, stability and electronic spectra of complexes* ➢ *Analyze the chemistry of metal carbonyls and metal nitrosyls.* ➢ *Solve the Schrodinger equation for the hydrogen atom and utilize Huckel theory for conjugated systems.* ➢ *Analyze collision theory and transition state theory to understand chemical reactions.*	
6	**Credit Value**	**3 Credits**	***Credit = 15 Hours - learning & Observation***
7	**Total Marks**	**Max. Marks: 100**	**Min Passing Marks: 40**

PART -B: Content of the Course

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

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

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

Signature of Convener & Members (CBoS) :

PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

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

Reference Books Recommended:-

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

Online Resources–

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

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

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

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)**	➢ ***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	***Heterocyclic Chemistry, Nomenclature, Tautomerism, Strain, Rings, Synthesis, Reactions, Bicyclic hetrocycles,***	

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

Name and Signature of Convener & Members of CBoS:

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

PART- A: Introduction				
Program: Bachelor in Science *(Degree/Honors)*			**Semester - VI**	Session: **2024-2025**
1	**Course Code**	**CHSE-04P**		
2	**Course Title**	**HETEROCYCLIC CHEMISTRY LAB. COURSE I**		
3	**Course Type**	**DSE**		
4	**Pre-requisite** (if, any)	***As per Program***		
5	**Course Learning. Outcomes (CLO)**	➢ ***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	**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-syntheis) or nicotinamide) followed by purification (recrystallization/distillation) and characterization using melting point, thin-layer chromatography (TLC). **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. **Synthesis and Characterization of a Benzofused Heterocycle** This experiment experiment will involve the synthesis of Coumarins, Coumarone, 2-Phenylindole, Indigo(Dye) **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. **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.	**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

Text Books Recommended –

1. *Ahluwalia, V. K., & Aggarwal, R. (2000). Comprehensive practical organic chemistry: Preparations and quantitative analysis, Universities Press*

Reference Books Recommended –

1. *Miller, J. R., & Friswell, M. D. (2000). Organic Chemistry Laboratory Techniques. Pearson Education Limited.*
2. *Mohrig, J., Garland, T. L., & Hammond, P. C. (2022). Techniques and Experiments in Organic Chemistry. 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 *(Degree/Honors)*			**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 ➢ 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**	***Credit = 15 Hours - learning & Observation***	
7	**Total Marks**	**Max. Marks: 100**	**Min Passing Marks: 40**	

PART -B: Content of the Course

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

Unit	Topics (Course contents)	No. of Period
I	**Plant-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, C4pathways; 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; C3, C4 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) (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**

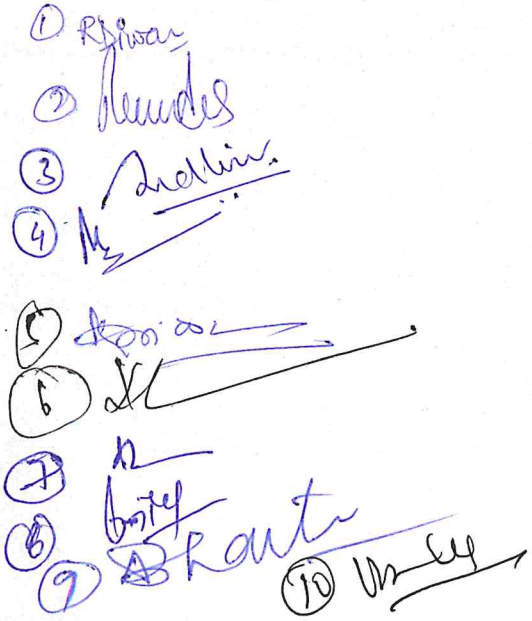
PART -D: Assessment and Evaluation

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

Name and Signature of Convener & Members of CBoS:



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

PART- A: Introduction			
Program: Bachelor in Life Sciences *(Degree/ Honors)*		**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) :

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.eshiksha.mp.gov.in**
- **www.vlab.co.in**
- **www.internshala.com**
- **www.ndl.iitkgp.ac.in**

Online Resources–

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

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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)**	At the end of this course, the students will be able to • 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:** • 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:** • 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:** • 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:** • Medicinal plants Conservation – issues and approaches • IUCN criteria - Red list criteria; • *In situ* conservation: Biosphere reserves, sacred groves, National Parks; *Ex situ* 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) :

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

Name and Signature of Convener & Members of CBoS:

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF BOTANY

COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(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	1. Identify and collect medicinal plant specimens from various habitats. Documentation for relevant information such as plant parts used, traditional uses, and ecological characteristics. 2. Preparation of herbarium of the collected plants 3. To study the distribution of tribals / ethnic peoples of a selected area. 4. Collection of locally used plants of ethnobotanically important plants 5. To study morphological description and identification of various medicinal plants. 6. 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. 7. To study common name, botanical name, important varieties and commercially important parts of medicinal and aromatic plants. 8. To study different methods of plant extraction to obtain bioactive compounds 9. Phytochemical and secondary metabolites analysis to determine the chemical potential therapeutic properties of collected specimens of local area. 10. Tribal knowledge towards disease diagnosis, treatment for different medicinal plants and its cultivation and conservation. 11. To find out antimicrobial potential of medicinal plant extracts.	**30**
Keywords	1. Therapeutic, antimicrobial, medicinal plants. herbarium	

Signature of Convener & Members (CBoS) :

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:

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

Part A: Introduction			
Program: Bachelor in Life Sciences (Degree/Honors)		Semester: **VI Sem**	Session:**2024-2025**
1	Course Code	**BTSC-06-T**	
2	Course Title	**Immunology**	
3	Course Type	Discipline Specific Course (DSC)	
4	Pre-requisite (if any)	As per program	
5	Course Learning Outcomes (CLO)	After completing this course, the students will be able to - • Understand the immunological organizations. • To explore antigens, antibodies, and cytokines. • To explore the regulation of immunological factors. • To compete with pathogenic factors related to immunology.	
6	Credit Value	03 Credits (Credit = 15 Hours - learning & observation)	
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40

Part B: Content of Course (Theory)		
Total No. of Teaching–learning Periods (01 Hr. per period)- 45 Periods (45 Hours)		
Unit	Topic (Course content)	No. of Period
I	**Concept of immunology** 1. Immunology – General concept, history, and development. 2. Immune system and immunity. 3. Organization of the immune system. 4. Cells are involved in the immune system.	12 (12 Hrs)
II	**Antigen & antibodies** 1. Types of Antigens. 2. Types and structure of antibodies. 3. Antigen-antibody interaction. 4. Basic structure and function of cytokines.	11 (11 Hrs)
III	**Immunological expression** 1. Major histocompatibility agents. 2. Cell-mediated immunity. 3. Interferons and hypersensitivity. 4. Immunohematology.	11 (11 Hrs)
IV	**Pathogenicity and immunology** 1. Monoclonal antibodies. 2. Autoimmune diseases: Hemolytic anemia, Rheumatoid arthritis, insulin-dependent diabetes, Myasthenia gravis. 3. Immunology of organ transplantation. 4. Immunodeficient disease -Cancer and AIDS.	11 (11 Hrs)
Keywords	Antigen, Antibody, MHC, Autoimmune Diseases.	

• Part C - **Learning Resource**
Text Books, Reference Books, Other Resources -
Text book-

Essentials of immunology- S K Gupta
A textbook of immunology- Latha P Madhavee

- Immunology – Kuby
- Textbook of microbiology – Anantnarayan&Panikar
- Immunology – Roitt
- Immunology – NandiniSethi
- Fundamentals of Immunology – William Paul
- Immunology – A short course 5th Edn – Eli Benjamin , Richard Coico

Online resources- https://archive.nptel.ac.in/courses/102/105/102105083/
https://archive.nptel.ac.in/courses/102/103/102103038/

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

Name and Signature of Convener and Members of CBoS:

(Dr. Neha Behar)

(Anita Pande)

(Dr Shubha Diwan)

Dr. Shivani Sharma

(Dr Sanjaan Bhagat)

Dr Pramod Malik

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

Part A: Introduction			
Program: Bachelor in Life Sciences (Degree/Honors)		Semester: **VI Sem**	Session:**2024-2025**
1	Course Code	**BTSC-06-P**	
2	Course Title	**Immunology**	
3	Course Type	Discipline Specific Course (DSC) - Practical	
4	Pre-requisite (if any)	As per program.	
5	Course Learning Outcomes (CLO)	After completing this course, the students will be able to - • Identify immunological cells and tissues. • Perform antigen antibody interaction. • Estimate antigen antibody reactions. • Estimate immunological specificity.	
6	Credit Value	01 Credits Credit =30 Hours Laboratory or Field learning/Training	
7	Total Marks	Max. Marks: 50	Min Passing Marks: 20

Part B: Content of Course		
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)		
Module	Topic (Course content)	No. of Period
Lab./Field Training/ Experiment Contents of Course	1. Blood film preparation and identification of cells. 2. Lymphoid organs and their microscopic organization. 3. Immunization, collection of serum. 4. Blood grouping concerning antigen-antibody interaction. 5. Rh factor determination. 6. Widal test. 7. VDRL test. 8. Ouchterlony Double diffusion for antigen-antibody pattern. 9. Rocket Immunoelectrophoresis. 10. Radial Immunodiffusion. 11. DOT ELISA.	30
Keywords	Antigen, Antibody, MHC, Autoimmune Diseases.	

• Part C - **Learning Resource**
Text Books, Reference Books, Other Resources -
Text book- **Essentials of immunology- S K Gupta** **A textbook of immunology- Latha P Madhavee**
• Immunology – Kuby • Textbook of microbiology – Anantnarayan&Panikar • Immunology – Roitt • Immunology – NandiniSethi • Fundamentals of Immunology – William Paul

• Immunology – A short course 5th Edn – Eli Benjamin , Richard Coico
Online resources- https://archive.nptel.ac.in/courses/102/105/102105083/ https://archive.nptel.ac.in/courses/102/103/102103038/

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

Name and Signature of Convener and Members of CBoS:

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

Part A: Introduction			
Program: Bachelor in Life Sciences (Degree/Honors)		Semester: **VI Sem**	Session:**2024-2025**
1	Course Code	**BTSE-04-T**	
2	Course Title	**Medical Biotechnology**	
3	Course Type	Discipline Specific Elective course (DSE)	
4	Pre-requisite (if any)	As per program	
5	Course Learning Outcomes (CLO)	After completing this course, the students will be able to - • Understand about rDNA technology and its outcome. • Understand about diagnostics methods. • Understand about tissue engineering and its therapeutics. • Understand about immunodeficiency and biomarkers.	
6	Credit Value	03 Credits (Credit = 15 Hours - learning & observation)	
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40

Part B: Content of Course (Theory)		
Total No. of Teaching–learning Periods (01 Hr. per period)- 45 Periods (45 Hours)		
Unit	Topic (Course content)	No. of Period
I	**Immunization and therapy** 1. Immunization- Immunization, live, killed, attenuated, subunit vaccine. 2. Recombinant DNA and protein-based vaccines. 3. Transfusion of immuno-competent cells. 4. Stem cell therapy.	12 (12 hrs)
II	**Diagnostics** 1. Antibody-based diagnosis 2. Monoclonal antibodies as diagnostic reagents. 3. Diagnosis of bacterial, viral, and parasitic diseases by using ELISA. 4. Diagnosis of bacterial, viral, and parasitic diseases by using western blot.	11 (11 hrs)
III	**Tissue engineering and therapy** 1. Concept of tissue engineering. 2. Cellular therapy. 3. Role of scaffolds and growth factors. 4. Ethical issues.	11 (11 hrs)
IV	**Immunological imbalance and pathogenicity** 1. Primary immunodeficiency (SCID, X-linked agammaglobulinemia, Defects in complement system). 2. Secondary immunodeficiency (AIDS). 3. Biomarkers for organ dysfunctions. 4. Therapeutic intervention of uncontrolled cell growth.	11 (11 hrs)
Keywords	Immunization, Diagnostics, Cellular Therapy, Ethical Issues.	

• Part C - **Learning Resource**
Text Books, Reference Books, Other Resources -
Text book- **Essentials of immunology- S K Gupta** **A textbook of immunology- Latha P Madhavee**
• Immunology – Kuby • Textbook of microbiology – Anantnarayan&Panikar • Immunology – Roitt • Immunology – NandiniSethi • Fundamentals of Immunology – William Paul • Immunology – A short course 5thEdn – Eli Benjamin , Richard Coico
Online resources- https://archive.nptel.ac.in/courses/102/105/102105083/ https://archive.nptel.ac.in/courses/102/103/102103038/

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

Name and Signature of Convener and Members of CBoS:

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

Part A: Introduction			
Program: Bachlor in Life Sciences (Ceritificate/Diploma/Degree/Honors)		Semester: **VI Sem**	Session:**2024-2025**
1	Course Code	**BTSE-04-P**	
2	Course Title	**Medical Biotechnology**	
3	Course Type	Discipline-Specific Elective (DSE)--Practical	
4	Pre-requisite (if any)	As per program.	
5	Course Learning Outcomes (CLO)	After completing this practical course, the students will be able to - • Interpret the immunological reactions. • Estimate immunological molecules. • Analyze biomarkers. • Evaluate molecules related to organ physiology.	
6	Credit Value	01 Credits Credit =30 Hours Laboratory or Field learning/Training	
7	Total Marks	Max. Marks: 50	Min Passing Marks: 20

Part B: Content of Course (Theory)		
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)		
Module	Topic (Course content)	No. of Period
Lab./Field Training/ Experiment Contents of Course	1. Study of Ag-Ab reaction. 2. Widal test. 3. VDRL test. 4. Haemogram preparation. 5. TLC, DLC counting. 6. Hb estimation. 7. Total protein, albumin, and globulin estimation. 8. Lipid profiling. 9. Sugar testing. 10. SGPT/SGOT estimation.	30
Keywords	Immunization, Diagnostics, Cellular Therapy, Ethical Issues.	

• Part C - Learning Resource
Text Books, Reference Books, Other Resources -
Text book- **Essentials of immunology- S K Gupta** **A textbook of immunology- Latha P Madhavee**
• Immunology – Kuby • Textbook of microbiology – Anantnarayan&Panikar

• Immunology – Roitt • Immunology – NandiniSethi • Fundamentals of Immunology – William Paul • Immunology – A short course 5thEdn – Eli Benjamin , Richard Coico
Online resources- https://archive.nptel.ac.in/courses/102/105/102105083/ https://archive.nptel.ac.in/courses/102/103/102103038/

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

Name and Signature of Convener and Members of CBoS: