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

PART-A: Introduction				
Program: Bachelor in Science *(Degree/Honors)*			**Semester -V**	Session: **2024-2025**
1	**Course Code**	**CHSC-05T**		
2	**Course Title**	**ORGANIC AND INORGANIC CHEMISTRY - I**		
3	**Course Type**	**DSC**		
4	**Pre-requisite(if,any)**	***As per Program***		
5	**Course Learning. Outcomes(CLO)**	➢ ***Explore role of nitrogen in organic chemistry by studying N-containing compounds and heterocycles.*** ➢ ***Unravel molecular structures using techniques like rotational, vibrational, and Raman spectroscopy.*** ➢ ***Demystify bonding in transition metal complexes, including stability, lability, and magnetic properties.*** ➢ ***Understand the importance of organometallic and inorganic compounds in biological systems.***		
6	**Credit Value**	**3 Credits**	***Credit = 15 Hours -learning & Observation***	
7	**Total Marks**	**Max. Marks: 100**		**Min Passing Marks:40**

PART -B: Content oftheCourse

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

Unit	Topics(Course contents)	No. of Periods
I	**(A)Organic Compound of Nitrogen** Preparation of Nitroalkanes and Nitroarenes, Chemical properties of nitroalkanes, Mechanism of nucleophilic substitutions in nitroarenes, Reduction of nitroalkane in acidic, neutral, and alkaline medium.Picric acid Amines:- Nomenclature, Structure and stereochemistry. Basicity, Structural feature effecting basicity of amines. separation of primary, secondary and tertiary ammines. Amine salt as phase transfer catalyst. Preparation of alkyl and aryl amines:- reduction of nitro compound, reductive amination of aldehydic and ketonic compounds. Gabriel Phthalimide reaction, Hoffmann Bromamide reaction. Physical and chemical properties of amine: electrophilic aromatic substitution in aryl amines, reaction of amines with nitrous acid, synthetic transformation of aryl diazonium salts, Azo-coupling reaction.	12
II	**Spectroscopy:** General introduction, electromagnetic radiation, region of spectrum, representation of spectral width and intensity of spectral transition. (A)Rotational spectra of diatomic molecule as rigid rotor, selection rule, energy level, transition, spectra. Determination of bond length, Isotope effect, Qualitative description of non-rigid rotor. (B)Vibrational Spectra: Fundamental vibrational bands and their symmetry. Diatomic molecule as harmonic oscillator. Selection rule, pure vibrational spectrum, Determination of force constant Anharmonic oscillator. (C)Raman Spectra: introduction, concept of polarization, quantum theory, stoke and antistoke line, pure rotational and vibrational Raman spectra. Applications of Raman spectra.	11
III	**(A)Metal Ligand Bonding in Transition Metal Complex:** postulate of CFT. Splitting of d orbitals in octahedral, tetrahedral complex, Spectro-chemical series, Calculation of CFSE, Factors affecting CFSE, Applications of CFSE, Jahn-Teller Distortion, Limitations of CFT. **(B) Thermodynamic and Kinetic aspects of Metal Complexes:** A brief introduction of	11

	thermodynamic and kinetic stability of complex, Stepwise and overall stability constant. (C) Magnetic properties: Types of magnetic behavior, Methods of determining magnetic susceptibility, Spin Only formula, L-S Coupling, Calculation of effective magnetic moment, Orbital contribution to magnetic moment.	
IV	**(A)Organometallic Chemistry:** Definition, nomenclature, and Classification of organometallic compounds. Preparation, properties, bonding and application of alkyls and aryls of Li, Al. A brief account of metal ethylenic metal complexes special reference to Zeisse's salt. Mononuclear carbonyls and nature of bonding in metal carbonyls. 18 electron rules(Effective Atomic Number Rule). Ziegler-Nata Catalyst for polymerization of alkene, Wilkinson Catalyst and Hydrogenation , Hydroformylation. **(B)Bioinorganic Chemistry:** Essentials and trace elements in biological system, metalloporphyrins, with special reference to hemoglobin and myoglobin. Biological role of alkali and alkaline earth metals with special reference to Na^+ K^+ Ca^{2+} and Mg^{+2}, Nitrogen fixation.	**11**
Keywords	***Amines, Nitro compounds, Zeigler-Nata Catalyst, Wilkinson Catalyst, rigid rotor, harmonic oscillator, Hemoglobin, myoglobin.***	

SignatureofConvener&Members:

PART–C:Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. *Bahl, A., & Bahl, B. S. (2020). Organic chemistry (5th ed.). S. Chand & Company.*
2. *Madan, R. D. (2018). Advanced organic chemistry. S. Chand & Company.*
3. *Soni, P. L. (2019). A textbook of organic chemistry. S. Chand & Company.*
4. *Sharma, B. K. (2015). Spectroscopy. GOEL Publishing House.*
5. *Kaur, H. (2018). Spectroscopy. Pragati Prakashan.*
6. *Das, A. K. (2012). Bioinorganic Chemistry. Publisher.*

Reference Books Recommended:

1. *Skoog, D. A., Holler, F. J., & Crouch, S. R. (2017). Principles of Instrumental Analysis. Cengage Learning.*
2. *Mehrotra, R. C. (2010). Organometallic Chemistry. New Age International.*
3. *Carbtree, R. H. (2014). Organometallic Chemistry of the Transition Metal. University Science Books.*
4. *Housecroft, C. E., & Sharpe, A. G. (2012). Inorganic Chemistry. Pearson.*
5. *Miessler, G. L., Fischer, P. J., & Tarr, D. A. (2010). Inorganic Chemistry. Pearson.*

Online Resource:

- **e-Resources / e-books and e-learning portals**
- **https://onlinecourses.nptel.ac.in/noc23_cy01/preview**
- **https://pubs.rsc.org/en/content/articlelanding/1978/f2/f29787401203**
- **https://onlinecourses.swayam2.ac.in/cec23_cy03/preview**
- **https://onlinecourses.nptel.ac.in/noc22_cy12/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** 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 of CBoS:

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM

PART-A: Introduction

Program: Bachelor in Science *(Degree/Honors)*	Semester -V	Session: 2024-2025

1	CourseCode	CHSC-05P	
2	CourseTitle	CHEMISTRY LAB COURSE -V	
3	CourseType	DSC	
4	Pre-requisite(if,any)	*As per Program*	
5	Course Learning. Outcomes(CLO)	➢ *To apply the knowledge of qualitative and quantitative estimations in real sample analysis.* ➢ *To get 'Hands on Training' and develop skill for synthesis of various inorganic compounds.* ➢ *To learn the concept of gravimetric estimation.* ➢ *To learn use of conductometer and spectrophotometer for titration.*	
6	CreditValue	1 Credits	*Credit =30 Hours Laboratory or Field learning/Training*
7	Total Marks	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 verify Beer-Lambert Law for $KMnO_4$/ $K_2Cr_2O_7$ and determine the concentration of the given solution of the substrate from absorbance measurement. 2)To Determine the strength of the given acid conductometrically using standard alkali solution. 3)Gravimetric estimation of Ba as $BaSO_4$ from given solution of $BaCl_2$. 4)Inorganic compound synthesis: (i) Synthesis of sodium trioalato ferrate(III) $Na_2[Fe(C_2O_4)_3]$ and determination of its composition by permangnometry. (ii) Synthesis of Ni-dimethylglyoxime complex $[Ni(dmg)_2]$ (iii) Synthesis of Tetraaminecopper(II) sulphate $[Cu(NH_3)_4]SO_4$ (iv) Synthesis of Cis- and Trans-bisoxalateochromate(III)ion.	30
Keywords	*Spectrophotometer, Lambert beers law, Gravimetric estimation, synthesis of inorganic complexes*	

Signature of Convener &Members (CBoS):

PART–C:Learning Resources

Text Books, Reference Books and Others

Text Books:

1. Chatwal, G. R., & Sharma, A. (n.d.). *Instrumental methods of chemical analysis*. Himalaya Publishing House.
2. Raj, G. (2009). *Advanced Practical Inorganic Chemistry*. Krishna Prakashan.

Reference Books:

1. Svehla, G. (Ed.). (1978). *A textbook of quantitative inorganic analysis* (by A. I. Vogel). ELBS Publishers and Distributors. (Original work published 1968)
2. Henderson, W. A. (n.d.). *Inorganic synthesis*. Benjamin-Cummings Publishing Company.
3. Fernelius, W. G. (2009). *Experimental inorganic chemistry* (Adapted by R. K. Sharma & G. Panda). New Age International Publishers. (Original work published 1972)
4. Mendham, J., Denney, R. C., Barnes, J. D., & Thomas, M. (Eds.). (2000). *Vogels textbook of quantitative chemical analysis* (6th ed.). Pearson Education India. (Original work by A. I. Vogel)
5. Furniss, B. S., Hannaford, A. J., Smith, P. W. G., & Tatchell, A. R. (Eds.). (1989). *Vogel's textbook of practical organic chemistry* (5th ed.). Longman Scientific & Technical. (Original work by A. I. Vogel)

Online Resources:

- **e-Resources / e-books and e-learning portals**
- **https://www.youtube.com/watch?v=s7pXbV9dumI**
- **https://onlinelibrary.wiley.com/series/2146**
- **https://chem.libretexts.org/Ancillary_Materials/Laboratory_Experiments/Wet_Lab_Experiments/General_Chemistry_Labs/Online_Chemistry_Lab_Manual/Chem_11_Experiments/07%3A_Gravimetric_Analysis_(Experiment)**
- **https://mas-iiith.vlabs.ac.in/exp/beer-lambert-law/**

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** **M. Performed the Task based on lab. work - 20 Marks** **N. Spotting based on tools& technology (written) – 10 Marks** **O. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

Name and Signature of Convener & Members of CBoS:

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

PART-A: Introduction				
Program:Bachelor in Science *(Degree/Honors)*			**Semester- V**	Session: **2024-2025**
1	**CourseCode**	**CHSE-03T**		
2	**CourseTitle**	**DYES & POLYMER CHEMISTRY**		
3	**CourseType**	**DSE**		
4	**Pre-requisite**(if,any)	*As per Program*		
5	**Course Learning. Outcomes(CLO)**	➢ *To know about various synthetic dyes and their structures.* ➢ *To understand classification, colour and chemical constitution of dyes.* ➢ *To know about various types of polymeric materials.* ➢ *To understand preparation, structure, properties and application of polymers.*		
6	**Credit Value**	**3 Credits**	*Credit = 15 Hours -learning & Observation*	
7	**TotalMarks**	**Max.Marks:**	**100**	**Min Passing Marks:40**

PART -B: Content of the Course

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

Unit	Topics(Course contents)	No.ofPeriod
I	**Introduction to dyes:** Requirements of a good dye Solubility, Linearity, Co-planarity, Fastness, Substantivity, Economic viability. Definition of fastness and its properties and Mordants with examples Explanation of nomenclature or abbreviations of commercial dyes with at least one example suffixes – G, O, R. Naming of dyes by colour index (two examples) used in dye industries. **Colour and chemical constitution of dyes:** Absorption of visible light, colour o wavelength absorbed and complementary colour, chromogen, chromophore, auxochrome bathochromic and hypsochromic shifts. Relation of colour to resonance in the followin classes of dyes: Azo, Triphenylmethane, Anthraquinone.	12
II	**Classification of dyes based on application:** Definition, fastness properties and applicability on substrates, examples with structures. (a) Acid dyes – Orange II, Alizarin Cyanine Green G. (b) Basic dyes – Crystal Violet, Bismark Brown. (c) Direct Cotton Dyes – Chrysophenine G. (d) Azoic dyes – Diazo components: Fast Red B Base, Fast Blue B Base; Coupling components: Naphthol AS, Naphthol AS-G. (e) Mordant dyes – Eriochrome Black T, Alizarin. (f) Vat dyes – Indigo, Indanthrene (g) Disperse dyes– Celliton Scarlet B, Disperse Yellow 6G	11
III	**Introduction and history of polymeric materials:** Different schemes of classification of polymers, Polymer nomenclature, Molecular forces and chemical bonding in polymers, Texture of Polymers. **Functionality and its importance:** Criteria for synthetic polymer formation, classification of polymerization processes, Relationships between functionality, extent of reaction and degree of polymerization. Bifunctional systems, Poly-functional systems.	11
IV	**Determination of molecular weight of polymers** (*Mn,Mw*, etc) by end group analysis, viscometry, light scattering and osmotic pressure methods. Molecular weight distribution and its significance. Polydispersity index **Brief introduction to preparation, structure, properties and application**: polyolefins, polystyrene and styrene copolymers, poly(vinyl chloride), polyamides and related polymers, Phenol formaldehyde resins (Bakelite, Novalac), Conducting Polymers,	11

	[polyacetylene, polyaniline, poly(p-phenylene sulphide polypyrrole, polythiophene)].	
Keywords	***Average molecular mass, PDI, Dyes, Polymer, diazodyes, bismarkbrown,Vat dyes,indigo dyes.***	

SignatureofConvener&Members (CBoS):

PART–C:Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. *Bhatnagar, M. S. (2010). A textbook of polymer chemistry. S. Chand & Company.*
2. *Misra, G. S. (2004). Introductory polymer chemistry. New Age International Publishers & Distributors.*
3. *Gowariker, V. R., Vishvanathan, N. V., & Sreedhar, J. (2008). Polymer science. New Age International Publication.*

Reference Books Recommended:

1. *Braun, D., Cherdron, H., Rehahm, M., Ritter, H., & Voit, B. (Year). Polymer synthesis: Theory and practice: fundamental method experiments (5th ed.). Springer.*
2. *Vogel, A. I. (Year). A textbook of Organic Chemistry including Qualitative Organic Analysis. Longman Publication.*
3. *Mann, F. G., & Saunders, B. C. (Year). Organic Chemistry. Pearson Publications.*

Online Resources–

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

- **https://onlinecourses.nptel.ac.in/noc22_cy53/preview**
- **https://nptel.ac.in/courses/116104044**
- **http://ndl.iitkgp.ac.in/he_document/swayam_prabha/1tcmcnbo3sk**
- **http://www.ndl.gov.in/he_document/swayam_prabha/cyvucrniwcq**

PART-D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:
MaximumMarks: 100 Marks
Continuous Internal Assessment(CIA):30 Marks
End Semester Exam(ESE):70 Marks

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

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-V**	Session: **2024-2025**
1	**Course Code**	**CHSE-03P**		
2	**Course Title**	**DYES AND POLYMER CHEMISTRY LAB. COURSE**		
3	**Course Type**	**DSE**		
4	**Pre-requisite(if,any)**	***As per Program***		
5	**Course Learning Outcomes(CLO)**	➢ To learn the synthesis of organic dyes in laboratory. ➢ To learn the synthesis of common drugs. ➢ To learn the synthesis of polymer. ➢ To make aware the student about polymer in our day to day life.		
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

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. Synthesis of organic compound or dyes:- Methyl orange(azo coupling) phenolphthalein, Methyl red, Cango red, Fluorecein, Alizarin 2. Synthesis of drugs: Paracetamol, aspirin, sulphanilamide, Chlorobutanol, Tolbutamide, hexamine, 3. Synthesis of Some polymer or project work on some polymer: polyvinyl alcohol, Rayon,PVC,Nylon6, silicon based inorganic polymer, silicone, zeolite 4. Project work of identification of polymer around us in day to day life	**30**
Keywords	***Synthesis of organic compound, Crude test, Limit test, Pharmaceutical Packaging.***	

PART–C:Learning Resources

Text Books, Reference Books and Others

Text Books:

1. *Gupta, V. R., Kumar, R., & Gupta, A. (Year). Organic Chemistry. I. K. International Publishing House.*
2. *Bansal, R. K. (Year). Industrial Organic Chemistry. New Age International Publishers.*
3. *Kar, A. (Year). Medicinal Chemistry. New Age International Publishers.*
4. *Jain, A. K. (Year). Introduction to Pharmaceutical Chemistry. Pharma Book Publications.*
5. *Ghosh, B. (Year). Polymer Chemistry. New Age International Publishers.*
6. *Sinha, U. C., & Sinha, N. K. (Year). Polymer Science. Oxford University Press.*

Reference Books:

1. Braun, D., Cherdron, H., Rehahm, M., Ritter, H., & Voit, B. (Year). Polymer synthesis: Theory and practice: fundamental method experiments (5th ed.). Springer.
2. Vogel, A. I. (Year). A text book of Practical Organic Chemistry including Qualitative Organic Analysis. Longman Publication London.
3. Mann, F. G., & Saunders, B. C. (Year). Practical Organic Chemistry. Pearson Publications.
4. Burrell, H. (Year). Polymer Analysis. John Wiley & Sons.
5. Griffiths, R. F. (Year). Identification of Polymers. John Wiley & Sons.

Online Resources:

- **https://chem.libretexts.org/Ancillary_Materials/Laboratory_Experiments/Wet_Lab_Experiments/Organic_Chemistry_Labs/Experiments/1%3A_Synthesis_of_Aspirin_(Experiment)**
- **https://edu.rsc.org/experiments/the-microscale-synthesis-of-azo-dyes/559.article#:~:text=In%20this%20experiment%2C%20students%20prepare,practical%20should%20take%2020%20minutes.**
- **https://www.scribd.com/doc/36584645/Polymers-Chemistry-Project**

PART-D: Assessment and Evaluation

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

Continuous InternalAssessment(CIA): **(By Course Teacher)**	Internal Test / Quiz-(2): **10 &10** Assignment/Seminar +Attendance- 05 Total Marks -**15**	Better marks out of thetwo Test / Quiz **+**obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory / Field Skill Performance: On spot Assessment** **G. Performed the Task based on lab. work - 20 Marks** **H. Spotting based on tools& technology (written) – 10 Marks** **I. 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 - V**	Session: **2024-2025**
1	**Course Code**	**BOSC-05 T**		
2	**Course Title**	**Cytology & Genetics**		
3	**Course Type**	**Discipline Specific course (DSC)**		
4	**Pre-requisite** (if, any)	***As per program***		
5	**Course Learning. Outcomes (CLO)**	At the end of the course, the students will be able: ➢ Aquire knowledge of cell and its components. ➢ Learn about the structure and function of membrane and cell division ➢ InterpretMendalian and non Mendelian genetics ➢ Interpret linkage, crossing over and gene interaction		
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	**The cell, cell wall, plasma membrane :** Cell structure and function; Characteristics of prokaryotic and eukaryotic cells; Structure, function and chemical composition of Plant cell wall. Plasma membrane structure and chemical nature; Membrane transport – Passive, active and facilitated transport, endocytosis and exocytosis. Nucleus: Structure-nuclear envelope, nuclear pore complex, nuclear lamina, molecular organization of chromatin; nucleolus. Cytoskeleton: Role and structure of microtubules, microfilaments and intermediary filament	12
II	**Cell organelles, Division of Cell** Mitochondria and Chloroplast; Structure and functions. Endoplasmic Reticulum – Structure, and functions, role in protein synthesis.Golgi Apparatus – organization, protein glycosylation, Lysosomes. Cell cycle, mitosis and meiosis; Regulation of cell cycle- checkpoints, role of protein kinases.	11
III	**Mendelian genetics, Linkage and Crossing over;**Mendelism: History; Principles of inheritance;terminology.Chromosome theory of inheritance; Autosomes and sex chromosomes; Probability and pedigree analysis; Non-Mendelian inheritance: Incomplete dominance and co-dominance.Gene interaction; duplicate,complimentary, supplimentry, epistasis. Linkage and crossing over.	11
IV	**Extrachromosomal Inheritance, Mutation** :Extrachromosomal inheritance: Cytoplasmic inheritance in plants. Mutations; types, Molecular basis of Mutations; Mutagens – physical and chemical.Chromosomal aberration: Deletion, Duplication, Inversion, Translocation, Euploidy and Aneuploidy.	11
Keywords	***Cytology, Cell division, Genetics, Mendelian genetics, Mutation***	

Signature of Convener & Members (CBoS) :

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PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

1. Cell Biology: Powar C. B. and Daginawala H. I., Himalay Pub. House, Bombay
2. Cell biology by Karp, G. 2010.
3. Cell and Molecular Biology: Concepts and Experiments. 6th Edition.John Wiley & Sons. Inc.
4. De Robertis, E.D.P. and De Robertis, E.M.F. 2006.Cell and Molecular Biology.8" edition Lippincott Williams and Wilkins, Philadelphia.
5. Genetics by P. K. Gupta, Rastogi Publication
6. Gytogenetics, Molecular biology and Plant breeding by P. K. Gupta, Rastogi Publication

Reference Books Recommended–

1. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009 The World of of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.
2. L.J. (2012). Becker's World of the Cell, Pearson EducationInc. U.S.A. 8th edition.
3. Hausman, R.E. (2009) The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington,
4. D.C.; Sinauer Associates, MA. 9. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009) The World of the Cell. 7 th edition. Pearson Benjamin Cummings Publishing, San Francisco

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://www.cytology-iac.org/educational-resources/virtual-slide-library https://www.asct.com/ASCTWeb/Content/Cytopreparation_Online_Course.aspx
- https://www.mooc-list.com/tags/genetics
- https://www.coursera.org/learn/genetics-evolution
- https://www.my-mooc.com/en/mooc/introduction-to-genetics-and-evolution
- http://rastogipublications.com/index.php?route=product/product&product id-50
- https://www.nou.ac.in/sites/default/files/sim/BSCBO
- http://ysmubooks.am/uploads/MEDICAL BIOLOGY.pilf

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

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

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

Name and Signature of Convener & Members of CBoS:

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

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

PART- A: Introduction			
Program: Bachelor in Life Sciences *(Degree/ Honours)*		**Semester - V**	**Session: 2024-2025**
1	**Course Code**	**BOSC-05**	
2	**Course Title**	**Lab. Course -05 (Cytology and Genetics)**	
3	**Course Type**	**Laboratory Course**	
4	**Pre-requisite** (if, any)	***As per program***	
5	**Course Learning. Outcomes (CLO)**	At the end of this course, students will be able to: ➢ Handle the Compound light Microscope and apply microscopy ➢ Achieve elaborate idea about cell staining procedures and mitotic plate observation &analysis ➢ Identify the various stages of cell division karyotype analysis Get practice of genetic crosses and genetic analysis.	
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. Staining technique of cell organelles. 2. Study of different stages of Mitosis. 3. Study of different stages of Meiosis. 4. Study of plant cell structure with the help of epidermal peel mount of Onion/Rhoeo/Crinum. 5. Demonstration of the phenomenon of protoplasmic streaming in *Hydrilla* leaves. 6. Counting the cells per unit volume with the help of haemocytometer. (Yeast/pollen grains) 7. Exercise on genetics (Mendelian ratio and test cross) 8. Karyotype of chromosomes. 9. Study of polytene and lampbrush chromosomes.	**30**
Keywords	***Mitosis, Mendelian ratio, Karyotype, Chromosome.***	

Signature of Convener & Members (CBoS) :

PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

1. Laboratory Manual of Cyto-tecnique and Chromosome handling By Sharma A K
2. Manual of Cytology, Ministry of Health & Welfare
3. Cytogenetics By PK Gupta.
4. Cell biology By C. B. Powar

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://ijrbat.in/upload_papers/0410202102153609.%20Basarkar%20UG%20and%20%20Patil-Behere%20KP.pdf
- https://www2.samford.edu/~djohnso2/44962w/334/mitosis.html
- https://www.findel-international.com/product/science/biology/prepared-slides/philip-harris-prepared-microscope-slide-set-meiosis-and-mitosis-set-of-9-slides/e8r06642

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

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF BOTANY

COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Degree/Honors)*			**Semester - V**	Session: **2024-2025**
1	**Course Code**	**BOSE -03 T**		
2	**Course Title**	**Phytopaleontology and Evolutionary Botany**		
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 ➢ have a basic idea of fossils and process of fossilization ➢ Describe how plants evolved including their origin and diversification ➢ Summarize and evaluate information from scientific literature ➢ Identify plat fossil through study of the remains of organisms, anatomical evidence and diversity ➢ Understand and track evolution of species over millions of years identify transional forms of life ➢ Understand how earth's environment has changed over geological time.		
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	**Phytopaleontology-** ❖ General account, ❖ Geological time scale; ❖ Brief account of process of fossilization & types of fossils and their study techniques; ❖ Fossils of algae, fungi, bryophytes	12
II	**Fossils and India:** ❖ Fossil plants: *Rhynia, Horneophyton, Williamsonia, Cycadeoidea.* ❖ Contribution of Prof. Birbal Sahni,-*Pentoxyles- Pentoxylon sahnii* ❖ Role of Indian Gondwana Flora in Chhattisgarh with reference to coal mines	11
III	**Brief account of the families of Pteridospermales –** ❖ Lyginopteridaceae, ❖ Medullosaceae, ❖ Caytoniaceae & ➢ Glossopteridaceae	11
IV	**General Account and Affinities –** ❖ Cycadeoidales and Cordaitales. ❖ Paleozoic seeds ❖ Angiospermic and Gymnospermic fossils ❖ Uses of fossils ❖ Evolution : convergent, divergent and parallel evolution ❖ Telome concept	11
Keywords	Fossil, geological time table, gondwana flora, Telome	

Signature of Convener & Members (CBoS) :

PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

1. Vashishtha, B. R. (2005) Pteridophytes S. Chand and Co., Delhi.
2. Vashishtha, B. R. (2005) Bryophytes S. Chand and Co., Delhi.
3. Parihar, N.S. (1991). An introduction to Embryophyta. Vol. I. Bryophyta. Central Book Depot, Allahabad.
4. Rashid A (1999) An Introduction to Pteridophyta, Vikas Publishing House Pvt. Ltd. New Delhi.
5. Sharma OP (1990) Textbook of Pteridophyta. MacMillan India Ltd. Delhi.
6. Vashishtha BR, Sinha AK and Kumar A (2010) Botany for Degree Students – Pteridophyta, S. Chand and Company,
7. Vashishtha BR, Sinha AK and Kumar A (2010) Botany for Degree Students – Gymnosperms, S. Chand and
8. Parihar NS (1976) Biology and Morphology of Pteridophytes. Central Book Depot.
9. Bhatnagar SP (1996) Gymnosperms, New Age International Publisher.
10. Pandey BP (2010) College Botany Vol II S. Chand and Company, New Delhi .

Reference Books Recommended –

1. Kumar, H. D. (1988) introductory Phycology, Affliated East-West Press Ltd., New Delhi.
2. Morris, I (1986) An Introduction to Algae, Cambridge Univ. Press, UK.
3. Puri, P. (1980) Bryophytes, Atma Ram and Sons, Delhi.
4. Sporne, K. K. (1991) The Morphology of Pteridophytes, B. I. Publishing Pvt. Ltd. Bombay.
5. Stewart, W. N. and Ruthwell, G. W. (1993) Paleobotany and the Evolution of Plants. Cambridge Univ. Press, UK.
6. Principles of Paleontology Edition 3 Paperback–1 January 2006 by Arnold Miller, Michael Foote Publishers - W.H.Freeman & Co Ltd

Online Resources–

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

1. **https://efaidnbmnnnibpcajpcglclefindmkaj/https://egyankosh.ac.in/bitstream/123456789/69611/1/Unit-9.pdf**
2. **https://www.encyclopedia.com/science/encyclopedias-almanacs-transcripts-and-maps/fossil-and-fossilization**
3. https://palaeobotany.org

- **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 - V**	Session: **2024-2025**
1	**Course Code**	**BOSE-03 P**		
2	**Course Title**	**Lab. Course -03 (Phytopaleontology and Evolutionary Botany)**		
3	**Course Type**	**Laboratory course**		
4	**Pre-requisite** (if, any)	***As per program***		
5	**Course Learning. Outcomes (CLO)**	1. Understand evolutionary trends of plant development and diversification. 2. Study remnant of past and its natural conservation. 3. Phylogenetic relationship with the help of paleontological evidences 4. Understand role of fossil as an educational tool promoting science literacy an appreciation for earth's rich biological heritage.		
6	**Credit Value**	**1 Credits**	***Credit =30 Hours Laboratory or Field learning/Training***	
7	**Total Marks**	**Max. Marks: 50**	**Min Passing Marks: 20**	

PART -B: Content of the Course		
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)		
Module	**Topics (Course contents)**	**No. of Period**
Lab./Field Training/ Experiment Contents of Course	1) Study of important fossil of pteridophytes from prepared slides and specimens 2) Study of important fossil of gymnosperms from prepared slides and specimens 3) Study of important fossil of algae, fungi, bryophytes and angiosperms from prepared slides and specimens 4) Local trip to coal mines or fossil area for collection of fossil specimens and prepare study reports.	**30**
Keywords	1) Fossil, slides and specimens	

Signature of Convener & Members (CBoS) :

PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

1. Principles of Paleontology Edition 3 Paperback–1 January 2006 by Arnold Miller, Michael Foote Publishers - W.H.Freeman & Co Lt
2. The Practical Fossil Finder (Practical Handbook) Hardcover – 1 October 1991by Steve Parker (Author) Publishers Facts On File Inc

Online Resources–

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

1. **https://efaidnbmnnnibpcajpcglclefindmkaj/https://egyankosh.ac.in/bitstream/123456789/69611/1/Unit-9.pdf**
2. https://www.encyclopedia.com/science/encyclopedias-almanacs-transcripts-and-maps/fossil-and-fossilization
3. https://palaeobotany.org

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: **V Sem**	Session:**2024-2025**
1	Course Code	**BTSC-05-T**	
2	Course Title	**Enzymology**	
3	Course Type	Discipline Specific Course (DSC)	
4	Pre-requisite (if any)	As per program	
5	Course Learning Outcomes (CLO)	After completing this course, the students will be able to - • Develop competency in enzymatic mechanism. • To explore the mechanistic process of enzymes. • Develop industrial application of enzymes. • Develop skills for entrepreneurship.	
6	Credit Value	03 Credits (Credit = 15 Hours - learning & observation)	
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40

Part B: Content of Course (Theory)		
Total No. of Teaching–learning Periods (01 Hr. per period)- 45 Periods (45 Hours)		
Unit	Topic (Course content)	No. of Period
I	**Basics of enzymes and their action** 1. Isolation, crystallization, and purification of enzymes, a test of homogeneity of enzyme preparation, methods of enzyme analysis. 2. Enzyme classification (rationale, overview, and specific examples) zymogens and their activation (proteases and prothrombin). 3. Enzyme substrate complex: the concept of E-S complex, binding sites, active site, specificity, kinetics of enzyme activity, Michaelis-Menten equation and its derivation. 4. Different plots for the determination of Km and Vmax and their physiological significance, factors affecting initial rate, E, S, temperature & pH. Collision and transition state theories, significance of activation energy and free energy.	12 (12 Hrs)
II	**Enzyme action mechanism** 1. Two substrate reactions (Random, ordered, and ping-pong mechanism) 2. Enzyme inhibition types of inhibition, determination of Ki, suicide inhibitor. 3. Mechanism of enzyme action: General mechanistic principle, factors associated with catalytic efficiency: proximity, orientation, distortion of strain, acid-base, nucleophilic and covalent catalysis. 4. Techniques for studying mechanisms of action, chemical modification of active site groups, specific examples-: chymotrypsin, lysozyme, GPDH, aldolase, RNase, Carboxypeptidase, and alcohol dehydrogenase.	11 (11 Hrs)
III	**Regulation of enzymes** 1. Enzyme regulation: Product inhibition, feedback control, covalent modification 2. Allosteric enzymes with special reference to aspartate transcarbamoylase and phosphofructokinase.	11 (11 Hrs)

	3. Qualitative description of concerted and sequential models. Negative cooperativity and half-site reactivity. 4. Enzyme - Enzyme interaction.	
IV	**Enzyme variations** 1. Protein-ligand binding, measurements analysis of binding isotherm, cooperativity, Hill and Scatchard plots, and the kinetics of allosteric enzymes. 2. Isoenzymes– multiple forms of enzymes with special reference to lactate dehydrogenase. 3. Multienzyme complexes. Multifunctional enzyme-eg Fatty Acid synthase. 4. Ribozymes	11 (11 Hrs)
Keywords	Enzyme action, Enzyme Kinetics, Enzyme Regulation, Isoenzymes.	

• Part C - **Learning Resource**
Text Books, Reference Books, Other Resources -
Text book- Biochemistry- U Stayanarayana Modern enzymology- Dr. Vinod Ramkrishna Ragade and Dr. B.B. Sharma
• Lehninger Principles of Biochemistry; Nelson & Cox. • Biochemistry; Voet& Pratt. • Principles of Enzymology; Price & Stevens. • Enzyme Biocatalysis, Principle & Applications; Andres Illanes. • Enzyme Kinetics; Hans Bisswanger
Online resources- https://onlinecourses.nptel.ac.in/noc23_bt05/preview onlinecourses.swayam2.ac.in/cec20_bt20/preview

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

Name and Signature of Convener and Members of CBoS:

Dr. Ujjwala Supe

(Dr. Neha Behal)

(Dr. Arun Kr. Kashyap)

(Dr. Shubha Diwan)

(Amrita Pande)

(Dr. Sanjana Bhagat)

Dr Pramod Mahish

Dr Shirin Sharma

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

Part A: Introduction			
Program: Bachelor in Life Sciences (Degree/Honors)		Semester: **V Sem**	Session:**2024-2025**
1	Course Code	**BTSC-05-P**	
2	Course Title	**Enzymology**	
3	Course Type	Discipline Specific Course (DSC) - Practical	
4	Pre-requisite (if any)	As per program.	
5	Course Learning Outcomes (CLO)	After completing this practical course, the students will be able to - • Analyses factors affecting enzymatic activity. • Determine enzymatic activity. • Purify and estimate kinetics of enzymes. • Immobilize enzymes for industrial applications.	
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. Effect of pH and temperature on the action of salivary amylase. 2. Determination of the activity of amylase enzyme (crude) extracted from sweet potato. 3. Determination of the specific activity of the enzyme. 4. Determine Vmax and Km in of enzyme. 5. Protein electrophoresis – native and denaturing conditions. 6. Enzyme purification and kinetic analysis. 7. Method for immobilization of enzyme.	30
Keywords	Enzyme action, Enzyme Kinetics, Enzyme Regulation, Isoenzymes.	

• Part C - **Learning Resource**
Text Books, Reference Books, Other Resources -
Text book- Biochemistry- U Stayanarayana Modern enzymology- Dr. Vinod Ramkrishna Ragade and Dr. B.B. Sharma
• Lehninger Principles of Biochemistry; Nelson & Cox. • Biochemistry; Voet& Pratt. • Principles of Enzymology; Price & Stevens. • Enzyme Biocatalysis, Principle & Applications; Andres Illanes. • Enzyme Kinetics; Hans Bisswanger
Online resources- https://onlinecourses.nptel.ac.in/noc23_bt05/preview onlinecourses.swayam2.ac.in/cec20_bt20/preview

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

Name and Signature of Convener and Members of CBoS:

(Amrita Pande)

(Dr. Shubhra Diwan)

Dr. Ujjwala ...

(Dr. Sanjana Bhagat)

Dr Pramod Kumar Mahish

Dr Shivani Sharma

(Dr. Arun Kr. Kashyap)

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

Part A: Introduction			
Program: Bachelor in Life Sciences (Degree/Honors)		Semester: **V Sem**	Session:2024-2025
1	Course Code	**BTSE-03**	
2	Course Title	**Industrial 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 mutants for significant industrial production. • Develop skills in physical and chemical methods for industrial products. • Develop skills in the fermentation process for industrial products. • Understand economics and quality control.	
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	**Industrial mutants** 1. Selection of mutants producing improved levels of primary metabolites with suitable examples. 2. Isolation of mutants that do not produce feedback inhibitors or repressors. 3. Mutants that do not recognize the presence of inhibitors or repressors. 4. Modification of permeability.	12 (12 Hrs)
II	**Industrial methodologies** 1. Removal and recovery of cell mass (precipitation, filtration, and centrifugation) 2. Cell disruption - Physical and chemical methods. 3. Purification of product liquid-liquid extraction: solvent recovery. 4. Chromatography: Adsorption, ion-exchange, HPLC	11 (11 hrs)
III	**Industrial bioneeds** 1. Fermentation processes: Microorganisms involved, inoculum preparation, the medium used and product recovery. 2. Enzyme: Protease, pectinase. 3. Organic acid and vitamins: Citric acid, vitamin B12 and vitamin B2. 4. Antibiotics: Penicillin, erythromycin.	11 (11 hrs)
IV	**Testing and quality control** 1. Testing- Sterility, pyrogen, carcinogenicity, and toxicity. 2. Fermentation economics- Cost estimates, process design, capital cost estimates, operating cost.	11 (11 hrs)

	3. Concept of quality control and quality assurance. 4. Good laboratory practices and good manufacturing practices.	
Keywords	Mutants, removal and recovery, fermentation process, fermentation economics.	

• Part C - **Learning Resource**
Text Books, Reference Books, Other Resources -
➢ **Text book-** Industrial Biotechnology- D Das ➢ Industrial Microbiology- A.H. Patel.
• Peppler H.J and Perlman D - Microbial Technology, Vol I and II-Elsevier • Stanbury P.F., Whitaker A. and Hall S.J - Principles of Fermentation Technology-Elsevier • Prescott and Dunn"s- Industrial Microbiology-CBS 7. Ed. • G. Subramaniam- Bioseparation& Bioprocessing • Casida L.E - Industrial Microbiology- New Age • Crueger W and Crueger A - Biotechnology: A Textbook of Industrial Microbiology-Panima Publishing • Patel A.H. - Industrial Microbiology, Macmillan
Online resources- https://archive.nptel.ac.in/courses/102/105/102105058/ http://www.ndl.gov.in/he_document/nptel/downloads_new_lecturenotes_102105058_102105058

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

Name and Signature of Convener and Members of CBoS:

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

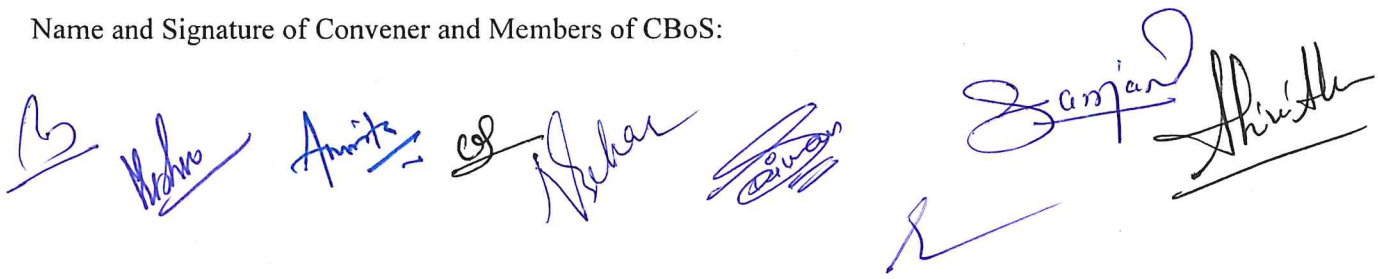
Part A: Introduction			
Program: Bachelor in Life Sciences (Ceritificate/Diploma/Degree/Honors)		Semester: **V Sem**	Session:**2024-2025**
1	Course Code	**BTSE-03-P**	
2	Course Title	**Industrial Biotechnology**	
3	Course Type	Discipline-Specific Elective (DSE)--Practical	
4	Pre-requisite (if any)	As per program.	
5	Course Learning Outcomes (CLO)	After completing this course, the students will be able to – • Isolation and maintenance of industrially significant microbes. • Understand and develop concept of fermentation technology. • Develop skills for industrially significant acid production. • Develop skills for industrially significant nutrients production.	
6	Credit Value	01 Credits Credit =30 Hours Laboratory or Field learning/Training	
7	Total Marks	Max. Marks: 70	Min Passing Marks: 20

Part B: Content of Course (Theory)		
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)		
Module	Topic (Course content)	No. of Period
Lab./Field Training/ Experiment Contents of Course	1. Isolation and screening of industrially important microbes. 2. Isolation and identification of bacteria from milk and water samples. 3. Fermentative production, purification, and estimation of citric acid. 4. Fermentative production, purification, and estimation of alcohol. 5. Wine production and estimation of alcohol. 6. Production of cheese using different substrates and microorganisms.	30
Keywords	Mutants, removal and recovery, fermentation process, fermentation economics.	

• Part C - **Learning Resource**
Text Books, Reference Books, Other Resources -
➢ **Text book-** Industrial Biotechnology- D Das ➢ Industrial Microbiology- A.H. Patel.
• Peppler H.J and Perlman D - Microbial Technology, Vol I and II-Elsevier • Stanbury P.F., Whitaker A. and Hall S.J - Principles of Fermentation Technology-Elsevier • Prescott and Dunn"s- Industrial Microbiology-CBS 7. Ed. • G. Subramaniam- Bioseparation& Bioprocessing • Casida L.E - Industrial Microbiology- New Age • Crueger W and Crueger A - Biotechnology: A Textbook of Industrial Microbiology-Panima Publishing • Patel A.H. - Industrial Microbiology, Macmillan
Online resources- https://archive.nptel.ac.in/courses/102/105/102105058/ http://www.ndl.gov.in/he_document/nptel/downloads_new_lecturenotes_102105058_102105058

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

Name and Signature of Convener and Members of CBoS:



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

PART-A: Introduction				
Program:Bachelor in Science *(Certificate / Diploma / Degree/Honors)*		**Semester-I/III/V**	Session: **2024-2025**	
1	**Course Code**	**CHVAC**		
2	**Course Title**	**Chemistry in Daily Life**		
3	**Course Type**	**Value Added Course(VAC)**		
4	**Pre-requisite(if,any)**	***As per Program***		
5	**Course Learning Outcomes(CLO)**	➢ ***To introduce the student about dairy product,beverages,food additives, artificial sweeteners, flavors, food colorants, paints, pigments, dyes etc.*** ➢ ***To make aware the students about air pollution, hydrological cycle, composition of soil, fertilizers etc.*** ➢ ***To introduce the students about carbohydrate, vitamins,drugs.*** ➢ ***To introduce students about concept of thermodynamics used in day to day life.***		
6	**Credit Value**	**2 Credits**	***Credit = 15 Hours -learning & Observation***	
7	**Total Marks**	**Max.Marks:50**	**Min Passing Marks:20**	

PART -B: Content of the Course

TotalNo.of Teaching–learning Periods(01 Hr. per period) - 30 Periods (30 Hours)

Unit	Topics(Course contents)	No. of Period
I	**Dairy Products:** Composition of milk and milk products. Analysis of fat content, minerals in milk and butter. Estimation of added water in milk. **Beverages:** Analysis of caffeine in coffee and tea, detection of chicory in coffee, chloral hydrate in toddy, estimation of methyl alcohol in alcoholic beverages. **Food additives, adulterants and contaminants:** Food preservatives like benzoates, propionates, sorbates, disulphites. **Artificial sweeteners:** spartame, saccharin, dulcin, sucralose and sodium cyclamate. **Flavors:** Vanillin, alkyl esters (fruit flavours) and monosodium glutamate. Artificial food colorants: Coal tar dyes and non-permitted colours and metallic salts. Analysis of pesticide residues in food. **Paints & Pigments:** White pigments (white lead, ZnO, lithopone, TiO_2). Blue, red, yellow and green pigments. Paints and distempers: Requirement of a good paint. Emulsion, latex; luminescent paints. Fire retardant paints and enamels, lacquers. Solvents and thinners for paints. **Dyes:** Colour and constitution (electronic concept). Classification of dyes. Methods of applying dyes to the fabrics. A general study of azo dyes, Mordant brown, Congo red and methyl orange.	08
II	**Air Pollution:** Air pollutants, prevention and control, Greenhouse gases and acid rain. Ozone hole and CFC's. Photochemical smog and PAN. Catalytic converters for mobile sources. Bhopal gas tragedy. Hydrologic cycle, sources, criteria and standards of water quality - safe drinking water. Public health significance and measurement of water quality parameters - (Colour, turbidity, total solids, acidity, alkalinity, hardness, sulphate, fluoride, phosphate, nitrite, nitrate, BOD and COD). Water purification for drinking and industrial purposes. Toxic chemicals in the environment. Detergents - pollution aspects, eutrophication. Pesticides and insecticides - pollution aspects. Heavy metal pollution. Solid pollutants - treatment and disposal. Treatment of industrial liquid wastes. Sewage and industrial effluent treatment.	07

	Composition of soil – inorganic and organic components in soil - micro and macronutrients. **Fertilizers:** Classification of fertilizers - Straight Fertilizers, Compound/Complex Fertilizers, Fertilizer Mixtures. Manufacture and general properties of fertilizer products - Urea and DAP.	
III	**Carbohydrates**: Structure, function and Chemistry of some important mono and disaccharides. **Vitamins:** Classification and Nomenclature.Sources, deficiency diseases and structures of Vitamin A_1, Vitamin B_1,VitaminC, Vitamin D, Vitamin E &Vitamin K_1. **Drugs:** Classification and nomenclature. Structure and function of: *Analgesics* –aspirin, paracetamol. *Anthelmentic drug*:mebendazole. *Antiallergic drug:* Chloropheneramine maleate. *Antibiotics:*PenicillinV,Chloromycetin,Streptomycin. *Anti-infalmmatory agent:* Oxypheno-butazone. *Antimalarials:* Primazuine phosphate & Chloroquine. **Oils and fats:** Composition of edible oils, detection of purity, rancidity of fats and oil. Tests for adulterants like aregemone oil and mineral oils. **Soaps & Detergents:** Structures and methods of use of soaps and detergents.	**08**
IV	**Chemical Thermodynamics**: Concept of fugacity and free energy, Activity and activity coefficient, spontaneity of processes-entropy and free energy changes. Partial molar quantities, colligative properties, Le-Chatelier principle, phase equilibrium. Enzyme catalyzed reactions. **Principles of Reactivity**: Basis kinetic concepts, rates of simple and complex chemical reactions, empirical rate equations.Temperature dependence of rates and activation parameters. Branched chain reactions – explosion limits. Oscillatory reactions. **Chemical energy system** and limitations, principles and applications of primary & secondary batteries and fuel cell. Basics of solar energy, future energy storer. aerospace materials. Problems of plastic waste management.Strategies for the development of environment friendly polymers.	**08**
Keywords	***Air pollution, carbohydrate,vitamins, LeChatteliar's law, Dairy product, artificial sweeteners. fertilizers,Paint,pigment ,dyes.***	

SignatureofConvener&Members (CBoS):

PART–C:Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. *Sharma, B. K. (1998). Introduction to Industrial Chemistry. Meerut: Goel Publishing.*
2. *Many, N. S., & Swamy, S. (1998). Foods: Facts and Principles (4th ed.). New Age International.*
3. *Kar, A. (2022). Medicinal Chemistry. NEW AGE International Pvt Ltd*

Reference books Recommended:

1. *Drugs and Pharmaceutical Sciences Series. (Year). Marcel Dekker, Vol. II. New York: INC.*
2. *Atkins, P., & de Paula, J. (2002). Physical Chemistry (7th ed.). Oxford University Press.*
3. *Swaminathan, & Goswamy. (2001). Handbook on Fertilizer Technology (6th ed.). FAI.*
4. *Finar, I. L. (Year). Organic Chemistry (Vol. 1&2).*
5. *Fired, J. R. (Year). Polymer Science and Technology. Prentice Hall.*

Online Resources:

https://onlinecourses.swayam2.ac.in/nos22_sc23/preview
https://www.researchgate.net/publication/343585969_Chemistry_in_Everyday_Life
https://www.youtube.com/watch?v=P3p1C87gc0U
https://www.slideshare.net/sanjaijosephManesh/food-chemistry-51688453

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 InternalAssessment (CIA): **(By Course Teacher)**	Internal Test / Quiz-(2): **10 &10** Assignment/Seminar +Attendance- **05** Total Marks -**15**	Better marks out of thetwo Test / Quiz+obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Two section – A & B** Section **A**: **Q1**. Objective – **05 x1= 05** Mark; **Q2**. Short answer type- **5x2 =10Marks** Section **B**: Descriptive answer type qts.,**1out of 2** from each unit-**4x05=20Marks**	

Name and Signature of Convener & Members of CBoS:

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
Department of Biochemistry
Course Curriculum

PART- A: Introduction				
Program: Bachelor in Science *(Certificate / Diploma / Degree/Honors)*		**Semester - I / III / V**		Session: **2024-2025**
1	**Course Code**	**BCVAC- 01**		
2	**Course Title**	**Ethno Medicine in Chhattisgarh**		
3	**Course Type**	**Value added Course**		
4	**Pre-requisite (if, any)**	As Per the Course		
5	**Course Learning. Outcomes (CLO)**	*On successful completion of the course, the student shall be able to:* ➢ Explain the basic components of Medicinal plant. ➢ Summarize the bioactive compound in herbs. ➢ Recognize the disorder and ethno medicine for it. ➢ Understand the effect of bioactive compound on the disease as well as interpret the effect of toxic chemicals on body parts and their cure.		
6	**Credit Value**	**2 Credits**	***Credit = 15 Hours - learning & Observation***	
7	**Total Marks**	**Max. Marks: 50**	**Min Passing Marks: 20**	

PART -B: Content of the Course

Total No. of Teaching–learning Periods (01 Hr. per period) - 30 Periods (30 Hours)

Unit	Topics (Course contents)	No. of Period
I	Historical perspective, scope and future prospects. Scrutinizing the term 'Ethno medicine'. Common and crucial Medicinal Plants in Chhattisgarh: Ethno medicine in India.	07
II	**Properties and functions of photochemical and their medicinal effects** - Glucosamine, Octacosanol, Lycopene, Falvanoids, Carnitine, Melatonin and Ornithine alpha, ketoglutarate. Use of proanthocyanidins, grape products, flaxseed oil as Medicine.	08
III	**Disease and Ethno medicine**; Common Herbal/ House hold/ food used as Medicines in in treatment for cognitive decline. Herbal/ House hold/ food used as Medicines for common disorders like Arthritis, Bronchitis, circulatory problems, hypoglycemia, Nephrological disorders, Liver disorders, Osteoporosis, Psoriasis and Ulcers etc.	07
IV	Brief idea about Medicinal effect of some Nutraceutical rich supplements e.g. Bee pollen, Caffeine, Green tea, Lecithin, Mushroom extract, Chlorophyll, Kelp and Spirulina etc.	08
Keywords	Phytochemical, Nutraceuticals, Herbal Medicine, Disorders, Disease.	

Name and Signature of Convener & Members of CBoS:

PART–C: Learning Resources		
Text Books, Reference Books and Others		
Text Books Recommended – ➢ 1. Gopalan C., et al Dietary Allowances for Indians, NIH, Hyderabad. ➢ 2. Anita F.P. Clinical Dietetics and Nutrition, 4th Ed, 1997, ➢ 3. Devlin, T.M. Text Book of Biochemistry with Clinical Correlation, ➢ 4. Mahan, L.K. &Ecott- Stump, S. [Ed.] Krause's Food, Nutrition and Diet Therapy .		
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):	**Two section – A & B** Section **A**: **Q1**. Objective – **05 x1= 05** Mark; **Q2**. Short answer type- **5x2 =10 Marks** Section **B**: Descriptive answer type qts.,**1out of 2** from each unit- **4x05 =20 Marks**	

Name and Signature of Convener & Members of CBoS: