ATAL BIHARI VAJPAYEE VISHWAVIDYALAYA, BILASPUR (C.G)

(Established by Chhattisgarh Legislative Assembly Act No. 07 of 2012)

Scheme and Syllabus

of

Bachelor of Science

Year- Second

W.E.F. Session:-~~2024-25~~ 24-25

Syllabus Approved by the Central Board of Studies

अटल बिहारी वाजपेयीविश्वविद्यालय,बिलासपुर(छग.)

कोनी पुलीस थाना के सामने, बिलासपुर –रतनपर मार्ग, कोनी, जिला–बिलासपुर (छ.ग.) 495009
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Bachelor of Science

Part-Two Scheme Session-2024-25

S.No.	Subject	Paper	Maximum Marks		Minimum Marks
	Foundation Course				
1	Hindi Language	I	75		26
2	English Language	II	75		26
		Core Group			
3	Physics	I	50	33	50
		II	50		
		Practical	50	17	
3	Chemistry	I	50	33	50
		II	50		
		Practical	50	17	
4	Botany	I	50	33	50
		II	50		
		Practical	50	17	
5	Zoology	I	50	33	50
		II	50		
		Practical	50	17	
6	Mathematics	I	50	33	50
		II	50		
		Practical	50	17	
7	Microbiology	I	50	33	50
		II	50		
		Practical	50	17	
8	Geology	I	50	33	50
		II	50		
		Practical	50	17	
9	Anthropology	I	50	33	50
		II	50		
		Practical	50	17	
10	Biochemistry	I	50	33	50
		II	50		
		Practical	50	17	

11	Biotechnology	I	50	33	50
		II	50		
		Practical	50	17	
12	Computer Science	I	50	33	50
		II	50		
		Practical	50	17	
13	Information Technology	I	50	33	50
		II	50		
		Practical	50	17	
14	Electronics	I	50	33	50
		II	50		
		Practical	50	17	
15	Forestry	I	50	33	50
		II	50		
		Practical	50	17	

B.Sc. IInd Year

1. Foundation Course - i. Hindi ii. English

2. Physics

3. Chemistry

4. Botany

5. Zoology

6. Mathematics

7. Microbiology

8. Geology

9. Anthropology

10. Biochemistry

11. Biotechnology

12. Computer Science

13. Information Technology

14. Electronics

15. Forestry

हिंदी भाषाकेव्याकरण के रचना पक्ष का ज्ञान, संप्रेषण कौशल, सामाजिकसंदेश एवं भाषायी दक्षता की दृष्टि तथा नई शिक्षा नीति के उद्देश्य को ध्यान में रखकर पाठ्यक्रम का निर्माण किया गया है।

बी.ए./ बी.एस-सी./ बी.कॉम./ बी.एच.एस.सी. भाग- दो

(आधार पाठ्यक्रम)

प्रथम प्रश्नपत्र

हिंदी भाषा

कोड....

पूर्णांक 75

क्रेडिट 05

पाठ्यक्रम का उद्देश्य:-

(1)गद्य विधाओंसे अवगत कराना एवं निबंध कौशल सिखाना।

(2)कार्यालयीन हिंदी का ज्ञान प्रदान करना ।

(3)हिंदी व्याकरण का समग्र ज्ञान प्रदान करना ।

(4)हिंदी भाषा में प्रचलित विभिन्न शब्द रूपों से परिचित कराना।

पाठ्य विषय:-

इकाई1. (क) नाखून क्यों बढ़ते हैं?: हजारी प्रसाद द्विवेदी (ख) कार्यालयीन भाषा, मीडिया की भाषा, वित्त एवं वाणिज्य की भाषा,मशीनी भाषा	अंक 15 18 कालखंड
इकाई 2. (क)युवकों का समाज में स्थान : आचार्य नरेंद्र देव (ख) हिंदी के तत्सम, तद्भव, देशज, विदेशी शब्द-परिचय,	अंक 15 18 कालखंड

22.2.23

23.2.2023

23/2/23

23/2/23

संज्ञा, सर्वनाम,	
इकाई 3 (क)डॉ खूबचंद बघेल : हरि ठाकुर (ख)कारक, विशेषण, क्रिया विशेषण	अंक 15 18 कालखंड
इकाई 4 (क) एक पहाड़ीमैना की मौत : डॉ. कांति कुमार जैन (ख) समास, संधि	अंक 15 18 कालखंड
इकाई 5 (क) मातृभूमि : वासुदेव शरण अग्रवाल (ख)अनुवाद - परिभाषा, स्वरूप, प्रकार, स्रोत भाषा और लक्ष्य भाषा, अंग्रेजी से हिंदी में अनुवाद	अंक 15 18 कालखंड

मूल्यांकन योजना:-

प्रत्येक इकाई से एक-एक प्रश्न पूछे जाएंगे। प्रत्येक प्रश्न में आंतरिक विकल्प होगा। प्रत्येक प्रश्न के 15 अंक होंगे। प्रत्येक प्रश्न के दो भाग 'क' और 'ख' होंगे एवं अंक क्रमश: 08 एवं 07 होंगे। प्रश्नपत्र का पूर्णांक 75 निर्धारित

है।प्रश्नपत्रकेपूर्णांककादसप्रतिशतअंकआंतरिकमूल्यांकनकेलिएनिर्धारितहै।

पाठ्यक्रम अधिगम परिणाम:-

1. गद्य की विभिन्न विधाओं से परिचित हो सकेंगे एवंउनमेंसाहित्यिक रूझान पैदा होगा।
2. हिंदी के आधारभूत व्याकरणिक अवधारणाओं से विद्यार्थी परिचित हो सकेंगे। उनमें रचनात्मकताएवं भाषाकौशल का विकास होगा।
3. विभिन्नप्रतियोगी परीक्षाओं की तैयारी में यह पाठ्यक्रम सहायक होगा।

पाठ्यक्रम निर्माण का औचित्य :-

सुप्रसिद्ध विद्वानों के लेख/निबंध/संस्मरण के माध्यम से विद्यार्थियों के चिंतनपरक दृष्टिकोण एवं व्यक्तित्व का विकास करते हुए उन्हें व्याकरणिक एवं भाषा-प्रयोग विषयक पक्ष से परिचित कराते हुए प्रतियोगी परीक्षाओं की दृष्टि से तैयार करने की दिशा में यह पाठ्यक्रम उपयोगी रहेगा।

23/2/23 23.2.2023 23/2/23

Central Board of Studies Foundation Course Paper-II
English Language for Under Graduate Students

Programme Outcomes for English Language B.A/B.Sc/B.Com I, II, III

The programme enables a student to get acquainted

- With the rich cultural heritage and develops patriotic feelings through the works of Indian authors & poets.
- To get exposure of the usage of grammar according to contemporary times.
- To have an exposure about the literary genre with the help of the authors & poets across the globe.
- To develop an appreciation for English Language & Communication Skills.

27/6/23
(PC Choudhury)

Dr. Sushama Mishra

Learning Outcomes (English Language) B.A/B.Sc/B.Com - I, II,III

The learning outcomes are as follows:

1. To strengthen the linguistic skills -Listening, Speaking, Reading and Writing.
2. To refine the way of thinking and speaking which would lead them to have mighty ideas in day to day life.
3. To improve students speaking ability in English both in terms of fluency and comprehensibility.
4. To enhance practical use of English in day-to-day life.
5. To enrich the vocabulary of the students.

Dr. Sushama Mishra 12.6.2023

2/6/23

BA/B.Sc./B.Com/B.Sc. Home.Sc. (Part-II)
Foundation Course Paper-II English Language

Qualifying Marks:26

Max. Marks:75
Total credits: 05

Paper-II	Mark's	Period's	Credit
Unit-I English in Use: A Textbook for College Students (Semester III), Macmillan Publishers India Pvt Ltd	3x5=15	18	01
Unit -II Business Reports & Media Reports Writing Notices, Blog Writing	1x10=10	18	01
Unit -III Reading Comprehension (a) Unseen Passage (MCQ -based) (b) Vocabulary (Text-based)	1x5=05 1x10=10	18	01
Unit -IV Essay Writing: Discursive Essay, Argumentative Essay	1x10=10	09	0.5
Unit-V Grammar : • Ordering of words • Voice • Conditional sentences • Use of some, any, enough, too,otherwise, few, many, such, very • Prepositions • Question tags • Transformation of sentences(like-Simple to Compound to Complex,Exclamatory to Assertive) • Transformation of sentences with positive, Comparative and superlative degrees • Grammatical items given in the textbook'English in Use'	1x25=25	27	1.5
Total	**75**	**90**	**05**
Recommended Books- 1. Essential English Grammar, 2nd Edition by Raymond Murphy, Cambridge Publication 2. English Grammar in use 5th edition by Raymond Murphy, Cambridge Publication. 3. Advanced English Grammar by Martin Hewings Cambridge University Press.			

2/6/23

Scheme of B.Sc. Physics

Year	Course Code	Subject Name	Theory/ Practical	Total Credit	Total Marks	
					Max	Min
Second Year	PHY-3T	Thermal Physics and Statistical Mechanics	Theory	4	50	17
	PHY-4T	Waves and Optics	Theory	4	50	17
	PHY-2P	Lab:2 Thermal Physics,Statistical Mechanics, Waves and Optics	Practical	2	50	17

Part A: Introduction				
Program: **Diploma**		Class: **B.Sc.**	Year: **Second**	Session: 2024-2025
1	Course Code	**PHY – 3T**		
2	Course Title	**THERMAL PHYSICS AND STATISTICAL MECHANICS**		
3	Course Type	**Theory**		
4	Pre-requisite (if any)	No		
5	Course Learning Outcomes (CLO)	**After completion of the course students will be able to :** • Understand the relations between heat, work, temperature, and energy. • Understand how the thermal energy in a system change and perform useful work on its surroundings. • Understand the interrelationship between thermodynamic functions and ability to use such relationships to solve practical problems. • Get the understanding about black body radiation. • Get the introductory knowledge of statistical mechanics • Solve numerical problems based on entire syllabus		
6	**Credit Value**	4		
7	**Total Marks**	**Max. Marks: 50**	**Min Passing Marks: 17**	

Part B: Content of the Course		
Total number of Periods: 60		
Unit	Topic	Number of Periods
I	**Laws of Thermodynamics:** **Thermodynamic Description of system**: Zeroth Law of thermodynamics and temperature. First law and internal energy, conversion of heat into work, various Thermodynamical Processes, Work Done during Isothermal and Adiabatic Processes, Reversible & irreversible processes. Second law of thermodynamics & Entropy, Carnot's cycle, Carnot's theorem. Entropy changes in reversible & irreversible processes, Entropy-temperature diagrams. Third law of thermodynamics.	12
II	**Thermodynamic Potentials:** Internal Energy, Enthalpy, Helmholtz Free Energy and Gibbs function. Maxwell's relations & applications, Clausius- Clapeyron Equation, Expression for $(C_P - C_V)$, C_P/C_V, TdS equations, Thermodynamic energy equation- change in internal energy of an ideal and Vander Waal's gas, Joule-Thompson Effect, Cooling by adiabatic demagnetization	12
III	**Kinetic Theory of Gases:** Maxwellian distribution of speeds in an ideal gas: distribution of speeds and velocities, experimental verification, distinction between mean, rms and most probable speed values, Molecular Collision and Mean Free Path .Transport Phenomena in gases: Viscosity, Conduction and Diffusion, Law of equipartition of energy.	12
IV	**Theory of Radiation:** Blackbody radiation, Spectral distribution, Concept of Energy Density, Stefan Boltzmann Law, Newton's law of cooling from Stefan Boltzmann's law, Wien's displacement law and Rayleigh-Jeans Law (Only qualitative).Planck's radiation Law, Deduction of Wien's distribution law and Rayleigh- Jeans Law from Planck's law, Experimental verification	12

	of Planck's radiation law.	
V	**Statistical Mechanics:** Introductory Idea, Phase space, Macro-state and Microstate, Entropy andThermodynamic probability, fundamental postulates of statistical mechanics. Boltzmann's Canonical Distribution Law. Maxwell-Boltzmann distribution law, Quantum statistics - Fermi-Dirac distribution law and its application for Fermi Levels and Fermi Energy, Bose-Einstein distribution law and its application for Liquid Helium, comparison of three statistics.	12

Part C - Learning Resource

Text Books, Reference Books, Other Resources

Reference Books:

1. Heat and Thermodynamics, M.W.Zemasky and R. Dittman, 1981, McGraw Hill
2. Heat and Thermodynamics, Enrico Fermi, 1956, Courier Dover Publications.
3. Heat and Thermodynamics: Singhal, Agrawal and Satya Prakash, Pragati Prakashan 1984
4. A Treatise on Heat, Meghnad Saha, and B.N. Srivastava, 1969, Indian Press.
5. Physics (Part-2): Editor, Prof. B.P.Chandra, M.P. Hindi Granth Academy
6. Thermodynamics, Kinetic theory & Statistical thermodynamics, F.W.Sears & G.L.Salinger. 1988, Narosa
7. Introduction to Statistical Mechanics: B.B.laud, New age International Publications Second Edition
8. Statistical Mechanics : R.K. Pathria and Paul D.Beale, ELSEVIER ,Fourth Edition,

Link for e-resources:

1. Basics of thermodynamics ***https://www.youtube.com/watch?v=9GMBpZZtjXM&list=PLD8E646BAB3366BC8***
2. Thermodynamics ***https://www.youtube.com/watch?v=E9cOAMhFUz0***
3. Second law of thermodynamics ***https://www.youtube.com/watch?v=F_f1GosPY8o***
4. Introduction of statistical mechanics ***https://www.youtube.com/watch?v=N7ykXugu3D0&list=PLZbgNdSTyWDYtZXp9DN9mGP1sNAjPNGgO***
5. Basic of statistical mechnics ***https://www.youtube.com/watch?v=M4nvGS30b-s&list=PLuBpI7LKkMIGolbgdfvtzMTR2l4hdQv-r***
6. Classical Statistical Mechanics https://youtu.be/XIXQ38JnF0k
7. Bose-Einstein Statistics https://youtu.be/1aHFG7VLr-g

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 50

Continuous Comprehensive Evaluation (CCE): As per University Guideline

University Exam (UE): 50 Marks

Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test/Assignment/Presentation	As per University Guideline

Part A: Introduction				
Program: **Diploma**		Class: **B.Sc.**	Year: **Second**	Session: 2024-28
1	Course Code	**PHY – 4T**		
2	Course Title	**WAVE AND OPTICS**		
3	Course Type	**Theory**		
4	Pre-requisite (if any)	No		
5	Course Learning Outcomes (CLO)	On successful completion of this course students will: • Solve wave equation and understand significance of transverse waves • Acquire skills to identify and apply formulas of optics and wave physics • Understand the properties of light like interference, diffraction and poiarization • Understand the applications of interference in design and working of interferometers. • Understand the resolving power of grating • Get knowledge about laser and its application. • Solve numerical problems based on entire syllabus		
6	**Credit Value**	**Theory: 4**		
7	**Total Marks**	**Max. Marks: 50**	**Min Passing Marks: 17**	

Part B: Content of the Course		
Total number of Periods: 60		
Unit	Topics	Number of Periods
1	**Waves in Medium:** Speed of transverse waves on uniform string, speed of longitudinal waves in a fluid, energy density and energy transmission in waves. Group velocity and phase velocity and relationship between them. Reflection, refraction and diffraction of sound: Acoustic impedance of a medium, percentage reflection & refraction at a boundary, diffraction of sound, principle of a sonar system.	12
2	**Interference:** Interference: Division of amplitude and division of wavefront. Young's Double Slit experiment. Fresnel's Biprism. Phase change on reflection: Stokes' treatment. Interference in Thin Films: parallel and wedge-shaped films. Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes). Newton's Rings: measurement of wavelength and refractive index. Michelson's Interferometer: Formation of fringes, Determination of wavelength, Wavelength difference.	12
3	**Diffraction:** Fresnel Diffraction: Half-period zones. Zone plate. Fresnel Diffraction pattern of a straight edge, a slit and a wire using half-period zone analysis. Fraunhofer diffraction: Single slit, Double slit. Multiple slits &Plane	12

	Diffraction Grating, Resolving Power of Grating.	
4	**Polarization:** Polarized light and its mathematical representation, Electromagnetic theory of double refraction, Nicol Prism, Double image prism, Polaroid, Phase retardation plates, Circular and elliptical polarization. Polarization by double refraction and Huygens's theory, Rotation of plane of polarization, Biquartz polarimeter.	12
5	**LASER:** Basic properties of LASERs, coherence length and coherence time, spatial coherence of a source, Einstein's A and B coefficients, Spontaneous and induced emissions, conditions for laser action, population inversion. Types of Laser: Ruby, He-Ne Laser and Semiconductor Laser, Application of Laser in communication and Holography.	12

Part C - Learning Resource

Text Books, Reference Books, Other Resources

Reference Books:

1. Fundamentals of Optics, F A Jenkins and H E White, 1976, McGraw-Hill
2. Principles of Optics, B.K. Mathur, 1995, Gopal Printing
3. Fundamentals of Optics, H.R. Gulati and D.R. Khanna, 1991, S. Chand Publication
4. University Physics, FW Sears, MW Zemansky and HD Young 13/e, 1986. Addison-Wesley
5. Physical Optics , A.K. Ghatak
6. Berkely Physics Course: Vol.-III, 'Waves and Oscillations'

Link for e-resources:

1. Wave an introduction https://youtu.be/SuQE7eUEriU
2. Interference https://youtu.be/hvpYKPyT-vc
3. Diffraction https://youtu.be/3RZZQvEVrEA
4. Polarization https://youtu.be/nEI_Yaf_N528
5. Laser and application https://youtu.be/EK4yEAGiHSEc

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 50

Continuous Comprehensive Evaluation (CCE): As per University Guideline

University Exam(UE): 50 Marks

Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test/Assignment Presentation	As per University Guideline

Part A: Introduction				
Program: **Practical Course**		Class: **B.Sc.**	Year: **Second**	Session: 2024-2025
1	Course Code	**PHY – 2P**		
2	Course Title	LAB 2: Thermal Physics, Statistical Mechanics, Waves and Optics		
3	Course Type	**Practical**		
4	Pre-requisite (if any)	No		
5	Course Learning Outcomes (CLO)	**Expected Outcomes: -** • Students able to get working knowledge of laws and methods of thermodynamics and elementary statistical mechanics and to use this knowledge students can explore various application related to physics of condensed matter. • Students experience experimental evidence of laws of wave optics and how light has wave nature is confirmed through experiment.		
6	**Credit Value**	**2**		
7	**Total Marks**	**Max. Marks: 50**	**Min Passing Marks : 17**	

Part B: Content of the Course	
Total Lectures: 30	
Tentative Practical List	Any 14 practical from the following 1. To determine the thermal conductivity of a non-conducting material by Lee`s disc method. 2. To determine the specific rotation of sugar solution with the help of polarimeter. 3. To verify Newton`s law of cooling. 4. To study binomial distribution law of probability using 4 coins. 5. To determin e the frequency of electric generator by Melde`s experiment. 6. To determine the coefficient of thermal conductivity(k) by rubber tubing method. 7. To study the heat efficiency of an electric kettle with varying voltage. 8. To determine the frequency of A.C. mains using sonometer. 9. To determine the ratio of specific heat at constant pressure and constant volume ($\gamma = C_p/C_v$) of air Clement and Desorme's method. 10. To study the variation of thermos-Emf of thermos couple with Difference of Temperature of its Two Junctions. 11. To determine the refractive index of the material of the prism with the help of spectrometer. 12. To determine the radius of curvature of a plano-convex lens by Newton's circular ring method. 13. To find out wavelength of monochromatic light source with the help of Newton's Rings. 14. To determine the wavelength of laser light by diffraction grating. 15. To determine the resolving power of a telescope. 16. To determine the resolving power of a plane diffraction grating. 17. To determine the wavelength of monochromatic light source by

	single slit diffraction. 18. To determine the dispersive power of the prism with the help of spectrometer. 19. To determine the refractive index of ordinary and extra-ordinary rays for the calcite prism using spectrometer. 20. To determine the refractive index of water using laser light and photocell.

Part C - Learning Resource

Text Books, Reference Books, Other Resources

Reference Books:

1. Advanced Practical Physics for students, B.L.Flint & H.T.Worsnop, 1971, AsiaPublishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
3. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition,2011, Kitab Mahal, New Delhi.
4. A Laboratory Manual of Physics for Undergraduate Classes, D.P. Khandelwal,1985, Vani Publication.

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 50

Continuous Comprehensive Evaluation (CCE): As per University Guideline

University Exam(UE): 50 Marks

Internal Assessment: Continuous Comprehensive Evaluation(CCE)	Class Test/Assignment/Presentation	As per University Guideline

Scheme of B.Sc. Chemistry

Year	Course Code	Subject Name	Theory/ Practical	Total Credit	Total Marks	
					Max	Min
Second year	CHEM-3T	Inorganic and Physical Chemistry	Theory	4	50	17
	CHEM-4T	Organic and Physical Chemistry	Theory	4	50	17
	CHEM -2P	LAB:2 General Chemistry-2	Practical	2	50	17

Part A: Introduction				
Program: **Diploma Course**		Class: **B.Sc. II Year**	Year: 2024	Session: 2024-25
1.	Course Code	CHEM-3T		
2.	Course Title	Inorganic and Physical Chemistry		
3.	Course Type	Theory		
4.	Pre-requisite (if any)	To Study this course our students must have had the subject chemistry in class B.Sc. I Year/ Certificate Course or equivalent		
5.	Course Learning Outcomes (CLO)	At the end of this course, the students will be able to learn the following aspects of Chemistry • Understand the general characteristics of transition elements. • Explain the chemistry of Coordination Compounds. • Analyze water and coal. • Basic concepts of thermodynamics. • Basic concepts of Chemical and Ionic Equilibrium		
6.	Credit Value	Theory: 4		
7.	Total Marks	**Max. Marks: 50**	**Min. Passing Marks: 17**	

Part B: Content of the Course		
Total No. of Lecturers: **90**		
Unit	**Topics**	**No. of Lectures**
I	**Chemistry of transition series elements:** Transition elements- Position in periodic table, electronic configuration, General characteristics, *viz.*, atomic and ionic radii, variable oxidation states, ability to form complexes, formation of colored ions, magnetic moment μ_{so} (spin only) and μ_{eff} and catalytic behaviour. General comparative treatment of 4*d* and 5*d* elements with their 3*d* analogues with respect to ionic radii, oxidation states and magnetic properties. **Chemistry of lanthanides and actinides:** Electronic structure, oxidation states and ionic radii and lanthanide and actinide contraction, complex formation. Chemistry of separation of Np, Pu, and Am from Uranium. Later actinides and later lanthanides.	15
II	**Concepts of acids and bases**: Arrhenius theory, Bronsted–Lowry concepts, conjugate acids and bases, relative strength of acids and bases, Lewis concepts of acids and bases, **Hard and soft acids and bases (HSAB):** Classification of acids and bases as hard and soft. Pearson's HSAB concept, acid-base strength, hardness and softness. Symbiosis, Applications of HSAB principle. **Non- aqueous solvents:** Physical properties of a solvent, types of solvents and their general characteristics, reaction in non-aqueous solvents with reference to liquid ammonia, liquid sulphur dioxide, sulphuric acid, liquid HF, ionic liquids.	15
III	**Coordination chemistry:** Werner's theory and its experimental verification, IUPAC nomenclature of coordination compounds, Chelates, polynuclear complexes, Isomerism in coordination compound, stereochemistry of complexes 4 & 6 coordination compounds.	15

	Valence bond theory (inner and outer orbital complexes) : Limitations of valence bond theory, electroneutrality principle and back bonding. Crystal field theory, Crystal field splitting and stabilization energy, measurement of 10 Dq (Δ_o). CFSE in weak and strong fields, pairing energies, factors affecting the magnitude of 10 Dq (Δ_o, Δ_t). Octahedral vs. tetrahedral coordination.	
IV	**Chemistry of water analysis:** Water quality parameters and its determination – Acidity and alkalinity of water, Total dissolved solid (TDS), Hardness of water, Chloride, Phosphate, Fluoride, Dissolved Oxygen, Chemical oxygen demand, Biological oxygen demand. **Coal analysis:** Classification of coal, Proximate and Ultimate analysis of coal, Carbonization of coal, Coal gas-composition and uses.	15
V	**Thermodynamics:** Basics of Thermodynamics, brief review of zeroth and first law of thermodynamics. Concept of heat capacity, Relation between heat capacities, Joule-Thomson expansion, inversion temperature of gases, Joule Thomson coefficient of ideal and real gases. **Second law of thermodynamics:** Spontaneous process, second law, Statement of Carnot cycle and efficiency of heat engine, Carnot's theorem, thermodynamic state of temperature. Concept of entropy: Entropy change in a reversible and irreversible process, entropy change in isothermal reversible expansion of an ideal gas, entropy change in isothermal mixing of ideal gases, physical significance of entropy, Molecular and statistical interpretation of entropy, Gibbs and Helmholtz free energy, variation of G and A with pressure, volume, temperature, Gibbs-Helmholtz equation, Maxwell relations, Nernst heat theorem, Elementary idea of Third law of Thermodynamics, concept of residual entropy, calculation of absolute entropy of molecule.	15
VI	**Chemical equilibrium:** Criteria of thermodynamic equilibrium, degree of advancement of reaction, chemical equilibria in ideal gases. Concept of Fugacity, Thermodynamic derivation of relation between Gibbs free energy of reaction and reaction quotient. Concept of activity, activity coefficient and ionic strength, Equilibrium constants and their quantitative dependence on temperature, pressure and concentration. Thermodynamic derivation of relations between the various equilibrium constants K_p and K_c. Le-Chatelier's principle (quantitative treatment). Equilibrium between ideal gas and a pure condensed phase. **Ionic equilibrium:** Ionization of weak acids and bases, pH scale, common ion effect; dissociation constants of mono protonic acids (exact treatment). Salt hydrolysis- calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions; derivation of Henderson equation and its applications. Solubility, solubility product of sparingly soluble salts and its applications.	15

Keywords: Transition Elements, Lanthanides and Actinides, Coordination Compounds, Redox potential, Water Analysis, Coal Analysis, Non-aqueous solvents, Carnot's theorem, Fugacity, Salt hydrolysis.

Part C : Learning Resources

Text Books, Reference Books, Other Resources

Suggested Readings :

1. Basic Inorganic Chemistry, Cotton F.A, G. Wilkinson and P. L. Gaus, Wiley.
2. Concise Inorganic Chemistry, J. D. Lee, ELBS.
3. Concepts of Models of Inorganic Chemistry, B. Douglas, D. Mc Daniel and J. Alexander,John Wiley.
4. Inorganic Chemistry, D. E. Shriver, P. W. Atkins and C. H. Langford, Oxford.

5. Inorganic Chemistry, W. W. Porterfield, Addison – Wiley.
6. Inorganic Chemistry, A. G. Sharp, ELBS.
7. Inorganic Chemistry, G. L. Miessler and D. A. Tarr, Prentice Hall.
8. Advanced Inorganic Chemistry, Satya Prakash.
9. Advanced Inorganic Chemistry, Agrawal and Agrawal
10. Advanced Inorganic Chemistry, B.R. Puri, L. R. Sharma, S. Chand Publication
11. Inorganic Chemistry, R. D. Madan, S. Chand Publication.
12. Aadhunik Akarbanic Rasayan, A. K. Shrivastav & P. C. Jain, Goel Pub
13. Uchchattar Akarbanic Rasayan, Satya Prakash & G. D. Tuli, Shyamal Prakashan
14. Uchchattar Akarbanic Rasayan, B. R. Puri & L. R. Sharma
15. Selected topic in Inorganic Chemistry by R. D. Madan, M. Malik & G. R. Tuli, S. Chand Publication.
16. Environmental Chemistry, A. K. De, New Age International Publishers
17. Physical Chemistry, G.M. Barrow, International Student Edition, McGraw Hill.
18. University General Chemistry, C.N.R. Rao, Macmillan.
19. Physical Chemistry, R.A. Alberty, Willey Eastern.
20. The Elements of Physical Chemistry, Willey Eastern.
21. Physical Chemistry through problems, S.K. Dogra, Willey Eastern.
22. Physical Chemistry, B.D. Khosla.
23. Physical Chemistry, B.R. Puri and L. R. Sharma.
24. Physical Chemistry, R.L. Kapoor, Vol. I-IV.

E- Learning Resources:

1. http://heecontent.upsdc.gov.in/Home.aspx
2. https://nptel.ac.in/courses/104/106/104106096/
3. http://heecontent.upsdc.gov.in/Home.aspx
4. https://nptel.ac.in/courses/104/106/104106096/
5. https://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/intro1.htm
6. https://nptel.ac.in/courses/104/103/104103071/#

Fundamental Chemistry related topics on SWAYAM platform and E-pathshala

Part D: Assessment and Evaluation

Maximum Marks: 50

Part A: Introduction				
Program: **Diploma Course**		Class: **B.Sc. II Year**	Year: **2024**	Session: **2024-25**
1.	Course Code	CHEM-4T		
2.	Course Title	Organic and Physical Chemistry		
3.	Course Type	Theory		
4.	Pre-requisite (if any)	To Study this course our students must have had the subject chemistry in class B.Sc. I Year/ Certificate Course or equivalent		
5.	Course Learning Outcomes (CLO)	At the end of this course, the students will be able to learn the following aspects of Chemistry: • Reactions of the alcohols and phenols. • Reactivity of carbonyl compounds • Carboxylic acid and its derivatives • Organic compounds containing nitrogen • Phase Equilibrium • Electrochemistry		
6.	Credit Value	Theory: **4**		
7.	Total Marks	**Max. Marks: 50**	**Min. Passing Marks**: 17	

Part B: Content of the Course		
Total No. of Lecturers: **90**		
Unit	**Topics**	**No. of Lectures**
I	**Chemistry of organic halides: Alkyl halides**: Methods of preparation, nucleophilic substitution reactions – S_N1, S_N2 and S_Ni mechanisms with stereochemical aspects and effect of solvent etc.; nucleophilic substitution, elimination reactions. **Aryl halides:** Preparation, including preparation from diazonium salts, Nucleophilic Aromatic Substitution; S_NAr, Benzyne mechanism. Relative reactivity of alkyl, allyl/benzyl, vinyl and aryl halides towards nucleophilic substitution reactions. **Alcohols:** Dihydric alcohols – methods of formation, chemical reactions of vicinal glycols, oxidative cleavage [$Pb(OAc)_4$ and HIO_4] and pinacol-pinacolone rearrangement. Trihydric alcohols - Nomenclature, methods of formation, chemical reactions of glycerol. **Phenols:** Structure and bonding in phenols, physical properties and acidic character. Comparative acidic strength of alcohols and phenols, acylation and carboxylation. Mechanism of Claisen rearrangement, Gatterman synthesis and Reimer-Tiemann reaction.	15
II	**Aldehydes and ketones** : Nomenclature, structure and reactivity of carbonyl group. General methods of preparation of aldehydes and ketones. Mechanism of nucleophilic addition to carbonyl groups: Benzoin and Aldol condensation. Wittig reaction, Mannich reaction and Benzil- Benzilic rearrangement. Use of acetal as protecting group. Oxidation of aldehydes, Baeyer-Villiger oxidation of Ketones, Clemmensen reduction, Wolff-Kishner reaction, $LiAlH_4$ and $NaBH_4$ reduction. Halogenation of enolizable	15

	ketones, An introduction to α, β-unsaturated aldehydes and Ketones. Michael Addition reaction	
III	**Carboxylic acids :** Preparation, Structure and bonding, Physical and chemical properties including, acidity of carboxylic acids, effects of substituents on acid strength, Reduction of carboxylic groups, Mechanism of decarboxylation. **Dicarboxylic acids:** Methods of formation and effect of heat and dehydrating agents, Hydroxyacids. **Carboxylic acid derivatives :** Structure of acid chlorides, esters, amides and acid anhydrides, Relative stability of acyl derivatives. Physical properties, inter-conversion of acid derivatives by nucleophilic acyl substitution. Reaction with Grignard reagents, Organo-copper and Organo-lithium compound.	15
IV	**Organic compounds of nitrogen :** Preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes. Mechanism of nucleophilic substitution in nitroarenes and their reduction in acidic, neutral and alkaline medium. Reactivity, structure and nomenclature of amines, physical properties. Separation of mixture of primary, secondary and tertiary amines. Structural features affecting basicity of amines. Preparation of alkyl and aryl amines (reduction of nitro compounds and nitriles), reductive amination of aldehydic and ketonic compounds. Gabriel-Phthalimide reaction, Hofmann- Bromamide reaction, Reactions of amines, electrophilic aromatic substitution of aryl amines, Reaction of amines with nitrous acid. Synthetic transformations of aryl diazonium salts, Azo coupling.	15
V	**Phase equilibrium :** Phase rule, phase, component and degree of freedom, derivation of Gibbs phase rule, Clausius-Clayperon equation and its applications to solid-liquid, liquid-vapor and solid-vapor, limitations of phase rule, applications of phase rule to one component system: water system and sulphur system. Application of phase rule to two component system: Pb-Ag system, desilverization of lead, eutectic point. Zn-Mg system, ferric chloride-water system, sodium chloride-water system, congruent and incongruent melting point and freezing mixture	15
VI	**Electrochemistry :** Ostwald dilution law and its limitations, Elementary ideas of Debye-Huckel-Onsager's theory for strong electrolytes, relaxation and electrophoretic effects. Migration of ions: Transport number, Determination by Hittorf method and moving boundary method. Electrochemical cell–reversible and irreversible cells, conventional representation of electrochemical cells, Types of electrodes-metal-metal ion, metal-salt ion, gas, amalgam, redox electrodes. Electrode potential, Standard Redox potential, electrochemical series and its applications, derivation of Nernst equation and expression of Nernst equation for different electrodes. Calculation of ΔG, and equilibrium constant. Conductometric, pH metric and potentiometric titration.	15

Keywords: Alkyl and aryl halides, Alcohols and Phenols, Carboxylic Acid and its derivatives, Carbonyl Compounds, Organic Compounds of Nitrogen, Phase Equilibrium, Phase Rule, Phase, Component and Degree of Freedom, Gibbs phase rule, Clausius-Clayperon Equation, One Component System, Two Component System, Electrochemistry, Ostwald dilution law, Debye-Huckel-Onsager's theory, Electrochemical Cells, Electrode Potential, Nernst Equation, Conductometric Titration, pH Metric Titration, Potentiometric Titration.

Part C : Learning Resources

Text Books, Reference Books, Other Resources

Suggested Readings :

1. Organic Chemistry, Morrison R.N. and Boyd R.N., Dorling Kindersley (India) Pvt. Ltd.(Pearson Education).

2. Organic Chemistry, Finar I.L. Dorling Kindersley (India) Pvt. Ltd. (Pearson Education) Vol I.
3. Organic Chemistry, Paula Y. Bruice. 2nd Edition, Prentice-Hall, International Edition (1998).
4. Organic Chemistry, Mukherjee S.M., Singh S.P. and Kapoor R.P., Wiley Easters (New Age) Vol I, II, III.
8. Fundamentals of Organic Chemistry, Solomons T. W. G., John Wiley & Sons.
6. Organic Chemistry Carey, F.A. McGraw Hill.
7. A Guide Book of Reaction Mechanism by Peter Sykes.
9. Organic Chemistry, J. Clayden, N. Greeves, S. Warren
10. Modern Methods of Organic Synthesis, William Carruthers, Iain Coldham
11. Fundamental of Organic Chemistry, Jahn E. Mc Murry
12. Organic Chemistry Principal and Mechanism, Joel Karty
13. Reaction, rearrangements and reagents, S. N. Sanyal
14. Physical Chemistry, Puri and Sharma.
15. Bhautik Rasayan, Puri, Sharma and Pathaniya, Vishal Publishing Company.
16. P. Atkins & Julio De Paula, Physical Chemistry Oxford university Press
17. R. G. Mortimer , Physical Chemistry, 3rd ed. Elsevier
18. G. W. Castalen, Physical Chemistry, 4th Ed. Narosa.

Suggested online links:

1. https://www2.chemistry.msu.edu/faculty/reusch/virtTxtJml/intro1.htm
2. https://nptel.ac.in/courses/104/103/104103071/#

Fundamental Chemistry related topics on SWAYAM platform and E-pathshala

Part D: Assessment and Evaluation

Maximum Marks: 50

Part A: Introduction				
Program: **Diploma Course**		Class: **B.Sc. II Year**	Year: 2024	Session: 2024-25
1.	Course Code	CHEM-2P		
2.	Course Title	Lab. 2 : General Chemistry-2		
3.	Course Type	Practical		
4.	Pre-requisite (if any)	To Study this course our students must have had the subject chemistry in class B.Sc. I Year/ Certificate Course or equivalent.		
5.	Course Learning Outcomes (CLO)	By the end of this course students will learn the following aspects of Laboratory exercises in Chemistry : • To analyze the given mixture for anions (acid radicals) and cations (basic radicals). • Titrations • Qualitative Analysis • Transition Temperature. • Thermochemistry. • Water Analysis. • Phase Equilibrium		
6.	Credit Value	Practical: **2**		
7.	Total Marks	**Max. Marks: 50**		**Min Passing Marks: 17**

Part B: Content of the Course		
Total No. of Lecturers: **30**		
	LABORATORY COURSE	**No. of Lectures**
Tentative list of practical	**Inorganic chemistry :** Qualitative semimicro analysis of mixtures containing 5 radicals. Emphasis should be given to the understanding of the chemistry of different reactions. The following radicals are suggested: CO_3^{2-}, NO^{2-}, S^{2-}, SO_3^{2-}, $S_2O_3^{2-}$, CH_3COO^-, F^-, Cl^-, Br^-, I^-, NO_3^-, BO_3^{3-}, $C_2O_4^{2-}$, PO_4^{3-}, NH_4^+, K^+, Pb^{2+}, Cu^{2+}, Cd^{2+}, Bi^{3+}, Sn^{2+}, Sb^{3+}, Fe^{3+}, Al^{3+}, Cr^{3+}, Zn^{2+}, Mn^{2+}, Co^{2+}, Ni^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Mg^{2+}. Mixtures should preferably contain one interfering anion, or insoluble component ($BaSO_4$, $SrSO_4$, $PbSO_4$, CaF_2 or Al_2O_3) or combination of anions e.g. CO_3^{2-} and SO_3^{2-}, NO_2^- and NO_3^-, Cl^-, Br^-, and I^-.	10
	Volumetric analysis 1. Determination of acetic acid in commercial vinegar using NaOH. 2. Determination of alkali content-antacid tablet using HCl. 3. Estimation of calcium content in chalk as calcium oxalate by permanganometry. 4. Estimation of hardness of water by EDTA. 5. Estimation of ferrous & ferric by dichromate method. 6. Estimation of copper using thiosulphate. **Chromatographic separations** Paper chromatographic separation of following metal ions: a) Ni (II) and Co (II) b) Fe (III) and Al (III) Paper chromatographic separation of mixture of dyes **Water Analysis** 1. Determine chemical oxygen demand (COD) of given Water sample. 2. Determine Dissolved oxygen (DO) of given Water Sample. **Organic chemistry**	10

	1. Detection of elements (X, N, S). 2. Qualitative analysis of unknown organic compounds containing simple functional groups (alcohols, carboxylic acids, phenols, nitro, amine, amide, and carbonyl compounds, carbohydrates) Preparation of Organic Compounds: (i) m-dinitrobenzene, (ii) Acetanilide, (iii) Bromo/Nitro-acetanilide, (iv) Oxidation of primary alcohols-Benzoic acid from benzylacohol, (v) azo dye.	
	Physical chemistry **Transition Temperature** Determination of the transition temperature of the given substance by thermometric/ dialometric method (e.g. $MnCl_2.4H_2O/SrBr_2.2H_2O$). **Thermochemistry** 1. Determination of heat capacity of a calorimeter for different volumes using change of enthalpy data of a known system (method of back calculation of heat capacity of calorimeter from known enthalpy of solution or enthalpy of neutralization). 2. Determination of heat capacity of the calorimeter and enthalpy of neutralization of hydrochloric acid with sodium hydroxide. 3. To determine the solubility of benzoic acid at different temperature and to determine ΔH of the dissolution process. 4. To determine the enthalpy of neutralization of a weak acid/ weak base versus strong base/ strong acid and determine the enthalpy of ionization of the weak acid/ weak base. 5. To determine the enthalpy of solution of solid calcium chloride and calculate the lattice energy of calcium chloride from its enthalpy data using Born Haber cycle. **Phase Equilibrium** 6. To study the effect of a solute (e.g. NaCl, Succinic acid) on the critical solution temperature of two partially miscible liquids (e.g. phenol-water system) and to determine the concentration of that solute in the given phenol-water system. 7. To construct the phase diagram of two component system (e.g. diphenylamine– benzophenone) by cooling curve method. 8. Distribution of acetic/ benzoic acid between water and cyclohexane. 9. Study the equilibrium of at least one of the following reactions by the distribution method: (i) $I_2(aq) + I^- \rightarrow I_3(aq)^{2+}$ (ii) $Cu^{2+}(aq) + nNH_3 \rightarrow Cu(NH_3)n$ **Molecular Weight Determination** 10. Determination of molecular weight by Rast Camphor and Landsburger method.	**10**

Keywords: Qualitative semimicro analysis. Paper chromatographic Water Analysis. Transition Temperature Thermochemistry Molecular Weight.

Part C: Learning Resource

Suggested Readings :

1. Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson, 2009.
2. Ahluwalia, V. K., Dhingra, S. and Gulati, A. College practical Chemistry, University Press.
3. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009).
4. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. Practical Organic Chemistry, 5th Ed., Pearson (2012)
5. Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011).

6. Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. Experiments in Physical Chemistry 8th Ed.; McGraw-Hill: New York (2003).
7. Halpern, A. M. & McBane, G. C. Experimental Physical Chemistry 3rd Ed.; W.H. Freeman & Co.: New York (2003).
8. Sidhwani, I.T., Saini, G., Chowdhury, S., Garg, D., Malovika, Garg, N. Wealth from waste: 8.A green method to produce biodiesel from waste cooking oil and generation of useful products from waste further generated "A Social Awareness Project", Delhi University Journal of Undergraduate Research and Innovation.
9. Carpenter, William Lant; Leask, Henry (1895). A treatise on the manufacture of soap and candles, lubricants and glycerin. Free ebook at Google Books.

E- Learning Resources:

1. http://heecontent.upsdc.gov.in/Home.aspx
2. https://nptel.ac.in/courses/104/106/104106096/
3. http://heecontent.upsdc.gov.in/Home.aspx
4. https://nptel.ac.in/courses/104/106/104106096/
5. https://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/intro1.htm
6. https://nptel.ac.in/courses/104/103/104103071/#

Fundamental Chemistry related topics on SWAYAM platform and E-pathshala

Part D: Assessment and Evaluation

Maximum Marks: 50

PRACTICAL EXAMINATION **B. Sc. – II**	**05 Hrs.** **M.M. 50**
Three Experiments are to be performed. 1. Inorganic – Qualitative semimicro analysis of mixtures (5 radicals) including interfering/insoluble radicals. **OR** One experiment from synthesis and analysis by preparing the standard solution. **OR** • Determine chemical oxygen demand (COD) of given Water sample . • Determine Dissolved oxygen (DO) of given Water Sample.	12 marks
2. Organic (a) Identification of the given organic compound & determine its M.Pt./B.Pt.	6 marks
(b) Determination of Rf value and identification of metal ions/organic compounds by paper chromatography.	6 marks
3. Any one physical experiment that can be completed in two hours including calculations.	12 marks
4. Viva	10 marks
5. Sessional	04 marks
In case of Ex-Students one marks will be added to each of the experiment.	

Scheme of B.Sc. Botany

Year	Course Code	Subject Name	Theory/ Practical	Total Credit	Total Marks	
					Max	Min
Second year	BOT-3T	Plant Systematics,Economic Botany and Ethnobotany	Theory	4	50	17
	BOT-4T	Plant Anatomy,Embryology and Plant Breeding	Theory	4	50	17
	BOT -2P	LAB:2 Plant Identification and Embryology	Practical	2	50	17

6. Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. Experiments in Physical Chemistry 8th Ed.; McGraw-Hill: New York (2003).
7. Halpern, A. M. & McBane, G. C. Experimental Physical Chemistry 3rd Ed.; W.H. Freeman & Co.: New York (2003).
8. Sidhwani, I.T., Saini, G., Chowdhury, S., Garg, D., Malovika, Garg, N. Wealth from waste: 8.A green method to produce biodiesel from waste cooking oil and generation of useful products from waste further generated "A Social Awareness Project", Delhi University Journal of Undergraduate Research and Innovation.
9. Carpenter, William Lant; Leask, Henry (1895). A treatise on the manufacture of soap and candles, lubricants and glycerin. Free ebook at Google Books.

E- Learning Resources:

1. http://heecontent.upsdc.gov.in/Home.aspx
2. https://nptel.ac.in/courses/104/106/104106096/
3. http://heecontent.upsdc.gov.in/Home.aspx
4. https://nptel.ac.in/courses/104/106/104106096/
5. https://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/intro1.htm
6. https://nptel.ac.in/courses/104/103/104103071/#

Fundamental Chemistry related topics on SWAYAM platform and E-pathshala

Part D: Assessment and Evaluation

Maximum Marks: 50

PRACTICAL EXAMINATION **B. Sc. – II**	**05 Hrs.** **M.M. 50**
Three Experiments are to be performed. 1. Inorganic – Qualitative semimicro analysis of mixtures (5 radicals) including interfering/insoluble radicals. **OR** One experiment from synthesis and analysis by preparing the standard solution. **OR** • Determine chemical oxygen demand (COD) of given Water sample . • Determine Dissolved oxygen (DO) of given Water Sample.	12 marks
2. Organic (a) Identification of the given organic compound & determine its M.Pt./B.Pt. (b) Determination of Rf value and identification of metal ions/organic compounds by paper chromatography.	6 marks 6 marks
3. Any one physical experiment that can be completed in two hours including calculations.	12 marks
4. Viva	10 marks
5. Sessional	04 marks
In case of Ex-Students one marks will be added to each of the experiment.	

Part A: Introduction

Program: **Diploma in Plant Identification and plant preservation**		Class: B. Sc. **II Year**	Year: 2024	Session: 2024-25
1.	Course Code	**BOT-3T**		
2.	Course Title	**Plant Systematics, Economic Botany and Ethnobotany**		
3.	Course Type	**Theory**		
4.	Pre-requisite (if any)	NO		
5.	Course Learning Outcomes (CLO)	At the end of this course, the students will be able to • Understand the Plant Taxonomy • Learn the characteristics of families included • Learn economic importance of different plants of the concerned families • Understand the traditional knowledge about the plants and possible application of this knowledge		
6.	**Credit Value**	**Theory: 4**		
7.	**Total Marks**	**Max. Marks: 50**	**Min Passing Marks: 17**	

Part B: Content of the Course

Total Periods: 60

Unit	Topics	No. of Period
I	**Taxonomic Resources & Nomenclature:** Components of taxonomy (identification, nomenclature, classification); Taxonomic resources: Herbarium- functions & important herbaria, Botanical gardens, Flora, Keys- single access and multi-access. Principles and rules of Botanical Nomenclature according to ICBN	12
II	**Types of classification & Evidences:** Artificial, natural and phylogenetic. Bentham and Hooker (upto series), Engler and Prantl (upto series) and Hutchinson classification. Introduction to taxonomic evidences from palynology, cytology and phytochemistry	12
III	**Families:** A study of the following families (Following Bentham & Hooker's system) with economic importance: Ranunculaceae, Brassicaceae, Malvaceae, Rutaceae, Fabaceae, Myrtaceae, Cucurbitaceae, Rubiaceae, Asteraceae, Apocynaceae, Acanthaceae, Asclepiadaceae, Solanaceae, Amaranthaceae, Euphorbiaceae, Papaveraceae, Apiaceae, Lamiaceae, Orchidaceae, Liliaceae, Musaceae and Poaceae.	12
IV	**Economically valuable plants:** Centre of origin and domestication of crop plants; Botanical name, family, part used and uses of oil yielding plants, fibre yielding plants, Rubber, Dyes, Timber, Sugar and beverages	12
V	**Ethnobotany:** Concept of Ethnobotany, Documentation, Conservation and application of Traditional Knowledge, Sacred grooves, Role of AYUSH, CIMAP and NMPB **Role of important medicinal plants in Traditional therapeutic practices:** *Aegle marmelos, Asparagus racemosus, Andrographis paniculata, Ocimum sanctum, Aloe vera, Nyctanthes arbor-tristis* etc. Conservation of medicinal plants and ethnomedicinal knowledge. Plants in primary healthcare: *Tinospora cordifolia, Ocimum sanctum, Aloe vera, Azadirachta indica* etc.	12

Keywords: Taxonomy, classification, Families ,ethnobotany

Part C -Learning Resources

Suggested Readings:

1. Plant Systematics. Arun K. Pandey & Shruti Kansana. 2020. Jaya Publishing House.
2. Bole, P. V. and Vaghani, Y. (1986) Field guide to the common trees of India. Oxford University Press; Bombay.
3. Brandis, D. (1906) Indian Trees (London, 5th edition. 1971). International Book Distributors; Dehra Dun.
4. Dallwitz, M. J., Paine, T. A. and Zurcher, E. J. (2003). Principles of interactive keys. http://delta-intkey.com
5. https://www.naace.co.uk/school-improvement/ict-mark/
6. Pandey, B.P. 2007. Botany for Degree Students: Diversity of Seed Plants and their Systematics, Structure, Development and Reproduction in Flowering Plants. S. Chand & Company Ltd.New Delhi.
7. Singh, G. 1999. Plant Systematics: Theory and Practice. Oxford and IBH, New Delhi.
8. Dutta A.C. 2016. Botany for Degree Students. Oxford University Press.
9. Randhawa, G.S. and Mukhopadhyay, A. 1986. Floriculture in India. Allied Publishers
10. Kochhar, S.L. (2011). Economic Botany in the Tropics, MacMillan Publishers India Ltd., New Delhi. 4th edition.
11. Sambamurthy, AVSS & Subrahmanyam, NS (2000). Economic Botany of Crop Plants. Asiatech Publishers. New Delhi.
12. Singh, D.K and K.V. Peter. 2014. Protected cultivation of horticultural crops. New India Publishing Agency, India.
13. Reddy P. Parvatha. 2016. Sustainable crop protection under protected cultivation. Springer, Singapore.
14. Amit Deogirikar. 2019. A Text Book on Protected Cultivation and Secondary Agriculture. Rajlaxmi Prakashan, Aurangabad, India.
15. Singh, B., B. Singh, N. Sabir and M Hasan. 2014. Advances in protected cultivation. New India Publishing Agency, India.
16. Sharma, OP. 1996. Hill's Economic Botany (Late Dr. AF Hill, adopted by OP Sharma). Tata McGraw Hill Co. Ltd., New Delhi.

Suggested equivalent online courses:

1. https://www.easybiologyclass.com/topic-botany/
2. http://egyankosh.ac.in/handle/123456789/53530
3. https://www.delta-intkey.com/www/desc.htm
4. https://milneorchid.weebly.com/plant-id-for-beginners.html
5. https://plants.usda.gov/classification.html
6. https://www.senecahs.org/pages/uploaded_files/Plant%20Classification.pdf
7. https://www.ladykeanecollege.edu.in/files/userfiles/file/Dr_%20S_%20Nongbri%20III%20Sem%20ppt.pdf
8. https://www.brainkart.com/article/Bentham-and-Hooker-s-classification-of-plants---Dicotyledonae,-Gymnospermae-and-Monocotyledonae_1000/
9. https://libguides.rutgers.edu/c.php?g=336690&p=2267037
   https://www.delta-intkey.com/

Part D: Assessment andEvaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 50

Continuous Comprehensive Evaluation (CCE):As per rule

University Exam(UE): 50Marks

Part A: Introduction

Program: **Diploma in Plant Identification and plant preservation**	Class: B.Sc. **II Year**	Year: 2024	Session 2024-25
1. Course Code	**BOT-4 T**		
2. Course Title	**Plant Anatomy, Embryology and Plant Breeding**		
3. Course Type	**Theory**		
4. Pre-requisite (if any)	NO		
5. Course Learning Outcomes (CLO)	At the end of this course, the students will be able to 1. Understand the internal structure of root, stem and leaves 2. learn about the anomalous secondary growth of some plants 3. understand the life cycle of angiospermic plants with details of microsporogenesis, megasporogenesis, fertilization and other developmental details up to embryogenesis 4. understand concept of plant breeding and its application		
6. **Credit Value**	**Theory: 4**		
7. **Total Marks**	**Max. Marks: 50**	**Min Passing Marks: 17**	

Part B: Content of the Course

Total Period: 60

Unit	Topics	No. ofPeriod
I	**Meristems and related theories**: Meristematic and permanent tissues, Root meristem, Stem meristem and Leaf meristem. Theories of apical organization: Apical Cell Theory, Histogen Theory and Tunica Carpus Theory	12
II	**Anatomy and Secondary growth:** Anatomy of Root, Stem and Leaves of both Dicots and Monocots. Secondary growth in Dicots, Anomalous secondary growth in *Bignonia, Boerhaavia, Dracaena and Nycthanthes*	12
III	**Plant Embryology:** Flower: Structure and types (Complete, Incomplete, Perfect and Imperfect flower), Microsporangium and Microsporogenesis, Ovule: Structure and types, Megasporogenesis, Development of female gametophyte (Embryo sac). Types of Embryo sac, Pollination, Pollen-pistil interaction, Fertilization, Double fertilization, Endosperm and its types, Embryogenesis, Apomixis and Polyembryony	12
IV	**Plant Breeding**: Plant Introduction, Agencies of plant introduction in India, Procedure of introduction- Acclimatization- Achievements, Selection- mass selection, pure line selection and clonal selection. Genetic basis of selection methods	12
V	**Hybridization**: Procedure of hybridization, inter-generic, inter-specific and inter-varietal hybridization. Composite and synthetic varieties. Heterosis, Mutation and Molecular breeding (use of DNA markers in plant breeding). Role of hybrization in agriculture, horticulture and forestry	12

Keywords: Meristems, Anomalous secondary growth. Pure line selection. Hybridization.

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heterosis

Part C -Learning Resources

Text Books, Reference Books, Other Resources

1. M K Raxdan An Introduction to Plant Tissue Culture –; Oxfird& IBH Publishing Co.Pvt. Ltd.,New Delhi
2. Allard RW (1960) Principles of Plant Breeding. John willey and Sons. Inc. New York
3. BD Singh (2003) Plant Breeding. Kalyani Publishers
4. Sharma JR (1994) Principles and Practices of Plant Breeding. Tata McGraw-Hill Pub. Co. New Delhi
5. Pandey BP (2010) College Botany Vol II, S. Chand and Company, New Delhi.
6. Maheshwari P (1971). An Introduction to Embryology of Angiosperms, McGraw Hill Book Co., London
7. Bhojwani SS and Bhatnagar SP (2000). The Embryology of Angiosperms (4th Ed.), Vikas Publishing House
8. Evert RF (2006). Esau's Plant Anatomy: Meristems, Cells and Tissues of the Plant body: Their Structure, Function and Development, John Willey and Sons, Inc
9. Pandey BP .Plant Anatomy, S. Chand Publishers, New Delhi
10. Srivastava HN (2006). Plant Anatomy, Pradeep Publications, Jalandhar

Suggested equivalent online resourses:

1. https://www.pnas.org/content/104/suppl_1/8641
2. https://www.journals.uchicago.edu/doi/pdfplus/10.1086/659998
3. https://bsi.gov.in/page/en/ethnobotany
4. http://www.legalserviceindia.com/article/l98-Intellectual-Property-and-Traditional-knowledge.html
5. https://www.brainkart.com/article/Economic-importance-Plants---Food,-Rice,-Oil,-Fibre,-Timber-yielding-plant_1095/
6. https://www.loc.gov/rr/scitech/tracer-bullets/economic-botanytb.html
7. http://nsdl.niscair.res.in/bitstream/123456789/127/1/Fibre%20crops%2C%20bamboo%2C%20timber%20-%20Final.pdf
8. https://www2.palomar.edu/users/warmstrong/econpls.htm
9. https://www.longdom.org/proceedings/phytochemistry-and-phytoconstituents-of-herbal-drugs-and-formulations-1668.html

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 50

Continuous Comprehensive Evaluation (CCE):As per rule

University Exam(UE): 50Marks

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Part A : Introduction			
Programme: Certificate	Class B.Sc.-II	Year: 2024	Session: 2024:25

1.	Course Code	BOT-2P
2.	Course Title	**Plant Identification and Embryology**
3.	Course Type	**Practical**
4.	Pre-requisite (if any)	No
5.	Course outcomes:	**Course outcomes:** After the completion of the course the students will be able: • To learn how plant specimens are collected, documented, and curated for a permanent record. • To observe, record, and employ plant morphological variation and the accompanying descriptive terminology. • To gain experience with the various tools and means available to identify plants. • To develop observational skills and field experience. • To identify a taxonomically diverse array of native plants. • To recognize common and major plant families. • Comprehend the concepts of plant taxonomy and classification of Angiosperms.
6.	Credit Value	2
7.	Total Marks	Max. Marks: 50 Min. Passing Marks:17

Part B : Content of the Course

Total No. of Periods - 30

Tentative Practical List	Topic* *(Topic * (**Minimum Any three from each unit depending on facilities and syllabus. 20% for spotting, 10% each for viva and sessional and rest 60 % marks equally in each unit.**)
	Herbarium: Plant collection, Preservation and Documentation: Stepwise Practicing Herbarium techniques: 1. FIELD EQUIPMENTS, Collection of any wild 25 plant specimens 2. Learn to handle Herbarium making tools 3. Pressing and Drying of collected plant specimens 4. Special treatments for all varied groups of plants 5. Mount on standard herbarium sheets 6. Label them using Standard methods
	Arrange the prepapared herbarium according to Bentham and Hookers system of classification- 1.herb, shrub and trees 2. annual, biannual and perennial 3. cereals, pulses, vegetables and medicinal 4. ethanobotanical importance

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Taxonomic Identification of angiospermic plants: Description of plants belonging to following families in semitechnical language and identification up to family level: Brassicaceae, Malvaceae, Fabaceae, Cucurbitaceae, Asteraceae, Apocyanaceae, Ascleapiadaceae, ,Solanaceae, Euphorbiaceae, Papaveraceae, Apiaceae Acanthaceae, Labiatae (Lamiaceae), Rubiaceae, Liliaceae, Musaceae, Poaceae.

Identification during field visits: Field identification of common wild plants from families included in the theory syllabus.

a) **Documentation of Ethnobotanical wisdom of area**
b) **Study of economically valuable plants:** Medicinal plants, oil yielding plants, cereals, sugarcane, beverages etc.

1. **Anatomy of:** Dicot root, stem and leaf
2. Monocot root, stem and leaf
3. Plants showing primary anomaly and anomalous secondary growth

a) **Study of an angiospermic flower**
b) **Dissection of Ladys finger /Tridax/citrus seeds for study of embryo**

Part C - Learning Resource

Text Books, Reference Books, Other Resources

Suggested Readings:

1. Bole, P. V. and Vaghani, Y. (1986) Field guide to the common trees of India. Oxford University Press; Bombay.
2. Womersley, J. S. 1981. Plant collecting and herbarium development: A manual.S.K. Pandey (2012). Quick Concept of Botany. Publisher LAP LAMBERT Academic Publishing GmbH & Co. KG, Germany (ISBN: 978-3-8484-3104-5).
3. Pandey S.K. (2012). Quick Concept of Botany. Publisher LAP LAMBERT Academic Publishing GmbH & Co. KG, Germany (ISBN: 978-3-8484-3104-5).
4. Manilal, K. S. and M. S. Muktesh Kumar (ed.) (1998) A Hand book of Taxonomy Training, DST,N. Delhi
5. Dhopte, A.M. (2003) Principles and Techniques for Plant Scientists. - Agrobios.Jodhpur, India.
6. Jain, S.K. & R.R. Rao. 1977. A handbook of field and herbarium methods. Today & Tomorrow's Printers and Publishers, New Delhi.

E-learning Resources:

1. http://egyankosh.ac.in/bitstream/123456789/13096/1/Unit-5.pdf
2. https://www.for.gov.bc.ca/hfd/pubs/docs/wp/wp18.pdf
3.https://www.researchgate.net/publication/267510854_The_Flowering_Plants_Handbook

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Part D – Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: 50 Continuous Comprehensive Evaluation (CCE): Not Applicable University Exam(UE): 50 Marks		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test/Assignment/Presentation	Not Applicable

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Scheme of B.Sc.
Zoology

Year	Course Code	Subject Name	Theory/ Practical	Total Credit	Total Marks	
					Max	Min
Second year	ZOOL-3T	Genetics Developmental Biology and Evolution	Theory	4	50	17
	ZOOL -4T	Biochemistry and Molecular Biology	Theory	4	50	17
	ZOOL -2P	Practical	Practical	2	50	17

Part A: Introduction			
Program: **Certificate Course**	Class: B.Sc. II Year	Year: 2024	Session: 2024-25
1	Course Code	**ZOOL - 3T**	
2	Course Title	**Genetics, Developmental Biology & Evolution**	
3	Course Type	Theory	
4	Pre-requisite (if any)	NO	
5	Course Outcome	After successfully completing this course, the students will be able to: • Apply the principles of Mendelian inheritance on interaction of genes. • Various methods of sex determination in animal kingdom. • Understand the cause and effect of alterations in chromosome number and structure. • Know the Recent Assisted Reproductive Techniques • Develop critical understanding how a single-celled fertilized egg becomes an embryo and then a fully formed adult by going through three important processes of cell division, cell differentiation and morphogenesis. • Understand the general patterns and sequential developmental stages during embryogenesis and understand how the developmental processes lead to establishment of body plan of multicellular organisms. • Understand evolution through natural selection, and other forces.	
6	Credit Value	Theory : 4	
7	Total Marks: 50	Max. Marks: 50	Min Passing Marks : 17

Part B : Content of Course		
Total No. of Periods : 60		
Unit	**Topics**	**No. of Period**
I	**Concept of Genes and The recombination and interaction of Genes :** Elements of heredity and variation - Classical and Modern concept of Gene (Cistron, muton, recon), Alleles. Mendel's laws of inheritance - Incomplete dominance, Codominance, Multiple alleles. Interaction of Genes - Lethal alleles, Pleiotropy, Epistasis, Supplementary Gene, Complementary genes, Polygenic inheritance. Linkage and crossing over, Linkage Map. Extra chromosomal and Maternal Inheritance. Sex Chromosomes and sex-linkage. Sex Determination	12
II	**Regulation of Gene expression & Human Population Genetics :** Gene Expressions and regulation - One gene-one enzyme hypothesis /one polypeptide hypothesis. Concept of Operon - Concept of Operon of bacteria and bacteriophages. Bacterial transposons. Transformation, transfection and transduction. Utility of the model organisms - *Escherichia coli*, & *Drosophila melanogaster*.Structural and numerical alterations of chromosomes - meiotic consequences in structural heterozygotes. Genetic disorders - Chromosomal Aneuploidy, Chromosome Translocation and Deletion, Single gene Disorders, Epigenetics, Pedigree analysis. Genetic counselling.	12

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III	**Developmental Biology :** Gametogenesis, Structure of Gametes and Types of Eggs. Fertilization - external and internal. Structural and biochemical changes in gametes during and after fertilization block to polyspermy, causes of Infertility. Establishment of the major embryonic axis, polarity. Cleavage - Types and patterns. Body plan and symmetries. Development of frog and Chick up to formation of three germ layers. Tubulation. Morphogenesis, Fate maps. Organogenesis - formation of gut, heart, kidney and muscles. Inhibition, induction, and recruitment. Concept of competence, determination and differentiation and growth. Pleuropotency.	12
IV	**Biology of development and Recent Techniques :** Parthenogenesis. Regeneration - epimorphosis, morphollaxis and compensatory regeneration. Extra embryonic membranes. Amniocentesis. Placenta - Types structure and functions. Recent Assisted Reproductive Techniques (ART) – Stem cell (Types and their uses), Gene bank, Sperm Bank. Superovulation, Cryopreservation, Invitro fertilization (IVF), Embryo transfer (ET).	12
V	**Evolution :** Origin of Life on Earth, Early life on Earth - Indirect evidences & direct evidence of early life. Evidences of Organic evolution. Theories of Organic evolution. Sources of variation - Mutation, recombination, Isolation, Genetic drift, Neutral and Artificial evolution. Evolution of Human.	12

Keywords: Genetics, Mendel's law, Interaction of Gene, Sex Linkage, Sex Determination, Gametogenesis, Fertilization, Cleavage, Embryology, Regeneration, Parthenogenesis, Extra embryonic membrane, Placenta, Evolution,

Part C - **Learning Resource**

Text Books, Reference Books, Other Resources

Suggested Readings:

Text Books:

1. Gardner, E.J. *et al.* (2006) Principles of Genetics (John Wiley).
2. Russell, P.J. (2010) Genetics (Benjamin Cumm ings).
3. Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). Principles of Genetics. (VIII edition) Wiley India.
4. Snustad, D.P. and Simmons, M.J. (2009). Principles of Genetics. (V edition) John Wiley and Sons Inc.
5. Klug, W.S., Cummings, M.R. and Spencer, C.A. (2012). Concepts of Genetics. (X edition) Benjamin Cummings.
6. Carroll S.B.; Doebley J.; Griffiths, A.J.F. and Wessler, S.R. (2018) An Introduction to Genetic Analysis. W. H. Freeman and Co. Ltd.
7. Gerhart, J. et al. (1997) Cells, Embryos and Evolution. Blackwell Science
8. Gilbert, S.F. (2010) Developmental Biology (9th edition).
9. Sinauer Wolpert, L. (2007) Principles of Developmental Biology (3rd edition). Oxford University Press.
10. Campbell, N. and Reece, J. (2014) Biology (10th edition). Benjamin Cummings
11. Ridley, M. (2004). Evolution. III Edition. Blackwell Publishing.
12. Barton, N. H., Briggs, D. E. G., Eisen, J. A., Goldstein, D. B. and Patel, N. H. (2007). Evolution. Cold Spring, Harbour Laboratory Press.
13. Hall, B. K. and Hallgrimsson, B. (2008). Evolution. IV Edition. Jones and Bartlett

Online Resources –

1. National digital Library.-

http://ndl.iitkgp.ac.in/document/Rm5qb3lqRngwWDZ2Tnl6UXl4VU9YR201R0cwYXJHV25HSHFacGxtS1h3REZGd1ByL28xcmlleEFFZU5najlCZ1lHdXBBTzBleTBVRGlDSFhkMEtuUkE9PQ

2. E-PG Pathshala.
   https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=2rAs1Puvga4LW93zMe83aA
3. eGyankosh- Genetics and Evolutionary Biology
4. eGyanKosh: BZYCT-137 Genetics and Evolutionary Biology

Part D: Assessment and Evaluation

University Exam(UE): Maximum Marks: 50 Marks

Part A:Introduction				
Program: Certificate Course		Class: B.Sc. II Year	Year: 2024	Session: 2024-25
1	Course Code	ZOOL- 4T		
2	Course Title	Biochemistry and Molecular Biology		
3	Course Type	Theory		
4	Pre-requisite (if any)	No		
5	Course Learning Outcomes (CLO)	At the end of this course, the students will be able • Understand the structure and biological significance of carbohydrates, amino acids, proteins, lipids and nucleic acids. • Understand the concept of enzyme, its mechanism of action and regulation. • Learn the preparation of models of peptides and nucleotides. • Learn biochemical tests for amino acids, carbohydrates, proteins and nucleic acids. • Develop an understanding of concepts, mechanisms and evolutionary significance and relevance of molecular biology in the current scenario. • Understand the process of DNA replication, transcription and translation.		
6	Credit Value	4		
7	Total Marks	Max. Marks: 50	Min Passing Marks: 17	

Part B: Content of the Course

Total No. of Periods: 60

Unit	Topics	No. of Peroid
I	**Biomolecules:** Amino Acids, Peptides, and Proteins- structure of amino acids, peptide bond, Primary, secondary, tertiary and quaternary structure of proteins and their biological functions. Carbohydrates- Biological roles of carbohydrates, Structure of monosacharides- Hexoses and pentoses. Disacharides-Sucrose, lactose, maltose. Storage and structural polysaccharides-Glycogen, starch and cellulose. Lipids- Role of lipids in cellular architecture and functions. Definition and classification of lipids. Structure and function of fatty acids, triacylglycerols, phospholipids and sterols. Nucleic Acids- Role of nucleic acids in living system. Composition of nucleic acids-the purine and pyrimidine bases.	12
II	**Enzymes and Metabolic Pathways:** Enzyme - Nomenclature and classification, general properties, specificity, cofactors, isozymes and mechanism of enzyme action. Protein metabolism-Transamination and deamination, Urea cycle. Carbohydrate metabolism-Glycolysis, gluconeogenesis, Cori-cycle, TCA cycle, HMP shunt, glycogenolysis & glycogenesis (Glycogen synthesis) . Lipid Metabolism-Mobilization of triglycerides, metabolism of glycerol, β-oxidation of fatty acids, Ketogenesis and significance.	12

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III	**Structure of chromosomes, Nucleic acids and DNA replication:** Structure of nucleic acids- Structure of DNA, forms of DNA, supercoiling of DNA, Nucleosomes, Histones, Structure of chromatin, chromosomes, packaging of DNA in the nucleus. Structure of RNA- Ribosomal RNA (rRNA), Transfer RNA (tRNA), Messenger RNA (mRNA), Noncoding RNA. DNA replication- Chemistry of DNA replication, enzymes involved, Unit of replication, replication origin and replication fork, accuracy during flow of genetic information, proof reading activity; Comparison of replication in prokaryotes and eukaryotes.	12
IV	**Central dogma, RNA transcription, RNA processing:** Central Dogma of Molecular Biology. Trancription (RNA Synthesis) - DNA-dependent RNA polymerases, sigma factor, bacterial promoters, the three stages of RNA synthesis- initiation, elongation and termination, rho dependent and rho-independent termination. Transcription in eukaryotes. RNA processing-splicing of hnRNA into mRNA, 5'-capping and 3'-polyadenylation of mRNA, differential RNA Processing, rRNA and tRNA modifications and processing.	12
V	**Ribosomes and Translation (Protein Synthesis):** Structure and types of Ribosome. Genetic Code- triplet codons, Wobble base, synonymous codons, degeneracy of codons, missense-, nonsense- and frame shift mutations. Translation- protein synthesis in *Prokaryote and its comparison with* eukaryote., Aminoacylation of tRNA, initiation, elongation, peptide bond formation, translocation, termination, recycling of ribosome. Regulation of protein synthesis and codon bias - Post-translational modifications and processing of proteins.	12

Keywords: Biomolecules, biochemical pathways, Metabolism, Central dogma, Nucleic acids, chromosome, DNA replication, RNA Synthesis (Transcription), Protein Synthesis (Translation), Genetic code.

Part C - **Learning Resource**

Text Books, Reference Books, Other Resources

Suggested Readings:

Text Books:

1. Lehninger: Principles of Biochemistry (2013) 6th ed., Nelson, D.L. and Cox, M.M., W.H. Freeman & Company (New York), ISBN: 13: 978-1-4292-3414-6 / ISBN:10-14641-0962-1.
2. Berg, J.M.; Tymoczko, J.L. and Stryer, L. (2012) Biochemistry (7th edition) Freeman.
3. Conn, E.E.; Stumpf, P.K.; Bruening, G. and Doi, R.H. (2006) Principles of Biochemistry (5th edition) Wiley.
4. Stryer, Lubert (1981) Biochemistry, 2nd Edition. W. H. Freeman and Company, New York.
5. Watson, J.D. *et al.* (2013) Molecular Biology of the Gene (7th edition) CSHL Press Pearson.
6. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition, John Wiley & Sons, Inc.
7. Walter, P. (2007) Molecular Biology of the Cell (5th edition) Garland Science.
8. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, and Peter Walter(2002) Molecular Biology of the Cell, 4th edition. New York: Garland Science.
9. Harvey Lodish, Arnold Berk, Paul Matsudaira, Chris A. Kaiser, Monty Krieger,

Freeman(2003) Molecular Cell Biology. 5th edition. W. H. & Company.

Online resources (Try to include similar course available on SWAYAM/NPTEL/CEC etc.)

https://onlinecourses.nptel.ac.in/noc20_cy10/preview

https://www.classcentral.com/course/swayam-biochemistry-iitm-22920

https://onlinecourses.swayam2.ac.in/cec20_ma13/preview

https://www.classcentral.com/course/swayam-molecular-biology-19952

Part D: Assessment and Evaluation

University Exam (UE) : Maximum Marks: 50

Part A: Introduction				
Program: **Certificate Course**		Class: **B.Sc. II Year**	Year: 2024	Session: 2024-25
1	Course Code	ZOOL-2P		
2	Course Title	Lab Course - 2		
3	Course Type	Practical		
4	Pre-requisite (if any)	No		
5	Course Learning Outcomes (CLO)	After completion of practical work the outcome will be : • Able to understand and explain Mendel's Law of Inheritance • Capable to analyze inheritance of gene by pedigree analysis. • Able to know laboratory culture of Drosophila. • Able to understand cytological, histological and osteological configuration for animal life. • Capable to understand Human keryotype and Numerical alteration in chromosomes • Capable to explain Evolution and evidences • Capable of performing tests for identification of biological macromolecules • Able to estimate nucleic acids and Isolation of DNA		
6	Credit Value	2		
7	Total Marks	Max. Marks: 50	Min Passing Marks : 17	

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Part B

Total No. of Lecturer (one hour per week)

Total Periods: 30

	Contents	No. of period
	Tentative list of practical/exercise: 1. Application of probability in the law of segregation with coin tossing. 2. Study of mode of inheritance of the following traits by pedigree charts – attached ear lobe, widow's peak. 3. Familiarization with techniques of handling *Drosophila*, identifying males and females; observing wild type and mutant (white eye, wing less) flies, and setting up cultures. 4. Study of human karyotypes and numerical alterations (Down syndrome, Klinefelter syndrome and Turner syndrome). 5. Types of eggs based on quantity and distribution of yolk: sea urchin, insect, frog, Chick. 6. Comparative study of cleavage patterns in Frog and Amphioxus models. 7. How do cells move, change shape and size during morphogenetic movement of Blastulation, Gastrulation in Frog, Amphioxus, Chick 8. Study of development of chick embryo through incubated chick eggs up to 96 h. 9. Extra embryonic membranes of chick through permanent slides. 10. Some videos to develop understanding on the process of development. 11. Study of adaptive radiations in feet of birds and mouth parts of insects. 12. Understanding embryological evidence of evolution (through charts and videos). 13. Study of types of fossils. 14. Analogy and homology (wings of birds and insects, forelimbs of bat and rabbit). 15. Preparation of models of amino acids and dipeptides. 16. Ninhydrin test for α-amino acids. 17. Determination of pK and pI values of glycine. 18. Benedict's test for reducing sugars. 19. Iodine test for starch. 20. Determination of acid value of oil 21. Preparation of ball and stick model for B-DNA molecule (A=T and G=C base pairs). 22. Estimation of DNA by DPA method. 23. Estimation of RNA by Orcinol method. 24. Isolation of genomic DNA by ethanol precipitation method.	30

Keywords: Genetics, Mendel's law, Interaction of Gene, Embryology, Regeneration, Evolution.

Part C - **Learning Resource**

Text Books, Reference Books, Other Resources

Suggested Readings:

Text Books:

1. Practical Hand Book of Genetics: Vikas Pali Kalyani Publication
3. Essential Practical Handbook of Cell Biology & Genetics, Biometry & Microbiology, A Laboratory Manual Debarati Das, Academic Publishers.
4. Cytogenetics:Mohan P Arora, Himalayan Publishing House
5. Modern Experimental Biochemistry by Rodney F. Boyer
6. Molecular Cloning: A Laboratory Manual by Joe Sambrook
7. Practical Manual for Biochemistry : By GG Kaushik, CBS Publication

E-Resources:

1. https://onlinecourses.nptel.ac.in/noc22_cy32/preview
2. https://www.classcentral.com/course/swayam-experimental-biochemistry-12909
3. https://jru.edu.in/studentcorner/lab-manual/bpharm/Lab%20Manual%20-%20Biochemistry.pdf
4. Fundamentals of Genetics.pdf (jru.edu.in)

Part D: Assessment and Evaluation

Practical Exam(UE): Maximum Marks: 50 Marks

Scheme of B.Sc. Mathematics

Year	Course Code	Subject Name	Theory/ Practical	Total Credit	Total Marks	
					Max	Min
Second year	MATH-3T	Differential Equations	Theory	4	50	17
	MATH-4T	Real Analysis	Theory	4	50	17
	MATH-2P **(Any One)**	Lab 2 : Differential Equations and Real Analysis	Practical	2	50	17
		Project 2 : History of Mathematicians	Project	2	50	17

Part A: Introduction				
Program: Diploma Course		Class: B. A / B.Sc. Part II	Year: 2024	Session: 2024-25
1	Course Code	Paper – MATH-3T		
2	Course Title	Differential Equations		
3	Course Type	Theory		
4	Pre-requisite (if any)	No		
5	Course Learning Outcome (CLO)	**This Course will enable the students to:** • Understand the genesis of ordinary as well as partial differential equations. • Learn various techniques of getting exact solutions of certain solvable first order differential equations and linear differential equations of second order. • Know Picard's method of obtaining successive approximations of solutions of first order ordinary differential equations, passing through a given point in the plane. • Learn about solution of first order linear partial differential equations using Lagrange's method. • Know how to solve second order linear partial differential equations with constant coefficients. • Formulate mathematical models in the form of ordinary and partial differential equations to problems arising in physical, chemical and biological disciplines.		
6	Credit Value	4		
7	Total Marks	Maximum Marks : 50	Minimum Passing Marks :	

Part B: Content of the Course Total Periods: 60		
Unit	Topics	No. of Periods
I	**First Order Differential Equations:** Basic concepts and genesis of ordinary differential equations, Order and degree of a differential equation, Differential equations of first order and first degree, Equations in which variables are separable, Homogeneous equations, Linear differential equations and equations reducible to linear form, Exact differential equations, Integrating factor, First order higher degree equations solvable for x, y and p, Clairaut's form and singular solutions; Picard's	12

	method of successive approximations and the statement of Picard's theorem for the existence and uniqueness of the solutions of the first order differential equations.	
II	**Second Order Linear Differential Equations:** Statement of existence and uniqueness theorem for the solution of linear differential equations, General theory of linear differential equations of second order with variable coefficients, Solutions of homogeneous linear ordinary differential equations of second order with constant coefficients, Method of variation of parameters and method of undetermined coefficients, Reduction of order, Euler-Cauchy equations, Coupled linear differential equations with constant coefficients.	12
III	**First Order Partial Differential Equations:** Genesis of Partial differential equations (PDE), Concept of linear and non-linear PDEs, Methods of solution of Simultaneous differential equations of the form: $dx/P(x,y,z) = dy/Q(x,y,z) = dz/R(x,y,z)$, Lagrange's method for PDEs of the form: $P(x,y,z)p+Q(x,y,z)q=R(x,y,z)$, where $p=\partial z/\partial x$ and $q=\partial z/\partial y$; Solutions passing through a given curve.	12
IV	**Second order Partial differential equations:** Principle of superposition for homogeneous linear PDEs, Relation between solution sets of non-homogeneous linear PDEs and their corresponding homogeneous equations, Reducible and irreducible homogeneous equations and their solutions in various possible cases, Solution of non-homogeneous reducible equations using Lagrange's method for first order equations.	12
V	**Applications:** Orthogonal trajectories of one-parameter families of curves in a plane, Minimum velocity of escape from Earth's gravitational field, Newton's law of cooling, Malthusian and logistic population models, Radioactive decay, Free and forced mechanical oscillations of a spring suspended vertically carrying a mass at its lowest tip, Phenomena of resonance, LCR circuits, Surfaces orthogonal to a given system of surfaces.	12

Part C - Learning Resource

Text Books and Reference Books:

1. Erwin Kreyszig . *Advanced Engineering Mathematics* (10th edition). J. Wiley &Sons 2011
2. B. Rai & D. P. Choudhury. *Ordinary Differential Equations - An Introduction*.Narosa Publishing House Pvt. Ltd. New Delhi. 2006
3. Shepley L. Ross. *Differential Equations* (3rd edition). Wiley. 2007
4. George F. Simmons. *Differential Equations with Applications and HistoricalNotes* (3rd edition). CRC Press. Taylor & Francis. 2017

5. Ian N. Sneddon. *Elements of Partial Differential Equations*. Dover Publications. 2006

E-Resources:

1. Suggested Equivalent **online courses:** Web link NPTEL/ SWAYAM/ MOOCs
2. Differential equation
   https://www.youtube.com/watch?v=NBeGLLU90fM&list=PLbMVogVj5nJSGlf9sluucwobyr_zz6gllD
3. Partial Differential equation
   https://www.youtube.com/watch?v=Kk5SEzASkZU&list=PL9m2Lkh6odgKbfY03TFRhwjOqW79UdzK8

Part D: Assessment and Evaluation	
Suggested Continuous Evaluation Methods:	
Maximum Marks:	50 Marks

Part A: Introduction				
Program: Diploma Course		Class: B. A. / B.Sc. Part II	Year: 2024	Session: 2024-25
1	Course Code	Paper – MATH-4T		
2	Course Title	Real Analysis		
3	Course Type	Theory		
4	Pre-requisite (if any)	No		
5	Course Learning Outcome (CLO)	**This Course will enable the students to:** • Understand basic properties of real number system such as least upper bound propertyand order property. • Realize importance of bounded, convergent, Cauchy and monotonic sequences of real l numbers, find their limit superior and limit inferior. • Apply various tests to determine convergence and absolute convergence of a series of real numbers. • Learn about Riemann integrability of bounded functions and algebra of R- integrable functions. • Determine various applications of the fundamental theorem of integral calculus. • Relate concepts of uniform continuity, differentiation, integration and uniformconvergence.		
6	Credit Value	4		
7	Total Marks	Maximum Marks : 50	Minimum Passing Marks :	

Part B: Content of the Course Total Periods: 60		
Unit	Topics	No. of Periods
I	**Real Numbers:** The set of real numbers $\mathbb{R}$ as an ordered field, Least upper bound properties of $\mathbb{R}$, Metric property and completeness of $\mathbb{R}$, Archimedean property of $\mathbb{R}$, Dense subsets of $\mathbb{R}$, Nested intervals property; Neighbourhood of a point in $\mathbb{R}$, Open sets, limit point of a set, closed and perfect sets in $\mathbb{R}$, connected and compact subsets of $\mathbb{R}$, Heine-Borel theorem.	12
II	**Convergence of Sequences in $\mathbb{R}$:** Bounded and monotonic sequences, Convergent sequence and its limit, Limit theorems, Monotone convergence	12

	theorem, Subsequences, Bolzano-Weierstrass theorem, Limit superior and limit inferior, Cauchy sequence, Cauchy's convergence criterion.	
III	**Infinite Series:** Convergence of a series of positive real numbers, Necessary condition for convergence, Cauchy criterion for convergence; Tests for convergence: Comparison test, Limit comparison test, D'Alembert's ratio test, Cauchy's n^{th} root test, Abel's test, Integral test; Alternating series, Absolute and conditional convergence, Leibniz theorem, Rearrangements of series, Riemann's rearrangement theorem.	12
IV	**Riemann Integration:** Riemann integrability of bounded functions, Examples of R-integrable and non-integrable functions, Algebra of Riemann integrable functions, Integrability of continuous and monotonic functions, Darboux theorems, Fundamental theorem of integral calculus, First mean value theorem and second mean value theorems (Bonnet and Weierstrass forms). Necessary and sufficient condition for Riemann integrable function (Statement only).	12
V	**Uniform Convergence, Continuity and Improper Integrals:** Pointwise and uniform convergence of sequence and series of functions, Uniform continuity, Weierstrass's M-test, Uniform convergence and continuity, Uniform convergence and differentiability, Improper integrals and tests for improper integrals, Beta and Gamma functions.	12

Part C - Learning Resource

Text Books, Reference Books:

1. T. M. Apostol. *Mathematical Analysis: A Modern Approach to AdvancedCalculus*. Pearson Education. 2008
2. Charalambos D. Aliprantis &) Owen Burkinshaw. *Principles of Real Analysis* (3rd edition). Academic Press. 1998
3. Robert G. Bartle & Donald R. Sherbert. *Introduction to Real Analysis* (4^{th}edition). Wiley India. 2015
4. Gerald G. Bilodeau, Paul R. Thie & G. E. Keough. *An Introduction to Analysis* (2nd edition). Jones and Bartlett India Pvt. Ltd. 2015
5. E. Hewitt & K. Stromberg (2013). *Real and Abstract Analysis*. Springer-Verlag.
6. K. A. Ross. *Elementary Analysis: The Theory of Calculus* (2nd edition). Springer. 2013

7 Walter Rudin. *Principles of Mathematical Analysis* (3rd edition). Tata McGraw Hill.

E-Resources:

1. Suggested Equivalent **online courses:** Web link NPTEL/ SWAYAM/ MOOCs
2. https://www.youtube.com/watch?v=Bef8QjljCy0&list=PLbMVogVj5nJQ1UXrOm7KqTg9UKk6eXRp_
3. https://www.youtube.com/watch?v=C2qIoHkhEuM&list=PLOzRYVm0a65cpVtcdj_5SBEh6VQvC_BvR

Part D: Assessment and Evaluation	
Suggested Continuous Evaluation Methods:	
Maximum Marks:	50 Marks

Part A: Introduction				
Program: **Diploma Course**		Class: **B.A/ B.Sc. II Year**	Year: 2024	Session: 2024-25
1	Course Code	**MATH-2P (I)**		
2	Course Title	I - Lab 02 - Differential Equations and Real Analysis		
3	Course Type	**Practical**		
4	Pre-requisite (if any)	No		
5	Course Learning Outcomes (CLO)	This course will enable the students to • Learn Free and Open Source Software (FOSS) tools for computer programming • Solve problem on differential equations and real analysis theory studied in Mathematics Paper 1 and 2 by using FOSS software's. • Acquire knowledge of applications of Differential Equations and Real Analysisthrough FOSS.		
6	**Credit Value**	**2**		
7	**Total Marks**	**Max. Marks: 50**	**Min Passing Marks : 17**	

Part B: Content of the Course	
Total Periods: 30	
Tentative Practical List	Mathematics practical with Free and Open Source Software (FOSS) tools for computer programs, such as GeoGebra/Maxima/Scilab/ Octave /Python/R. **Course Objectives:** • To learn Free and Open Source Software (FOSS) tool for computerprogramming • Acquire knowledge of applications of differential equations and real analysisthrough FOSS **List of Practicals**: (At least 10 practicals) • Solution of differential equation and plotting the graph of the solution: Variable separable. • Solution of differential equation and plotting the graph of the solution:Homogeneous equations. • Solution of differential equation and plotting the graph of the solution:Linear differential equations.

- Solution of differential equation and plotting the solution: Bernoulli`sequations
- Solution of second and higher order ordinary differential equations withconstant coefficients
- Solution of second order ordinary differential equations with variable coefficients by i) Method of variation of parameters ii) When the equationis exact.
- Finding complementary function and particular integral of constantcoefficient second and higher order ordinary differential equations.
- Solving second order linear partial differential equations in two variableswith constant coefficient.
- Solutions to the problems on total and simultaneous differential equations.
- Solutions to the problems on different types of Partial differentialequations.
- Illustration of convergent, divergent and oscillatory sequences.
- Using Cauchy's criterion to determine convergence of a sequence(simple examples).
- Illustration of convergent, divergent and oscillatory series.
- Programs to find the sum of the series and its radius of convergence.
- Using Cauchy's criterion on the sequence of partial sums of the series todetermine convergence of series.
- Testing the convergence of binomial, exponential and logarithmic seriesand finding the sum.
- To verify the given function is Riemann integrable or not over arbitraryclosed interval [a, b].

Part C - Learning Resource		
Text Books, Reference Books, Other Resources		
SUPPORT FROM THE GOVT FOR STUDENTS AND TEACHERS IN UNDERSTANDING AND LEARNING FOSS TOOLS: As a national level initiative towards learning FOSS tools, IIT Bombay for MHRD, government of India is giving free training to teachers interested in learning open source software's like scilab, maxima, octave, geogebra and others. (Website: http://spoken-tutorial.org:) (email: info@spokentutorial.org; contact@spoken-tutorial.org)		
Part D: **Assessment and Evaluation**		
Suggested Continuous Evaluation Methods: Maximum Marks: 50 Continuous Comprehensive Evaluation (CCE): Not Applicable University Exam(UE): 50 Marks		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test/Assignment/Presentation	Not Applicable

Part A: Introduction				
Program: **Diploma Course**		Class: **B.A./ B.Sc. II Year**	Year: ~~2024~~	Session: ~~2024-2025~~
1	Course Code	**MATH-2P (II)**		
2	Course Title	II - Project 02 - History of Mathematician		
3	Course Type	**Project**		
4	Pre-requisite (if any)	No		
5	Course Learning Outcomes (CLO)	Studying history of mathematicians help students: • Develop a deeper understanding of the mathematics they hare already studied by seeing how it was developed over time and in various places. • Know the rich intellectual heritage of the country. • Develop an appreciation of mathematics and build positive attitude towards mathematics increasing student's motivation decreasing anxiety related the subject. • To acquire knowledge about development of mathematics in ancient , medieval and modern period of history.		
6	**Credit Value**	2		
7	**Total Marks**	**Max. Marks: 50**	**Min Passing Marks : 17**	

Part B: Content of the Course	
Total Periods: 30	
Project List	**Course Objectives:** An elective course designed to acquire special / advance knowledge, such as supplement study / support study to a project work and a candidate study such a course on his own with an advisory support by a teacher / faculty member. **Project** Contributions and biographies of Indian Mathematicians Aryabhatta , Varahmihir , and Bhaskar I ,Shreedharacharya , Shreepati and Parmeshwar and contribution involved in contents of the paper of Differential Equations and Real Analysis. (Any 10 Mathematicians)

Part C - Learning Resource		
Text Books, Reference Books, Other Resources		
Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: 50 Continuous Comprehensive Evaluation (CCE): Not Applicable University Exam(UE): 50 Marks		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test/Assignment/Presentation	Not Applicable

Scheme of B.Sc./B.Sc.(Hons) Microbiology

Year	Course Code	Subject Name	Theory/ Practical	Total Credit	Total Marks	
					Max	Min
Second year	MICRO -3T	Cell Biology,Biochemistry and Bioinstrumentation	Theory	4	50	17
	MICRO -4T	Microbial Genetics,Molecular Biology & Genetic Engineering	Theory	4	50	17
	MICRO -2P	Lab 2 : Bacterial cell Biochemistry & Molecular Biology	Practical	2	50	17

Part - A: Introduction

Program: *Diploma Course*	Class: **B. Sc. Part - II**	Year 2024	Session: 2024-25

1	Course Code	**MICRO -3T**
2	Course Title	**Cell biology, Biochemistry and Bioinstrumentation**
3	Course Type	**Core course**
4	Pre-requisite (if any)	As per Government norms
5	Course Learning Outcomes (CLO)	At the end of this course, the students will be able to -- • *- clarify the basic concept of feature, types, function and importance of living cell as a structural & functional unit of living body* • *- get acquaintance of the knowledge about biochemical reactions and cellular mechanism to provide bio energy for living activities* • *- know about basic principle, procedure and application of various instruments and techniques to explore the biological system* • *- exercise the various experiments and perform fundamental biological techniques operating the concern instruments*
6	Credit Value	**04**
7	Total Marks	Max. Marks: **50** / Min Passing Marks: **17**

PART B: Content of the Course

Total No. of Teaching Hours – 40 / Periods - 60

Unit	Topics (Course contents)	No. of Periods
I	**Structure and organization of Cell** Cell Organization –Plant and animal cells: Plasma membrane: Structure and functions, Cell Wall: Eukaryotic cell wall. Cell-Cell Interactions - adhesion junctions, tight junctions, gap junctions, and plasmodesmata (only structural aspects). Mitochondria, endoplasmic reticulum, Golgibody, Ribosomes, Lysosomes, Chloroplasts and Peroxisomes.	12 08
II	**Biomolecules - Structure, classification, function and properties** Carbohydrates Monosaccharide, Oligosaccharides (Disaccharides) and Polysaccharides. Protein - Amino acids, peptides and Proteins structural organisation. Lipids Saturated and unsaturated.	12 08
III	**Metabolism** Glycolysis, TCA cycleand Oxidative Phosphorylation. Anaerobic catabolism of glucose; Fat Biosynthesis,alpha and beta oxidation of fatty acids, Decarboxylation, Deamination, trasns-amination and Urea cycle.	12 08

IV	**Bioinstrumentation - I: Principle, Instrumentation and applications** pH Meter, Microscopy (Light compound, Phase-contrast microscope & Electron microscope), Colorimeter, Spectrophotometer, Turbidometer, Centrifuge - differential & density gradient centrifugation techniques	12 / 08
V	**Bioinstrumentation –II: Principle, Instrumentation and applications** Electrophoresis - types, Gel electrophoresis, Chromatography - Paper Chromatography, Thin Layer Chromatography, Column Chromatography Ion Exchange Chromatography, High Pressure Liquid Chromatography and Gas Chromatography	12 / 08
Keywords	***cell biology, bio-molecules, metabolism, bioinstrumentation***	

PART - C

Learning Resources: Text Books, Reference Books and Others

Suggested **Readings:**

Text Books Recommended -

1. Watson JD, Baker TA, Bell SP, Gann A, Levine M and Losick R (2008) Molecular Biology of the
2. De Robertis EDP and De Robertis EMF (2006) Cell and Molecular Biology, 8th edition. Lippincott
3. Williams and Wilkins, Philadelphia
4. Karp G (2010) Cell and Molecular Biology: Concepts and Experiments, 6th edition, John Wiley & Sons, Inc
5. Sambrook J and Russell DW. (2001). Molecular Cloning: A Laboratory Manual. 4th Edition. ColdSpring Harbor Laboratory press.
6. Krebs J, Goldstein E, Kilpatrick S (2013). Lewin's Essential Genes, 3rd Ed., Jones and Bartlett Learning
7. Wiley JM, Sherwood LM and Woolverton CJ. (2008). Prescott, Harley and Klein's Microbiology. McGraw Hill Higher Education
8. Wilson K and Walker J. (2010). Principles and Techniques of Biochemistry and Molecular Biology, 7th Ed., Cambridge University Press.
9. Nelson DL and Cox MM. (2008). Lehninger Principles of Biochemistry, 5th Ed., W. H. Freeman and Company

Online Resources –

- **e-Resources / e-books and e-learning portals**
- **Use of following sites**
  1. https://nptel.ac.in/courses/102103015
  2. https://onlinecourses.swayam2.ac.in/cec19_bt11/preview
  3. https://www.britannica.com

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks:	50 Marks	
Continuous Comprehensive Evaluation (CCE):	NA	
Annual /University Exam(UE):	50 Marks	
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test/Assignment /Field work	NA

Part - A: Introduction

Program: *Diploma Course* | Class: **B. Sc. Part - II** | Year: 2024 Session: 2024-25

1	Course Code	**MICRO - 4T**
2	Course Title	**Microbial Genetics, Molecular Biology & Genetic Engineering**
3	Course Type	**Core course**
4	Pre-requisite (if, any)	As per Government norms
5	Course Learning Outcomes (**CLO**)	At the end of this course, the students will be able to -- • - ***clarify the basic concept of Genetics, Microbial genetics, mode of recombination microbes as basis of sexuality in living beings*** • - ***get acquaintance of the knowledge about the Gene expression & regulation with concept of central dogma of Molecular biology*** • - ***know about basic principle, procedure and application of Recombinant DNA Technology***
6	Credit Value	**04**
7	Total Marks	Max. Marks: **50** — Min Passing Marks: **17**

PART B: Content of the Course

Total No. of Teaching Hours – 40 / Periods - 60

Unit	Topics (Course contents)	Periods
I	**Microbial Genetics:** Mechanisms of Genetic Exchange Transformation, Conjugation and Transduction. Types of plasmids – F plasmid, R Plasmids, colicinogenic plasmids, Ti plasmids, linear plasmids. Plasmid replication and partitioning. Prokaryotic transposable elements – Insertion Sequences, Replicative and Non replicative transposition, composite and non-composite transposons. Mutations and mutagenesis.	12 / 08
II	**Genetic material:** Miescher to Watson and Crick- historic perspective, DNA structure. Types of DNA. Organization of DNA Prokaryotes, Viruses, and Eukaryotes. RNA Structure, Organelle DNA-mitochondria and chloroplast DNA. Replication of DNA (Prokaryotes). DNA Repair system and its types.	12 / 08
III	**Fundamentals of Molecular genetics:** Central dogma of Molecular biology. Transcription, Translation in Prokaryotes, Post Translational Processing. Regulation of gene Expression in Prokaryotes. Principles of transcriptional regulation, regulation at initiation with examples from lac- and trp- operons.	12 / 08

IV	**Introduction to Genetic Engineering:** Molecular Cloning- Tools; Restriction modification systems: Types I, II and III. Mode of action, nomenclature, DNA modifying enzymes and their applications. Cloning Vectors: Definition and Properties Plasmid vectors: pBR and pUC series. Bacteriophage lambda and M13 based vectors. Cosmids, BACs, YACs. Expression vectors: E.coli lac and T7 promoter-based vectors, SV40-based expression vectors.	12 / 08
V	**Molecular Cloning and Transformation:** Methods in Molecular Cloning and Transformation of DNA: Chemical method, Electroporation, Gene delivery: Microinjection, electroporation, DNA, RNA and Protein analysis: Agarose gel electrophoresis, Southern - and Northern - blotting techniques, dot blot, DNA microarray analysis, SDS-PAGE and Western blotting. Applications of Recombinant DNA Technology	12 / 08
Keywords	***Genetics, Microbial genetics, Nucleic acid, Central dogma, Gene, Gene expression***	

PART - C

Learning Resources: Text Books, Reference Books and Others

Suggested **Readings:**

Text Books Recommended -

1. Genetics by P. K. Gupta, Rastogi Publication, New Delhi
2. Watson JD, Baker TA, Bell SP, Gann A, Levine M and Losick R (2008) Molecular Biology
3. De Robertis EDP and De Robertis EMF (2006) Cell and Molecular Biology, 8th edition. Lippincott
4. Karp G (2010) Cell and Molecular Biology: Concepts and Experiments, 6th edition, John Wiley & Sons
5. Sambrook J and Russell DW. (2001). Molecular Cloning: A Laboratory Manual. 4th Edition. Cold Spring Harbour Laboratory press.
6. Wiley JM, Sherwood LM and Woolverton CJ. (2008). Prescott, Harley and Klein's Microbiology McGraw Hill Higher Education
7. Wilson K and Walker J. (2010). Principles and Techniques of Biochemistry and Molecular Biology. 7th Ed., Cambridge University Press.
8. Nelson DL and Cox MM. (2008). Lehninger Principles of Biochemistry, 5th Ed., W.H. Freeman and Company.

Online Resources –

- **e-Resources / e-books and e-learning portals**
- **Use of following sites**
  1. https://nptel.ac.in/courses/102103015
  2. https://onlinecourses.swayam2.ac.in/cec19_bt11/preview
  3. https://www.britannica.com

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: Continuous Comprehensive Evaluation (CCE): Annual /University Exam(UE):		50 Marks NA 50 Marks
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test/Assignment /Field work	NA

Part A: Introduction

Program: *Diploma Course* | Class: B. Sc. Part - II | Year: 2024 Session: 2024-25

1	Course Code	MICRO - 2P
2	Course Title	**Bacterial cell, Biochemistry & Molecular Biology**
3	Course Type	Laboratory course
4	Pre-requisite (if any)	As per Govt. norms
5	Course Learning Outcomes (CLO)	At the end of this course, the students will be able to • - ***understand the microscopy, cytometry and relevant biochemical techniques*** • - ***handle the instruments / equipments applied for biochemical & molecular experiments*** • - ***perform the exercise /experiments of molecular biology***
6	Credit Value	02
7	Total Marks	Max. Marks: **50** | Min Passing Marks: 17

PART B: Content of the Course

Total No. of Teaching Hours - 20 / Periods -30

L. C.	Topics (Course contents)	No. of Periods
A	1. Study of cell morphology – Prokaryotic & Eukaryotic cell 2. Study of cell division stages using Onion root tip. 3. Determination of antibiotic resistance by plating method. 4. Assaying of microbial enzymes; Catalase, Amylase 5. Separation of mixtures by paper / thin layer chromatography. 6. Demonstration of column packing in any form of column chromatography. 7. Separation of protein mixtures by any form of chromatography. 8. Determination of pH of various water and soil sample. 9. Testing of Lambert beer's law. 9. Production of any metabolite using batch fermentation.	15 / 10
B	1. Isolation of genomic DNA from *E. coli* 2. Isolation of DNA from plant cell (Onion/Mustard/Banana) 3. Transformation of E. coli – Preparation of competent cell 4. Conjugation in E. coli using plate method 5. Estimation of RNA using colorimeter or UV spectrophotometer 6. Resolution and visualization of DNA by Agarose Gel Electrophoresis. 7. Study survival curve of bacteria after exposure to ultraviolet (UV) light 8. Isolation of Plasmid DNA from *E. coli* 9. Separation of protein mixtures by Polyacrylamide Gel Electrophoresis (PAGE)	15 / 10

Keywords ***Biochemical techniques, Chromatography, DNA isolation, RNA estimation, Plasmid***

PART – C

Learning Resources: Text Books, Reference Books and Others

Suggested Readings:

Text Books Recommended –

1.Aneja K. R., Laboratory Manual Of Microbiology And Biotechnology, Medtech; 1st edition, 2017

books and Laboratory manuals as mentioned in MICRO - 3T and 4T

Online Resources –

https://thebookee.net/

http://site.iugaza.edu.ps/mwhindi/files/Laboratory_Manual_And_Workbook_In_Microbiolog

http://site.iugaza.edu.ps/ydahdouh/files/General-Microbiology-Laboratory-pdf.pdf

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks:		50 Marks
Continuous Comprehensive Evaluation (CCE):		NA
Annual /University Exam(UE):		50 Marks
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test/Assignment /Field work	NA

Scheme of Examination
B.Sc.
Geology

Year	Course Code	Subject Name	Theory/ Practical	Total Credit	Total Marks	
					Max	Min
Second year	GEOL -3T	Petrology	Theory	4	50	17
	GEOL -4T	Structural Geology	Theory	4	50	17
	GEOL -2P	Petrology Structural Geology	Practical	2	50	17

Part A Introduction				
Program: **DiplomaCourse**		Class: B.Sc. IIYear	Year: 2024	Session: 2024-25
S.No.				
1	Course Code	GEOL – 3 T		
2	Course Title	Petrology (Paper I)		
3	Course Type	Theory.		
4	Pre-requisite (if any)	To study this group, a student must have passed in the B.Sc. I Year Geology		
5	Course Learning Outcomes (CLO)	On completion of course, the students should be able to - • Discuss about the formation of igneous rocks, their texture and structures. • Explain about forms and classification of igneous rocks • Identify, describe and classify sedimentary rocks using hand specimens. • Describe the formation of sedimentary rocks, their textures and structures. • Explain about the formation of metamorphic rocks, their texture and structure. • Identify and classify various types of metamorphic rocks. • Explain the concept of metamorphic facies, ACF, AKF and AFM diagrams.		
6	Credit Value	Theory : 4		
7	Total Marks	Maximum Marks: 50		Minimum Passing Marks : 17

Part B Content of the Course		
Total Periods: 60		
Unit	**Topics**	**No. of Periods**
I	**Igneous petrology :** Magma: definition, origin & composition, Bowen's reaction series, magmatic differentiation & assimilation, Introduction to crystallisation of Unicomponent (silica), Bicomponent (albite-anorthite and diposide-anorthite) and tricomponent magma(diopside-albite-anorthite),Texture, structures & forms of igneous rocks, Classification of igneous rocks: Mineralogical, Chemical &Tabular classification	12
II	**Igneous petrology :** Brief idea of the formation of igneous rocks in relation to Plate Tectonics, Introduction to petrology of Acid igneous rocks, Introduction to petrology of Alkaline igneous rocks, Introduction to petrology of Basic igneous rock, Introduction to petrology of Ultrabasic igneous rocks.	12

III	**Sedimentary petrology :** Origin, transportation & deposition of sediments, Sedimentary depositional environments - Aeolian, fluvial, coastal and abyssal environment. Introduction to sedimentary facies. Lithification&Diagenesis. Textures &structures of sedimentary rocks. Brief idea of the formation of sedimentary rocks in relation to Plate Tectonics	12
IV	**Sedimentary & metamorphic petrology:** Classification of sedimentary rocks-Clastic, non-clastic and biogenic rocks, Petrographic description of Breccia,Conglomerate, sandstone, shale, siltstone andlimestone, Metamorphism:Definition, agents, facies& grades, Textures, structures & classification of metamorphic rocks, Phase rule in metamorphism. Elementary idea about Paragenetic diagrams& projective analysis.	12
V	**Metamorphic petrology:** A.C.F& A.K.F. diagrams, Progressive metamorphism of Argillaceous rocks and thermal metamorphism of impure limestone, Progressive metamorphism of basic igneous rocks, Petrographic description of slate, phyllite, schist, gneiss, marble, quartzite, amphibolite, Khondalite, Gondite, Kodurite&Charnockite, Introduction to Paired Metamorphic Belts.	12

Part C
Learning Resource

Suggested Readings:

(1) शैलिकी के सिद्धान्त–डॉ.अंबिकाप्रसादअग्रवाल
(2) शैलिकी के सिद्धान्त– ए.जी. झिंगरन
(3) Principles of petrology - G.W. Tyrell
(4) Petrology - H.William, F.J. Turner & E.M. Gilbert
(5) Petrology of igneous & metamorphic rocks of India- S.C. Chattarjee
(6) A text book of sedimentary petrology -Verma& Prasad
(7) Metamorphism & Metamorphic rocks of India - S.Ray
(8) Sedimentary rocks -F.J. Pettijohn
(9) Introduction of sedimentology -S.Sengupta
(10) Sedimentary environment -H.G. Readings

E-resources

1. https://epgp.inflibnet.ac.in/Home
2. https://archive.org/details/in.ernet.dli.2015.233340/page/n15/mode/2up
3. https://egyankosh.ac.in/
4. https://sites.google.com/ignou.ac.in/bscgeology
5. SWAYAM – https://swayam.gov.in/explorer?searchtext
6. National digital library – https://ndl.iitkgp.ac.in
7. e-PG pathshala (MHRD) portal, https://egpg.inflibnet .ac.in

PartD AssessmentandEvaluation		
SuggestedContinuousEvaluationMethods: MaximumMarks:50 ContinuousComprehensiveEvaluation(CCE):NA UniversityExam(UE): 50 marks		
InternalAssessment: ContinuousComprehensive Evaluation(CCE)	Class Test Assignment/Presentation	NA

Part A Introduction				
Program: **DiplomaCourse**		Class: **B.Sc. IIYear**	Year: 2024	Session: 2024-25
S.No.				
1	Course Code	GEOL 4 T		
2	Course Title	Structural Geology (Paper II)		
3	Course Type	Theory.		
4	Pre-requisite (if any)	To study this group, a student must have passed in the B.Sc. Part I Geology		
5	Course Learning Outcomes (CLO)	At the end of this course, the students will be ableto - • Demonstrate the use of Clinometer compass and Brunton compass in measurement of attitude of rock bed. • Explain about parts of fold and classify various folds. • Recognize and classify the faults in the field and on geological map. • Identify and classify Unconformities. • Discuss about various types of Joints. • Explain various types of foliations and lineations. • Identify the top and bottom of rock beds in a series of rocks.		
6	Credit Value	Theory : 4		
7	Total Marks	Maximum Marks: 50	Minimum Passing Marks : 17	

Part B Content of the Course		
Total Periods: 60		
Unit	**Topics**	**No. of Periods**
I	**Attitude of rocks and unconformity :** Structural Geology: Definition and scope. Study of outcrops. Identification of bedding, Dip and strike: definition & measurement. Effects of Dip and slope on outcrops: Rule of 'Vs', Clinometer and Brunton compass: Understanding and use in measuring attitude of rocks, Unconformity: Definition & types, Outlier and inlier. Overlap &offlap. Recogntion of unconformity.	12
II	**Fold :** Fold: Definition and morphology, Geometric and genetic classification of folds, Recognition of folds in the field and on geological maps, Effect of folds on outcrops, Elementary idea of mechanics of folding.	12

III	**Fault:** Fault: Definition and morphology, Geometric and genetic classification of faults, Recognition of faults in the field and on geological maps,Effect of faults on outcrops, Elementary idea of mechanics of faulting.	12
IV	**Joint, Foliation & Lineation :** Joint: Definition, geometric &genetic classification of joints. Significance of joints. Foliation: terminology, kinds, origin and relation to major structures, Lineation: terminology, Kinds, origin and relation to major structures, Plutons; tectonics & emplacement, Recognition of top and bottom of beds.	12
V	**Rock deformation and geological maps :** Concept of rock deformation, Stress and Stress Ellipsoids, Tectonic framework of India, Contours: Definition, patterns. Introduction to geological maps and their interpretation, Stereographic projection & it use in Structural geology.	12

PartC

LearningResources

SuggestedReadings

(1) संरचनात्मकभूविज्ञान–डॉ.डी.के. श्रीवास्तव
(2) भूवैज्ञानिकसंरचनाएँ–डॉ. भरत सिंह राठौर
(3) प्रायोगिकभूविज्ञान (भाग–2) –आर.पी. मांजरेकर
(4) Structural Geology. M.P. Billings.
(5) Theory of Structural Geology; Gokhale, N.W. CBS
(6) Exercises on Geological maps and dip-Strike: Gokhale, N.W. CBS.
(7) Outlines of structural Geology. E.S. Hills.
(8) Structural Geology- Hobbs. Means and Williams.
(9) Geological maps- Chiplonkar and Pawar.

E-resources :

1. https://epgp.inflibnet.ac.in/Home
2. https://archive.org/details/in.ernet.dli.2015.233340/page/n15/mode/2up
3. https://egyankosh.ac.in/
4. https://sites.google.com/ignou.ac.in/bscgeology
5. SWAYAM – https://swayam.gov.in/explorer?searchtext
6. National digital library – https://ndl.iitkgp.ac.in
7. e-PG pathshala (MHRD) portal, https://epgp.inflibnet .ac.in

PartD AssessmentandEvaluation		
SuggestedContinuousEvaluationMethods: MaximumMarks:50 ContinuousComprehensiveEvaluation(CCE):NA UniversityExam(UE): 50 marks		
InternalAssessment: ContinuousComprehensive Evaluation(CCE)	Class Test Assignment/Presentation	NA

Part A Introduction				
Program: **DiplomaCourse**		Class: **B.Sc. IIYear**	Year: 2024	Session: 2024-25
S.No.				
1	Course Code	GEOL-2 P		
2	Course Title	Petrology & Structural Geology (Practical)		
3	Course Type	Practical		
4	Pre-requisite (if any)	This practical Course is related to theory course Geology Paper I& II.		
5	Course Learning Outcomes (CLO)	On completion of Course, the students should be able to - • Identify the igneous, Sedimentary and metamorphic rocks in hand specimens and thin sections. • Use of Clinometer compass and Brunton compass. • Recognize the folds, faults , unconformities and joints in specimens and models. • Completion of outcrops and preparation of Geological cross section and interpretation of geological history.		
6	Credit Value	Practical : 2		
7	Total Marks	Maximum Marks: 50	Minimum Passing Marks : 17	

Part B1 Content of the Course	
Petrology	
Topics	**No. of Periods**
Diagrammatic representation of various forms of igneous, sedimentary & Metamorphic rocks	3
Diagrammatic representation of various structures of igneous, sedimentary & Metamorphic rocks	3
Megascopic studies of various sedimentary, metamorphic & igneous rocks.	3
Microscopic studies of various sedimentary, metamorphic & igneous rocks.	3
Diagrammatic representation of petrographic provinces of India in outline map of India.	3

Part B2 Content of the Course	
Structural Geology	
Topics	**Number of Periods**
Study of Natural Structures in specimens.	03
Study of structures models.	03
Completion of outcrops.	03
Preparation of geological section from simple to complex geological maps and its interpretation.	03
Introductory idea of stereographic projection in structural geology.	03
Field work of three days is compulsory for the students.	

Part C Learning Resource
Suggested Readings:
Text Books : (1) शैलिकी के सिद्धान्त–डॉ.अंबिकाप्रसादअग्रवाल (2) शैलिकी के सिद्धान्त– ए.जी. झिंगरन (3) Principles of petrology - G.W. Tyrell (4) Petrology - H.William, F.J. Turner & E.M. Gilbert (5) Petrology of igneous & metamorphic rocks of India- S.C. Chattarjee (6) A text book of sedimentary petrology - Verma& Prasad (7) Metamorphism & Metamorphic rocks of India -S.Ray (8) Sedimentary rocks - F.J. Pettijohn (9) Introduction of sedimentolog - S.Sengupta (10) Sedimentary environment-H.G. Readings (11) संरचनात्मकभूविज्ञान–डॉ.डी.के. श्रीवास्तव (12) भूवैज्ञानिकसंरचनाएँ–डॉ. भरत सिंह राठौर (13) प्रायोगिकभूविज्ञान (भाग–2) –आर.पी. मांजरेकर (14) Structural Geology. - M.P. Billings. (15) Theory of Structural Geology; Gokhale, N.W. CBS (16) Exercises on Geological maps and dip-Strike: Gokhale, N.W. CBS. (17) Outlines of structural Geology. E.S. Hills. (18) Structural Geology- Hobbs. Means and Williams (19) Geological maps- Chiplonkar and Pawar
E-resources
1. https://epgp.inflibnet.ac.in/Home 2. https://archive.org/details/in.ernet.dli.2015.233340/page/n15/mode/2up

3. https://egyankosh.ac.in/ 4. https://sites.google.com/ignou.ac.in/bscgeology 5. SWAYAM – https://swayam.gov.in/explorer?searchtext 6. National digital library – https://ndl.iitkgp.ac.in 7. e-PG pathshala (MHRD) portal, https://egpg.inflibnet .ac.in

PartD **AssessmentandEvaluation**		
SuggestedContinuousEvaluationMethods: MaximumMarks:50 ContinuousComprehensiveEvaluation(CCE):NA UniversityExam(UE): 50 marks		
InternalAssessment: ContinuousComprehensive Evaluation(CCE)	Class Test Assignment/Presentation	NA

B.A./B.Sc. in Anthropology
Scheme of Examination 2024

Class	Paper	Course Title	Course Code	Credit Value	Maximum Marks	Passing Marks
2nd Year	I	Archaeological Anthropology	ANTH-03T	04	50	17
	II	Tribal Culture of India	ANTH-04T	04	50	17
	III	Practical in Material Culture	ANTH-02P	02	50	17

Part A : Introduction

Programme Diploma Course	Class B.A./B.Sc. 2nd Year	Year 2024	Session 2024-25

1. Course Code : **ANTH-03T**
2. Course Title : **ARCHAEOLOGICAL ANTHROPOLOGY**
3. Course Type : **THEORY**
4. Course Objective : Archaeology is sub discipline of Anthropology. The course examines the major methods, theories and aims of archaeology by studying a board survey of famous sites and discoveries around the world. Student taking this course will achieve a good understanding of how archaeologists interpret the past through the material record and will be prepared for higher level courses in archaeology.
5. Course Learning Outcome :
   - Use the knowledge of archaeological research methods to make an original argument about past human cultures.
   - Understand the relationship between archeological data and interpretation.
   - Identify some of the major global cultures, sites and archaeological discoveries.
   - Understand the role of anthropological inquiry in archaeology.
   - Have a better idea of a region or specialty for student to continue to focus on advance archaeological studies.

1. Credit Value : Theory-04
2. Total Marks : Maximum Marks 50 Minimum Marks 17

Part B : Content of the Course

1. Total Units : 05
2. Total Lectures : 60

Unit	Topics	No. of Lectures
Units I, II, III, IV & V	Syllabus	12 Lectures each unit

UNIT-I

- Definition and scope of Archaeological Anthropology.
- Relation of archaeology with Life science, Physical Science and humanities.
- Types of Archaeology : Classical Archaeology, Prehistoric Archaeology, Historic Archaeology Ethno Archaeology
- Development of Indian Archaeology

UNIT – II

- Geo-Chronological Methods of Archaeology Study : Geological Time Scale, glacial Period, Pluvial period and their evidences
- Absolute & Relative dating method

UNIT – III

- Techniques of manufacturing stone tools.
- Type of stone tools : Core tools, Flake tools, Blade tools, Microliths & Grinding Polishing tools & their uses.
- Classification of human culture based on Stone Age and metal Age.

UNIT – IV

- Distribution of Paleolithic culture in Europe-Characters, distribution and interpretation of habitat
- lower Paleolithic culture, Middle Paleolithic culture, Upper Paleolithic culture & Mesolothic Culture
- Paleolithic Art in Europe – Characters, distribution, interpretation and chronology

UNIT – V

- Stone Age culture in India – Characters, distribution and interpretation of habitat and economy of Lower Paleolithic Culture, Middle Paleolithic Culture, Upper Paleolithic Culture & Neolithic Culture.
- Metal age culture in India – Characters, distribution and interpretation of habitat and economy of Chalcolithic culture, Bronze age civilization &, Iron age culture.
- Archaeological sites in Chhattisgarh – Sirpur, Deepadih & Karkabhatha.

Part C : Learning Resources

1. A grawal, D.P. & M.G. Yadava. 1995. Dating the human past.
2. Bhattacharya, D.K. 1977. Palaeolithic Europe.
3. Bordes,F. 1968. The Old Stone age. Weidenfeld and Nicolson.
4. Burkitt, M.C. 1969. Old Stone Age: Study of Palaeolithic Times.
5. Oakley, K.P. 1972. Man the tool maker
6. Roe, Derek 1970. Prehistory: An introduction.
7. Sankalia, H.D. 1964. Stone age tools: their techniques, names and probable functions, Pune, Deccan College.
8. Sankalia, H.D. 1974. Prehistory and Protohistory of Early India and Pakistan.
9. Allchin and Allchin, 1982. The rise of civilization in India and Pakistan, Select Book Service Syndicate, New Delhi.
10. Zeuner, F.E. Pleistocene Period.
11. Agrawal, D.P. The Archaeology of India, Curzon Press.
12. Sakalia, H.D., New Archaeology – Its Scope and Application to India, Ethnographic and Folk Culture Society.

Part D : Assessment and Evaluation

University Exam. (UE) : Max. Marks : 50 Marks

Part A : Introduction

Programme Diploma Course	Class B.A./B.Sc. 2nd Year	Year 2024	Session 2024-25

1. Course Code : **ANTH-04T**
2. Course Title : **TRIBAL CULTURE OF INDIA**
3. Course Type : **THEORY**
4. Course Objective : Adequate understanding of the concept of tribe : the nuances of defining tribe in India. The course seeks to explore various policies formulated for the welfare of the tribes to understand changes in the social structure of tribes in India due to development, migration etc.
5. Course Learning Outcome :

- The students will learn about various concepts of tribes and the importance of studying them.
- They will learn about the difficulties of differentiating between tribe and caste in India.
- They will also learn about classification of tribes based on religion, economy, occupation,race, etc.
- From the practical component they will learn about distribution of various categories of tribes in India and how to write an annotate and social structure of one of them.
- They should be able to evaluate, plan and implement any project work in rural and tribal areas.

1. Credit Value : Theory-04
2. Total Marks : Maximum Marks 50 Minimum Marks 17

Part B : Content of the Course

1. Total Units : 05
2. Total Lectures : 60

Unit	Topics	No. of Lectures
Units I, II, III, IV & V	Syllabus	12 Lectures Each Unit

UNIT – I

- Define tribe and scheduled tribe
- Distribution and classification of Indian tribes : Geographical, racial, linguistic
- Contribution of Anthropology in the study of Indian tribes.
- Sacred complex, Universalisation and parochialisation, Sanskritisation, Westernization and

Dominant caste.

UNIT – II

- Tribes of Chhattisgarh and their problems.
- PVTGs - 1.Kamar 2. Birhor 3. Hill Korwa 4. Abujhmaria 5.Baiga.
- Denotified & Nomedic Tribes.

UNIT – III

- Social organization's of Indian tribes: Family, marriage, Lineage and clan.
- Youth dormitory : Type, organizationand functions.
- Political organization of Indian tribes: Distinction between state and stateless society.
- Law and justice in primitive society.
- Tribal religion : Origin, function, animistic & totemistic.
- Concept and practices : Magic, witchcraft, shamanism & head hunting.

UNIT – IV

- Stages of tribal economy : Hunting, food gathering, fishing, shifting and settledagriculture.
- Concept of property and ownership in tribal societies,
- New Economics Anthropology : Exchange-Gift, Barter, Trade, Ceremonial exchange and market economy.

UNIT – V

- Tribal Problems: Culture contact, urbanization, industrialization. land alienation, bonded labour, indebtedness, shifting,cultivation, irrigation, Unemployment, Agricultural labour.
- Tribal development : History of tribal development.
- Constitutional safeguards for thescheduled tribes.
- Policies, plan and programmes of tribal development and their implementation.
- Tribal revolts in India.
- The role of anthropology in tribal development.

Part C : Learning Resources

1. Bose, N.K. : Tribal life of India.
2. Dube S.C. : Indain village.
3. Elwin, V. : A new deal of Tribal India.
4. Furer-Haimendorf C.V. : The Naked Nagas.
5. Ghurye, G.S. : The schedule tribes.
6. Mamvria : Tribal demography
7. Majumdar D.N. : Affairs of tribes.

8. Nathan D. : Tribe –Caste.
9. Nadim hasnain : Janjatiy bharat.
10. Srivastava V.K. : The Concept of tribe in Draft Tribal

Part D : Assessment and Evaluation

University Exam. (UE) : Max. Marks : 50 Marks

Part A : Introduction

Programme Diploma Course	Class B.A./B.Sc. 2nd Year	Year 2024	Session 2024-25

1. Course Code : **ANTH- 02P**
2. Course Title : **PRACTICAL IN MATERIAL CULTURE**
3. Course Type : **PRACTICAL**
4. Course Objective : The objective of this practical course is to introduce the student with the primitive material culture and technology used by primitive man and the students introduce with various techniques of tools making of ancient man. This will be helpful for students to understand the use and making technique of material culture of different human communities in the field of research.

1. Credit Value : Practical-02
2. Total Marks : Maximum Marks 50 Minimum Marks 17

Part B : Content of the Course

1. Total Units :
2. Total Lectures : 30

Unit	Topics	No. of Lectures
-	Syllabus	30 Lectures

Part – I : Material Culture of Tribe
Identification and technological Description of the Following -

- Tools of food gathering, hunting, fishing and agriculture.
- Fire making implements.
- Types of habitation
- Land and water transport

Part – II : Archaeological tools
Sketching, identification and the description of Stone Age tools -

- Paleolithic tools
- Mesolithic tools

- Neolithic tools

(It is essential that students should draw at least five tools of each age)

Part – III : Research tools in Anthropology

- Construction of Schedule, Genealogy and Questionnaire.
- Each student will be required to maintain practical records of all work done in the practical class.

Part C : Learning Resources

1. Prayogic Manav Vigyan Bhag. I Mitashree Mitra & Ramesh Chouby Madhy Pradesh Hindi Granth Acadmi
2. Bhoutik Sanskriti Kalpana Saini Modhya.

Part D : Assessment and Evaluation

University Exam. (UE) : Max. Marks : 50 Marks

Scheme of B.Sc./B.Sc.(Hons) Biochemistry

Year	Course Code	Subject Name	Theory/ Practical	Total Credit	Total Marks	
					Max	Min
Second year	BIOC -3T	Enzymology	Theory	4	50	17
	BIOC-4T	Metabolism of Biomolecules	Theory	4	50	17
	BIOC-2P	Lab 2 : Enzymology and Metabolism of Biomolecules	Practical	2	50	17

Part A: Introduction				
Program: **Diploma Course**		Class: **B.Sc. II Year**	Year: 2024	Session 2024-25
1	Course Code	BIOC-3T		
2	Course Title	**Enzymology**		
3	Course Type	Theory		
4	Pre-requisite (if any)	As per Govt. norms		
5	Course Learning. Outcomes (CLO)	At the end of this course, the students will be able to: • Describe the classification and nomenclature of enzymes on the basis of their action, specificity of enzyme action, mechanism of enzyme catalysis and regulatory enzymes. • Explain the mechanism of enzymes and the role of vitamins as coenzyme precursors. • Express the Michaelis-Menten equation, single and double reciprocal plots, and graphical representation of various inhibitors. • Discuss the factors affecting enzyme activity and enzyme isolation & purification. • Describe the principles and methods of enzyme immobilization. • CLO3: Acquire knowledge of allosteric enzymes and their kinetics. • Analyze the thermodynamics of enzyme substrate reactions. • Outline the knowledge of enzyme action, isolation and purification techniques.		
6	Credit Value	Theory: 4		
7	Total Marks	**Max. Marks:** 50	**Min Passing Marks:** 17	

Part B: Content of the Course		
Total No. of Teaching – Periods- 60 / Hours – 40		
Unit	**Topics**	No. of Period / Hour
1	**Introduction to enzymes:** Nature of enzymes - protein and non-protein (ribozyme). Cofactor and prosthetic group, apoenzyme, holoenzyme. IUBMB classification of enzymes.] **Features of enzyme catalysis:** Factors affecting the rate of chemical reactions, collision theory, activation energy and transition state theory, catalysis, reaction rates and thermodynamics of reaction. Catalytic power and specificity of enzymes (concept of active site), Fischer's lock and key hypothesis, Koshland's induced fit hypothesis.	12 Periods / 08 Hours
2	**Enzyme kinetics** : Relationship between initial velocity and substrate concentration, steady state kinetics, equilibrium constant - monosubstrate reactions. Michaelis-Menten equation, Lineweaver-Burk plot, Eadie-Hofstee and Hanes plot. Km and Vmax, Kcat and turnover number. Effect of pH, temperature and metal ions on the activity of enzyme. **Bisubstrate reactions:** Types of bi reactions (sequential – ordered and random, ping pong reactions). Differentiating bi substrate mechanisms (diagnostic plots, isotope exchange).	12 Periods / 08 Hours

3	**Enzyme inhibition** Reversible inhibition (competitive, uncompetitive, non-competitive, mixed and substrate). Mechanism based inhibitors - antibiotics as inhibitors. **Mechanism of action of enzymes** General features - proximity and orientation, strain and distortion, acid base and covalent catalysis (chymotrypsin, lysozyme). Metal activated enzymes and metalloenzymes, transition state analogues.	12 Periods / 08 Hours
4	**Regulation of enzyme activity:** Control of activities of single enzymes (end product inhibition) and metabolic pathways, feedback inhibition (aspartate transcarbomoylase), reversible covalent modification phosphorylation (glycogen phosphorylase). Proteolytic cleavage- zymogen. Multienzyme complex as regulatory enzymes. Occurrence and isolation, phylogenetic distribution and properties (pyruvate dehydrogenase, fatty acyl synthase) Isoenzymes - properties and physiological significance (lactate dehydrogenase). **Involvement of coenzymes in enzyme catalysed reactions**: TPP, FAD, NAD, pyridoxal phosphate, biotin, coenzyme A, tetrahydrofolate, lipoic acid.	12 Periods / 08 Hours
5	**Applications of enzymes:** Application of enzymes in diagnostics (SGPT, SGOT, creatine kinase, alkaline and acid phosphatases), enzyme immunoassay (HRPO), enzyme therapy (Streptokinase). Immobilized enzymes Immobolization of enzymes and their industrial applications. Use of glucose oxidase in Electrodes.	12 Periods / 08 Hours

Keywords: Enzymes, kinetics, activity, inhibition, regulation, catalysis, applications

Part C - Learning Resource

Text Books, Reference Books, Other Resources

Suggested Readings:

1. Lehninger: Principles of Biochemistry (2013) 6th ed., Nelson, D.L. and Cox, M.M., W.H.Freeman and Company (New York), ISBN:13: 978-1-4641-0962-1 / ISBN:10:1-4292-3414-8.
2. Physical Biochemistry (2009) 2nd ed., Sheehan, D., Wiley-Blackwell (West Sussex), ISBN: 9780470856024 / ISBN: 9780470856031.
3. Biochemistry (2011) 4th ed., Donald, V. and Judith G.V., John Wiley & Sons Asia Pvt. Ltd. (New Jersey), ISBN:978-1180-25024.
4. Fundamentals of Enzymology (1999) 3rd ed., Nicholas C.P. and Lewis S., Oxford University Press Inc. (New York), ISBN:0 19 850229 X.

E-learning Resources

https://ncert.nic.in/textbook/pdf/lech205.pdf
https://www.pdfdrive.com/biomolecules-books.html
https://schools.aglasem.com/ncert-books-class-11-biology-chapter-9/
https://swayam.gov.in/
https://www.edx.org/search?q=biomolecules&tab=course
https://britannica.com
https://en.wikibooks.org/wiki/Biochemistry
https://nptel.ac.in

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods: Maximum Marks: 50 Continuous Comprehensive Evaluation (CCE): Not Applicable University Exam(UE): 50 Marks		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test/Assignment/Presentation	Not Applicable
External assessment University Exam (UE)		
Any remarks/ Suggestions: -		

Declaration

Syllabus is framed as per the ToR

Name	Signature
Dr. DSVGK Kaladhar, Chairman BOS, Biochemistry, Professor, Atal Bihari Vajpayee University, Bilaspur	3.6.22
Dr. Mrigendra Dwivedi, Chairman BOS, Biochemistry, Pt.Ravishankar Shukla University Assistant Professor, Biochemistry, Govt Nagarjuna PG College of Science, Raipur	03/06/2022
Dr. Harit Jha, Subject expert, Assistant Professor, Biotechnology, Guru Ghasidas University, Bilaspur	

Part A: Introduction				
Program: Diploma Course		Class: B.Sc. II Year	Year: 2024	Session 2024-25
1	Course Code	BIOC-4T		
2	Course Title	**Metabolism of Biomolecules**		
3	Course Type	Theory		
4	Pre-requisite (if any)	As per Govt. norms		
5	Course Learning. Outcomes (CLO)	At the end of this course, the students will be able to: • Describe the fundamentals of thermodynamics in biochemical processes. • Acquire the knowledge of energy production in living systems by the degradation of fatty acids. • Explain the various pathways of fatty acid synthesis in living systems. • Describe the energy generated from the carbohydrate metabolism. • Explain the mechanism of the machinery system involved in carbohydrate metabolism. • Discuss breakdown and synthesis of amino acids in humans and recognize its relevance with respect to nutrition and human diseases. • Describe how amino acids are converted into a variety of precursors. • Describe breakdown and synthesis of nucleotides in humans and recognize its relevance with respect to nutrition and human diseases. • Explain inhibitors of nucleotide metabolism, which are potentially being used as chemotherapeutic drugs. • Define citric acid cycle and oxidative phosphorylation in the cell.		
6	Credit Value	Theory: 4		
7	Total Marks	**Max. Marks:** 50	**Min Passing Marks:** 17	

Part B: Content of the Course		
Total No. of Teaching – Periods- 60 / Hours – 40		
Unit	**Topics**	No. of Period Hours
1	**Basic design of metabolism**: Autotrophs, heterotrophs, metabolic pathways, catabolism, anabolism, ATP as energy currency, reducing power of the cell. **Glycolysis, gluconeogenesis and pentose phosphate pathway** **Glycogen metabolism**: Glycogenesis and glycogenolysis. regulation of glycogen metabolism, glycogen storage diseases. Citric acid cycle , Synthesis of carbohydrates and Calvin cycle	12 Periods / 08 Hours
2	**Fatty acid oxidation** : Digestion, mobilisation and transport of cholesterol and triacyl glycerols, β oxidation of saturated, unsaturated, odd and even numbered and branched chain fatty acids, regulation of fatty acid oxidation, peroxisomal oxidation, ω oxidation, ketone bodies metabolism, ketoacidosis. **Fatty acid Biosynthesis**: Fatty acid synthase complex. Synthesis of saturated, unsaturated, odd and even chain fatty acids and regulation. Biosynthesis of membrane lipids : Synthesis of membrane phospholipids in prokaryotes and eukaryotes, respiratory distress syndrome, biosynthesis of triacylglycerol, biosynthesis of plasmalogens, sphingolipids and glycolipids, lipid storage diseases	12 Periods / 08 Hours

3	**Electron Transport Chain and Oxidative Phosphorylation** Structure of mitochondria, sequence of electron carriers, sites of ATP production, inhibitors of electron transport chain. Hypothesis of mitochondrial Oxidative phosphorylation. Transport of reducing potentials into mitochondria.	12 Periods / 08 Hours
4	Amino acid metabolism, Metabolic fates of amino groups. Digestion and absorption of dietary proteins. transamination, role of pyridoxal phosphate, glucose-alanine cycle, Kreb's bicycle, urea cycle and inherited defects of urea cycle. Catabolism of amino acids: Catabolic pathways of individual amino acids. Glucogenic and ketogenic amino acids. Metabolism of one carbon units. Disorders of amino acids metabolism, phenylketonuria, Overview of amino acid synthesis. Biosynthesis of non-essential amino acids and its regulation.	12 Periods / 08 Hours
5	Biosynthesis of purine and pyrimidine nucleotides : De novo synthesis of purine and pyrimidine nucleotides, regulation and salvage pathways. Deoxyribonucleotides and synthesis of nucleotide triphosphate, Biosynthesis of deoxyribonucleotides and its regulation, conversion to triphosphates, Degradation of purine and pyrimidine nucleotides. Inhibitors of nucleotide metabolism. Disorders of purine and pyrimidine metabolism – Lesch-Nyhan syndrome, Gout, SCID, adenosine deaminase deficiency. Integration of metabolic pathways (carbohydrate, lipid and amino acid metabolic pathways), tissue specific metabolism (brain, muscle, and liver).	12 Periods / 08 Hours

Keywords: Metabolism, Biosynthesis, Oxidation, Catabolism, disorders, pathways

Part C - Learning Resource

Text Books, Reference Books, Other Resources

Suggested Readings:

1. Lehninger: Principles of Biochemistry (2013) 6th ed., /Nelson, D.L. and Cox, M.M., W.H. Freeman and Company (New York), ISBN:13: 978-1-4641-0962-1 ISBN:10:1-4292- 3414-8.
2. Textbook of Biochemistry with Clinical Correlations (2011)
3. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition John Wiley& Sons. Inc.
4. Textbook of Biochemistry with Clinical Correlations (2011) 7th ed., Devlin, T.M., John Wiley & Sons, Inc. (New York), ISBN: 978-0-470-28173-4 / BRV ISBN: 978-0-470-60152-5.
5. Textbook of Biochemistry with Clinical Correlations (2011) 7th ed., Devlin, T.M., John Wiley & Sons, Inc. (New Jersey), ISBN:978-0-470-28173-4.
6. Biochemistry (2012) 7th ed., Berg, J.M., Tymoczko, J.L. and Stryer L., W.H. Freeman and Company (New York), ISBN:10:1-4292-2936-5, ISBN:13:978-1-4292-2936-4

E-learning Resources

https://britannica.com
https://en.wikibooks.org/wiki/Biochemistry
https://nptel.ac.in

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 50
Continuous Comprehensive Evaluation (CCE): Not Applicable

University Exam(UE): 50 Marks		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test/Assignment/Presentation	Not Applicable
External assessment University Exam (UE)		
Any remarks/ Suggestions: -		

Declaration

Syllabus is framed as per the ToR

Name	Signature
Dr. DSVGK Kaladhar, Chairman BOS, Biochemistry, Professor, Atal Bihari Vajpayee University, Bilaspur	
Dr. Mrigendra Dwivedi, Chairman BOS, Biochemistry, Pt.Ravishankar Shukla University Assistant Professor, Biochemistry, Govt Nagarjuna PG College of Science, Raipur	03/06/2022
Dr. Harit Jha, Subject expert, Assistant Professor, Biotechnology, Guru Ghasidas University, Bilaspur	

Part A: Introduction			
Program: **Diploma Course**	Class: **B.Sc. II Year**	Year: 2024	Session: 2024-25

1	Course Code	**BIOC-2P**
2	Course Title	**LAB I : Enzymology and Metabolism of Biomolecules lab**
3	Course Type	**Practical**
4	Pre-requisite (if any)	As per Govt. norms
5	Course Learning Outcomes (CLO)	At the end of this course, the students will be able to: • Explain purification of proteins by various methods. • Estimate enzyme activity by different methods. • Explain progress curve of enzyme. • Interpret the effect of physical parameters on enzyme activity. • Practice the effect of inhibitors on enzyme activity. • Demonstrate the continuous assay of an enzyme. • Explain enzyme assay of salivary enzyme. • Practice the estimation of plasma sugar. • Demonstrate the cholesterol level from known sources • Demonstrate assay for various clinically important enzymes. • Practice clinical test by various proteins in biological samples.
6	Credit Value	**Practical: 2**
7	**Total Marks**	**Max. Marks: 50** / **Min Passing Marks : 17**

Part B: Content of the Course	
Total No. of Teaching Periods- 30/ Hours – 20	
Tentative Practical List	**Note:** This is tentative list; the teachers concern can add more practical's as per requirement. 1. Partial purification of acid phosphatase from germinating mung bean. 2. Assay of enzyme activity and specific activity, e.g. acid phosphatase. 3. Effect of pH on enzyme activity 4. Determination of Km and Vmax using Lineweaver-Burk graph. 5. Enzyme inhibition - calculation of Ki for competitive inhibition. 6. Continuous assay of lactate dehydrogenase. 7. Coupled assay of glucose-6-phosphate dehydrogenase. 8. Estimation of blood glucose. 9. Sugar fermentation of microorganisms. 10. Assay of salivary amylase. 11. Isolation of lecithin, identification by TLC, and its estimation. 12.. Isolation of cholesterol from egg yolk and its estimation. 13.. Assay of serum transaminases – SGOT and SGPT. 14. Estimation of serum urea. 15. Separation of Blood Plasma and Serum a. Estimation of proteins from serum by biuret and lowry methods. b. Determination of albumin and A/G ratio in serum. 16. Estimation of bilirubin (conjugated and unconjugated) in serum. 17. i. Estimation of total lipids in serum by vanillin ii. Estimation of cholesterol in serum. 18. Estimation of lipoproteins in plasma. 19. Estimation of lactic acid in blood before and after exercise. 20. Separation and identification of amino acids by (a) paper chromatography and (b) thinlayer chromatography. 21. Separation of polar and non-polar lipids by thin-layer chromatography. 22. Estimation of SGPT and SGOT in serum. 23. a. Assay of serum alkaline phosphatase activity.

	b. Inhibition of alkaline phosphatase activity by EDTA. c. Effect of substrate concentration on alkaline phosphatase activity and determination of its Km value. 24. a. Effect of temperature on enzyme activity and determination of activation energy. b. Effect of pH on enzyme activity and determination of optimum pH. c. Effect of enzyme concentration on enzyme activity. 25. a. Preparation of starch from potato and its hydrolysis by salivary amylase b. Determination of achromatic point in salivary amylase. c. Effect of sodium chloride onamylases
Keywords: Metabolism, Biosynthesis, Enzyme activity, techniques, serum, fermentation	

Part C - Learning Resource

Text Books, Reference Books, Other Resources

Suggested Readings:

1. Lehninger: Principles of Biochemistry (2013) 6th ed., /Nelson, D.L. and Cox, M.M., W.H. Freeman and Company (New York), ISBN:13: 978-1-4641-0962-1 / ISBN:10:1-4292-3414-8.
2. Textbook of Biochemistry with Clinical Correlations (2011) 7th ed., Devlin, T.M., John Wiley & Sons, Inc. (New York), ISBN: 978-0-470-28173-4 / BRV ISBN: 978-0-470- 60152-5.
3. Karp, G. 2010. 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. 8th edition Lippincott Williams and Wilkins, Philadelphia.
5. Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
6. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009 The World of the Cell.7th edition. Pearson Benjamin Cummings Publishing, San Francisco.
7. Biochemistry (2011) 4th ed., Donald, V. and Judith G.V., John Wiley & Sons Asia Pvt. Ltd. (New Jersey), ISBN:978-1180-25024.
8. Fundamentals of Enzymology (1999) 3rd ed., Nicholas C.P. and Lewis S., Oxford University Press Inc. (New York), ISBN:0 19 850229 X.
9. Biochemistry (2012) 7th ed., Berg, J.M., Tymoczko, J.L. and Stryer L., W.H. Freeman and Company (New York), ISBN:10:1-4292-2936-5, ISBN:13:978-1-4292-2936-4

E-learning Resources:

https://britannica.com
https://en.wikibooks.org/wiki/Biochemistry
https://nptel.ac.in

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 50
Continuous Comprehensive Evaluation (CCE): Not Applicable
University Exam(UE): 50 Marks

Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test/Assignment/Presentation	Not Applicable
External assessment University Exam (UE)		

ENCloud

Declaration

Syllabus is framed as per the ToR

Name	Signature
Dr. DSVGK Kaladhar, Chairman BOS, Biochemistry, Professor, Atal Bihari Vajpayee University, Bilaspur	
Dr. Mrigendra Dwivedi, Chairman BOS, Biochemistry, Pt.Ravishankar Shukla University Assistant Professor, Biochemistry, Govt Nagarjuna PG College of Science, Raipur	03/02/2022
Dr. Harit Jha. Subject expert, Assistant Professor, Biotechnology, Guru Ghasidas University, Bilaspur	

Scheme of B.Sc./B.Sc.(Hons) Biotechnology

Year	Course Code	Subject Name	Theory/ Practical	Total Credit	Total Marks	
					Max	Min
Second year	BIOT -3T	Molecular Biology and Biophysics	Theory	4	50	17
	BIOT-4T	Recombinant DNA Technology and Genomics	Theory	4	50	17
	BIOT-2P	Lab 2:Molecular Biology, Bioinstrumentation, and Genomics	Practical	2	50	17

Part A: Introduction				
Program: **Diploma Course**		Class: **B.Sc. II Year**	Year: 2021	Session: 2024-25
1	Course Code	BIOT-3T		
2	Course Title	**Molecular Biology and Biophysics**		
3	Course Type	Theory		
4	Pre-requisite (if any)	As per Govt. norms		
5	Course Learning Outcomes (CLO)	At the end of this course, the students will be able to: • Understand on fundamentals of molecular biology and instrumentation • Understand the concept of tools applied in the study of biotechnology • Understand the expression of gene		
6	Credit Value	Theory: 4		
7	Total Marks	**Max. Marks:** 50	**Min Passing Marks:** 17	

Part B: Content of the Course		
Total No. of Teaching – Periods- 60 / Hours – 40		
Unit	**Topics**	No. of Period / Hour
1	1. Nucleic Acid: Bases, Nucleosides and Nucleotides, Structure, types and functions of DNA and RNA. 2. Structure, types and functions of Plasmids. 3. Transposons: Repetitive elements, Retro-transposons, LINEs & SINEs. Structure of Gene.	12 Periods / 08 Hours
2	1. DNA Replication: Enzymes involved and mechanism of DNA Replication in Prokaryotes. 2. Mutation: Molecular level of Mutation, Types of Mutagens, Spontaneous and Induced Mutation. 3. DNA Repair: Direct, NER, BER, Mismatch and Recombination.	12 Periods / 08 Hours
3	1. Transcription: Initiation, Elongation and Termination in prokaryotes. 2. Genetic Code: Features, Codon Assignment and Wobble hypothesis 3. Translation: Initiation, Elongation and Termination Translation machinery in Prokaryotes. 4. Operon- Concept of Operator, Regulator, Promoter gene, Inducer and Co-repressor.	12 Periods / 08 Hours
4	1. Biophysics : Introduction, Scope and Application 2. Principle, Types, Instrumentation and Functions of the following: a. Microscope b. Colorimeter and UV-VIS Spectrophotometer c. Electrophoresis (Agarose and PAGE) d. Centrifuge e. Chromatography (Paper, TLC and HPLC).	12 Periods / 08 Hours
5	1. Radioisotopes techniques: Radioactive decay, Measurement of radioactivity, Ionization Chambers, Geiger Muller and Scintillation Counter. 2. Autoradiography, DNA Fingerprinting. 3. Blotting techniques: Southern Northern and western blotting.	12 Periods / 08 Hours

Keywords: DNA, RNA, Replication, Transcription, Translation, Bioinstruments, Biophysics

Part C - Learning Resource

Text Books, Reference Books, Other Resources

Suggested Readings:

1. Gerald Karp - Cell and Molecular biology, 4th Edition (2005).
2. Lewis J.Klein Smith and Valerie M.Kish-Principles of cell and molecular biology-Third Edition (2002)
3. P.K. Gupta- Cell and molecular biology, Second Edition (2003), Rastogi publications.
4. Richard M-Twyaman-Advanced Molecular Biology, First South Asian Edition (1998), VivaBooks Pvt. Ltd.
5. K. Wilson and J. Walker (2012) Principle and Techniques of Biotechnology and Molecular Biotechnology.
6. DSVGK Kaladhar, Molecular Biochemistry (2018) RBSA Publishers ISBN 9788176117708.
7. Upadhya and Upadhya : Biophysical Chemistry.
8. David. I. Nelson and Michael M.Cox :Lehniger : Principal of Biochemistry 4th Edition. W H Freeman and Company, New York.
9. Buchanan, Gruissemen & Jones (2015) Biochemistry & Molecular Biology of Plant, 2nd edition.

E-learning Resources

https://ncert.nic.in/textbook/pdf/lech205.pdf
https://www.pdfdrive.com/biomolecules-books.html
https://swayam.gov.in/
https://www.edx.org/search?q=biomolecules&tab=course
https://britannica.com
https://en.wikibooks.org/wiki/Biochemistry
https://nptel.ac.in

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 50
Continuous Comprehensive Evaluation (CCE): Not Applicable
University Exam(UE): 50 Marks

Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test/Assignment/Presentation	Not Applicable
External assessment University Exam (UE) Time 3Hours		As per Govt. norms
Any remarks/ Suggestions: -		

Declaration

Syllabus is framed as per the ToR

Name	Signature
Dr DSVGK Kaladhar, Prof & Chairperson CBoS Biotechnology, UTD ABVV	
Dr Pramod Kumar Mahish, Asst. Professor Govt. Digvijay College Rajnandgaon	
Dr Saumya Khare, Asst Prof, Kalyan PG. College Bhilai	
Dr Shubha Thakur, Asst Prof. St. Thomas College Bhilai	
Dr Akanksha Jain, Asst Prof. Shri Shankaracharya Mahavidyalaya, Bhilai	
Dr Arun Kumar Kashyap, Asst Professor, Govt. E raghavendra Rao PG. Science College Bilaspur	
Dr Tarun Kumar Patel, Asst Professor, Sant Guru Ghasidas PG. College Kurud	
Dr Neha Behar, Asst Prof. DLS PG. College Bilaspur	
Dr Sanjana Bhagat, Asst Prof. Govt Ngarjuna PG. Science College, Raipur	
Dr Kamlesh Shukla, PRSU, Raipur	
Dr Ashish Kumar, Sant Gahira Guru Vishwavidyalay Sarguja	

Part A: Introduction				
Program: Diploma Course		Class: B.Sc. II Year	Year: 2024	Session 2024-25
1	Course Code	BIOT-4T		
2	Course Title	RECOMBINANT DNA TECHNOLOGY AND GENOMICS		
3	Course Type	Theory		
4	Pre-requisite (if any)	As per Govt. norms		
5	Course Learning Outcomes (CLO)	At the end of this course, the students will be able to: • Understand the fundamentals of Genetic engineering and biological databases • learn the basic techniques of RDT • Understand the concept of genomics		
6	Credit Value	Theory: 4		
7	Total Marks	**Max. Marks:** 50	**Min Passing Marks:** 17	

Part B: Content of the Course		
Total No. of Teaching – Periods- 60 / Hours – 40		
Unit	**Topics**	No. of Period / Hour
1	1. Recombinant DNA technology: General concept. Steps in gene cloning and application. 2. Restriction Modification System, Ligases and Polymerases, Klenow fragment, Taq. Pfu polymerase and Nuclease (Endo, Exo and restriction endonuclease). 3. Modification Enzyme (Kinase, Phosphates and terminal deoxynucleotidyl transferase). Reverse Transcriptase.	12 Periods / 08 Hours
2	1. Vectors: Plasmid, Bacteriophages, Cosmid, Phagemid, BAC, YAC and Expression vectors. 2. Gene Library: Genomic and cDNA library. 3. Selection and Screening of Recombinants: Genetic (Blue White Screening) and Hybridization methods- Colony hybridization and immunoblotting	12 Periods / 08 Hours
3	1. PCR: Types of PCR, Steps (Denaturation, Annealing and Extension); Applications, Advantages and Limitation of PCR. 2. Molecular Marker-RFLP, RAPD, AFLP, SSR SNP . 3. Site Directed Mutagenesis, Gene Silencing (siRNA, miRNA)	12 Periods / 08 Hours
4	1. Basic concept of Gene Transfer Methods: Microinjection, Electroporation, Lipofection. 2. Gene Therapy: In vivo and Ex vivo, Germ line and Somatic gene therapy. 3. Basic idea of Stem cell technology: Types of stems cell cultures and their Significance.	12 Periods / 08 Hours
5	1. Basic concept of Genomics: Structural and Functional Genomics 2. Shot Gun and Whole Genome Sequencing 3. Comparative Genomics: RT-PCR, SAGE, Microarray 4. Human Genome Project.	12 Periods / 08 Hours
Keywords: Genetic engineering, Gene therapy, Bioinformatics, Genomics, Molecular Markers, PCR		

Declaration

Syllabus is framed as per the ToR

Name	Signature
Dr DSVGK Kaladhar, Prof & Chairperson CBoS Biotechnology, UTD ABVV	
Dr Pramod Kumar Mahish, Asst. Professor Govt. Digvijay College Rajnandgaon	
Dr Saumya Khare, Asst Prof, Kalyan PG. College Bhilai	
Dr Shubha Thakur, Asst Prof, St. Thomas College Bhilai	
Dr Akanksha Jain, Asst Prof. Shri Shankaracharya Mahavidyalaya, Bhilai	
Dr Arun Kumar Kashyap, Asst Professor, Govt. E raghavendra Rao PG. Science College Bilaspur	
Dr Tarun Kumar Patel, Asst Professor, Sant Guru Ghasidas PG. College Kurud	
Dr Neha Behar, Asst Prof. DLS PG. College Bilaspur	
Dr Sanjana Bhagat, Asst Prof. Govt Ngarjuna PG. Science College, Raipur	
Dr Kamlesh Shukla, PRSU, Raipur	
Dr Ashish Kumar, Sant Gahira Guru Vishwavidyalay Sarguja	

Part A: Introduction				
Program: **Diploma Course**		Class: **B.Sc. II Year**	Year: 2024	Session: 2024-25
1	Course Code	BIOT-2P		
2	Course Title	**LAB 2: Molecular Biology, Bioinstrumentation, and Genomics**		
3	Course Type	**Practical**		
4	Pre-requisite (if any)	As per Govt. norms.		
5	Course Learning Outcomes (CLO)	At the end of this course, the students will be able to: • Understand on fundamentals of Recombinant DNA Technology. • Understand on estimation of DNA and RNA. • Understand on the concept of bioinformatics		
6	**Credit Value**	**Practical: 2**		
7	**Total Marks**	**Max. Marks: 50**	**Min Passing Marks : 17**	

Part B: Content of the Course	
	Total No. of Teaching Hours – 20 / 30 Periods
Tentative Practical List	**Note:** This is tentative list; the teachers concern can add more program as per requirement. 1. Preparation of LB broth and agar 2. Isolation of DNA from Plant cell. 3. Estimation of DNA by DPA method. 4. Isolation RNA from yeast cells 5. Use of Centrifugation 6. Determination of glucose concentration using Spectrophotometer/Colorimeter 7. Electrophoresis, Agarose gel and SDS PAGE 8. Isolation of primary metabolites and Secondary metabolites from Paper chromatography/TLC 9. Retrieve DNA /Protein sequence from Biological Data Bases (NCBI). 10. Use of Bioinformatics tools studied 11. Primer designing 12. Study of similar sequence alignment using BLAST and Clustal W 13 Generating phylogenetic tree using MEGA 14. Tertiary structure prediction using SWISSMODEL
Keywords: DNA/RNA Isolation, NCBI, BLAST, Electrophoresis, TLC	

Part C - Learning Resource

Text Books, Reference Books, Other Resources

Suggested Readings:

1. Lehninger: Principles of Biochemistry (2013) 6th ed., /Nelson, D.L. and Cox, M.M., W H Freeman and Company (New York), ISBN:13: 978-1-4641-0962-1 / ISBN:10:1-4292- 3414-8.
2. Devlin, T.M., Textbook of Biochemistry with Clinical Correlations (2011) 7th ed., John Wiley & Sons, Inc. (New York), ISBN: 978-0-470-28173-4 / BRV ISBN: 978-0-470- 60152-5.
3. Karp, G. 2010. 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. 8th edition Lippincott Williams and Wilkins, Philadelphia.
5. Cooper, G.M. and Hausman. R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
6. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009 The World of the Cell 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.
7. Donald, V. and Judith G.V., Biochemistry (2011) 4th ed., John Wiley & Sons Asia Pvt. Ltd. (New Jersey), ISBN:978-1180-25024.
8. Nicholas C.P. and Lewis S Fundamentals of Enzymology (1999) 3rd ed., Oxford University Press Inc. (New York), ISBN:0 19 850229 X.

9. Berg, J.M., Tymoczko, J.L. and Stryer L.,Biochemistry (2012) 7th ed., W.H. Freeman and Company (New York), ISBN:10:1-4292-2936-5, ISBN:13:978-1-4292-2936-4
10. Akanksha Jain, Sonia Bajaj, Sushma Solanki (2022) Text book of Biotechnology, Probecell Press

E-learning Resources:

https://ia600105.us.archive.org/30/items/FundamentalsBiochemistry4e_201802/FundamentalsBiochemistry4e.pdf
https://vlab.amrita.edu/?sub=3&brch=273
https://britannica.com
https://en.wikibooks.org/wiki/Biochemistry
https://nptel.ac.in
https://www.biointeractive.org/classroom-resources/bacterial-identification-virtual-lab
https://www.vlab.co.in/

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 50
Continuous Comprehensive Evaluation (CCE): Not Applicable
University Exam(UE): 50 Marks

Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test/Assignment/Presentation	Not Applicable
External assessment University Exam (UE)	As per Govt. norms.	

Declaration

Syllabus is framed as per the ToR

Name	Signature
Dr DSVGK Kaladhar, Prof & Chairperson CBoS Biotechnology, UTD ABVV	
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Dr Saumya Khare, Asst Prof, Kalyan PG. College Bhilai	
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Dr Kamlesh Shukla, PRSU, Raipur	
Dr Ashish Kumar, Sant Gahira Guru Vishwavidyalay Sarguja	

Scheme of B.Sc. Computer Science

Year	Course Code	Subject Name	Theory/ Practical	Total Credit	Total Marks	
					Max	Min
Second	COMP -3T	Data Structure	Theory	4	50	17
	COMP -4T	Web technology and Java	Theory	4	50	17
	COMP -2P	Lab 2: Web technology and Java	Practical	2	50	17

Part A: Introduction				
Program: **Diploma Course**		Class: **B.Sc.-CS II Year**	Year: 2024	Session: 2024-25
1.	Course Code	**COMP-3T**		
2.	Course Title	**Data Structure**		
3.	Course Type	**Theory**		
4.	Pre-requisite (if any)	No		
5.	Course Learning Outcomes (CLO)	At the end of this course, the students will be able to: • Use different types of data structures, operations and algorithms. • Implement appropriate sorting/searching technique for any given problem. • Use stack, Queue, Lists, Trees and Graphs in problem solving. • Find suitable data structure during application development/ Problem Solving.		
6.	**Credit Value**	**Theory: 4**		
7.	**Total Marks**	**Max Marks: 50**	**Min Passing Marks: 17**	

Part B: Content of the Course		
Total Periods: 60		
Unit	**Topics**	**No. of Periods**
I	**Introduction and Basic Concepts of Data Structure:** Data types: primitive, non-primitive data types, ADT, Linear and nonlinear data structure. **Linear Data Structures**: Arrays: One dimensional, Multidimensional array, allocation methods, address calculations, sparse arrays. Linked List: Singly and Doubly Linear link lists, singly and doubly circular linked list: Definitions, operations (INSERT, DELETE, TRAVERSE) on these lists. (Insertion operation includes – insertion before a given element, insertion after a given element, insertion at given position, insertion in sorted linked list)	12
II	**Stack:** Stack: Definition, Operations PUSH, POP, TRAVERSE, implementations using array and linked list, Applications of stack: Infix, Prefix, Postfix representation and conversion using stack, Postfix expression evaluation using stack. **Queue:** Introduction, and Types of Queues: Priority Queue, Circular queue, Double Ended Queue, operations (INSERT, DELETE, TRAVERSE), implementation using array and linked list and applications	12
III	**Non-linear Data Structure:** Trees: Definition of trees and their types, Binary trees, Properties of Binary trees and Implementation operation (Insertion, deletion, searching and traversal algorithm: preorder, post order, in-order traversal), Binary Search Trees, Implementations, Threaded trees, AVL Trees.	12
IV	**Graph:** Definition of Graph and their types, adjacency and incident (matrix & linked list) representation of graphs, Graph Traversal – Breadth first Traversal, Depth first Traversal, Connectivity of graphs; Weighted Graphs, Shortest path Algorithm, spanning tree, Minimum Spanning tree, Kruskal's and prim's algorithms. Static Hashing: Introduction, Hash table, Hash function.	12

V.	**Sorting Methods:** Types of sorting, Sequential Sort, Insertion Sort, Bubble Sort, Quick Sort, Merge Sort. **Searching:** Linear search, Binary search, Hashing, collision resolution methods, Comparison of Search trees.	12
Keywords: Linear Data Structure, Non-linear Data Structure, Searching, Sorting, Graph.		

Part C - Learning Resources

Text Books, Reference Books, Other Resources

Suggested Readings:

1. "Data Structures and Algorithms in C++", Michael T. Goodrich, Wiley, 2007
2. "Fundamentals of Data Structures", Horowitz and Sahani, Computer Science Press, 1978
3. "Data structures and Algorithms", Aefred V. Aho, Jhon E. Joperoft and J.E. Ullman.
4. "An Introduction to Data Structures with Applications", Jean Paul Trembley and Paul Sorenson, TMH, International Student Edition, 1985
5. "Data Structures and Program Design in C", R. Kurse, Leung &Tondo, 2nd Edition, PHI publication

E- Resources:

1. Introduction to Data Structure
   https://www.youtube.com/watch?v=zWg7U0OEAoE&list=PLBF3763AF2E1C572F&index=1
2. Stacks
   https://www.youtube.com/watch?v=g1USSZVWDsY&list=PLBF3763AF2E1C572F&index=2
3. Queues and linked list
   https://www.youtube.com/watch?v=PGWZUgzDMYI&list=PLBF3763AF2E1C572F&index=3
4. Trees
   https://www.youtube.com/watch?v=tORLeHHtazM&list=PLBF3763AF2E1C572F&index=6
5. Graphs
   https://www.youtube.com/watch?v=9zpSs845wf8&list=PLBF3763AF2E1C572F&index=24

Part D: Assessment and Evaluation

Maximum Marks: 50

Part A: Introduction				
Program: **Diploma Course**		Class: **B.Sc.-CS II Year**	Year: 2024	Session: 2024-25
1.	Course Code	**COMP-4T**		
2.	Course Title	**Web Technology and Java**		
3.	Course Type	**Theory**		
4.	Pre-requisite (if any)	Basic understanding of programming concepts and programming language		
5.	Course Learning. Outcomes (CLO)	At the end of this course, the students will be able to: • Create applications using HTML, CSS and Java Script. • Understand fundamental tools and technologies for web design. • Specify design rules in constructing web pages and sites. • Understand how web pages are designed and created. • Design console-based GUI based and web based application. • Front end designing using html, CSS, java script and bootstrap. • Develop server-side programs in the form of Servlet. • Designing web application by using JSP as a server-side programming. • Design and implement dynamic websites with good aesthetic sense of designing and latest technical know-how's Create web pages using HTML and Cascading Styles sheets. • Analyze a web page and identify its elements and attributes Create dynamic web pages using JavaScript. • Build web applications using JSP and Servlet.		
6.	Credit Value	**Theory: 4**		
7.	**Total Marks**	**Max. Marks: 50**	**Min Passing Marks : 17**	

Part B: Content of the Course		
Total Periods: 60		
Unit	**Topics**	No. of Periods
I	**Introduction:** Overview of WWW, Web page, Web browsers, HTTP, URL, Hypertext, Web server, Tools for web site development, hosting options and domain name registration. **Markup language:** Introduction, DTD, Creating Web pages, Headings, Paragraphs, Lists, Hyperlinks, Tables, Web forms, Input Types, Input Attributes, Inserting images, Frames, Basics of DHTML, XML , XHTML.	12

II	**Web Development:** CSS- Introduction, Syntax, measurement units, colors, Backgrounds, Font, Text, position, Align, Images, Link, Table, List, Padding. **JavaScript:** Overview, syntax, Variables, Operators, Decision control statement, Looping statement, JavaScript functions, Java script Events, Cookies, Page Redirect, and Validation. **Bootstrap:** Introduction, Grid system, typography, tables, images, dropdowns, jumbotron, them, template and forms. **PHP:** Introduction, syntax, variables, operators, functions, include, get method, post method, cookies, session, PHP form validation, exception.	12
III	**JAVA:** Primitive Data Types, Variables, Array, operators, control statements, classes and objects, Abstract Classes, Polymorphism, Inheritance, Method Over-writing, method overriding, constructor, super keyword, this keyword, final static, package and interface, Multi-threading and Exception Handling, Collection Framework. Introduction to applet.	12
IV.	**Java Server Page (JSP):** Basics of Servlet, writing simple program in Servlet, Introduction to Java Server Page (JSP), Embedding Java Code into HTML, Implicit JSP Objects, Overview of the JSP Tags, Directives, Declarations, Expressions, Deploying Servlet and JSP, JSTL, JSP Action elements: jsp:forward, jsp:include, JSP Request, JSP Response, JSP Config, JSP Session, Cookies, JSP Exception Handling.	12
V.	**Database Using JDBC:** Concept, JDBC Driver Types, JDBC package, establishing a database connection and executing SQL Statements.	12
Keywords: Web Designing, Collection Framework, Servlet, JSP, Database Connectivity.		

Part C: Learning Resources

Text Books, Reference Books, Other Resources

Suggested Readings:

1. The Complete Reference JAVA, Herbert Scheldt, Tata McGraw Hill publication, 5° Edition.
2. Advance JAVA, Gajendra Gupta, Firewall Media, 1" Edition, 2006.
3. JAVA network programming, Elliotte Rusty Harold, O'Reilly Publication, 3" Edition.
4. Core Java for Beginners, Rashmi Kanta Das, Vikas Publishing House Pvt. Ltd.
5. Internet and Internet Engineering, Daniel Minoli, TMH (Latest Edition)
6. Java Script, Gosslin, Vikas (Latest Edition)
7. HTML The Definite Guide, Chuck musiano& Bill Kenndy, O Reilly (Latest Edition).

E Resources:

1. Introduction to web-app
   https://www.youtube.com/watch?v=lZnp3tRRTzw&list=PLJ5C_6qdAvBEJ6-TBzKoa1Ov21lwDzJfM&index=22
2. Building web-app
   https://www.youtube.com/watch?v=kIEn4LqAQlE&list=PLJ5C_6qdAvBEJ6-TBzKoa1Ov21lwDzJfM&index=3
3. Introduction to Java Script
   https://www.youtube.com/watch?v=fRbP92oScp0&list=PLJ5C_6qdAvBEJ6-TBzKoa1Ov21lwDzJfM&index=10
4. Introduction to Database
   https://www.youtube.com/watch?v=mtc0HHrUKpI&list=PLJ5C_6qdAvBEJ6-TBzKoa1Ov21lwDzJfM&index=12
5. Introduction to SQL
   https://www.youtube.com/watch?v=ar2naKy0aPw&list=PLJ5C_6qdAvBEJ6-TBzKoa1Ov21lwDzJfM&index=16
6. Introduction to Java
   https://www.youtube.com/watch?v=OjdT2l-EZJA&list=PLfn3cNtmZdPOe3R_wO_h540QNfMkCQ0ho&index=1

Part D: Assessment and Evaluation

Maximum Marks: 50

Part A: Introduction		
Program: **Diploma Course**	Class: **B.Sc.-CS II Year** | Year: 2024	Session: 2024-25
1 Course Code	**COMP-2P**	
2 Course Title	**LAB 2: Web Technology and JAVA**	
3 Course Type	**Practical**	
4 Pre-requisite (if any)	Theoretical knowledge of HTML, CSS, JavaScript and JAVA	
5 Course Learning Outcomes (CLO)	At the end of course, Students will be able to: • Develop web-based application. • Develop front end application using front end technologies. • Demonstrate the principles of object-oriented programming. • Create multi-threaded programs and event handling mechanisms • Develop simple GUI interfaces for a computer program to interact with users. • Use form validation on web page. • Develop server-based application using Servlet and JSP.	
6 Credit Value	**Practical: 2**	
7 Total Marks	**Max. Marks: 50**	**Min Passing Marks : 17**

Part B: Content of the Course

Total Lecturer: 30

Tentative Practical List

Note: This is tentative list; the teachers concern can add more program as per requirement.

Developing Web based application based on the concept of Web design technologies and Java programming.

1. Design a Login Page by using HTML and CSS.
2. Write a program to perform validation on web page.
3. Design a web page to demonstrate registration form of student.
4. Design a from by using HTML and CSS who will take input from the user through Java-script Function and check weather it is integer or not.
5. Design a device friendly web page which should be able to resize the display depending on the device by using bootstrap.
6. Write a java program to create an abstract class named shape that contains two integers and an empty method named print Area () Provide three classes named Rectangle. Triangle and Circle such that each one of the classes extends the class shape. Each one of the class contains only the method print Area () that print the area of the given shape.
7. Write a Java program that implements a multithreaded program that has three threads. First thread generates a random integer every 1 second and if the value

	is odd the third thread will print the value of the cube of the number. 8. Write a java program which creates a list containing ice cream flavours. On selection of any flavour price should be displayed in a text field. 9. Write a JDBC program to create a table product (id number, name varchar, Price varchar). And insert a record in the table. 10. Write a program to execute a select query using JDBC. 11. Write a program to execute an Update query using JDBC. 12. Write a server program to return the square root of a number to the client using Socket. 13. Write a server program to return Date and time to clients using socket programming. 14. Write a JSP program for basic arithmetic functions. 15. Write a advance java program to implement registration of student by using JSP. 16. Write a program to design a web page for login form and connect to the database while using JSP and JDBC. 17. Write a program to design a simple calculator using (a) JavaScript (b) Servlet and (c) JSP. 18. A web application that lists all cookies stored in the browser on clicking "List Cookies" button. Add cookies if necessary. 19. Write a java program that connects to a database using JDBC and does add, deletes, modify and retrieve operations. 20. Develop an applet that displays a simple message.

Part C: Learning Resources

Text Books, Reference Books, Other Resources

Suggested Readings:

1. The Complete Reference JAVA, Herbert Scheldt, Tata McGraw Hill publication, 5° Edition.
2. Advance JAVA, Gajendra Gupta, Firewall Media, 1" Edition, 2006.
3. JAVA network programming, Elliotte Rusty Harold, O'Reilly Publication, 3" Edition.
4. Core Java for Beginners, Rashmi Kanta Das, Vikas Publishing House Pvt. Ltd.
5. Internet and Internet Engineering, Daniel Minoli, TMH (Latest Edition)
6. Java Script, Gosslin, Vikas (Latest Edition)
7. HTML The Definite Guide, Chuck musiano& Bill Kenndy, O Reilly (Latest Edition).

E Resources:

1. Introduction to web-app
https://www.youtube.com/watch?v=IZnp3tRRTzw&list=PLJ5C_6qdAvBEJ6-TBzKoa1Ov21IwDzJIM&index=22

TBzKoa1Ov2HwDzJfM&index=22

- Building web-app
  https://www.youtube.com/watch?v=kILn4LqAQIE&list=PLJ5C_6qdAvBEJ6-TBzKoa1Ov2HwDzJfM&index=3
- Introduction to Java Script
  https://www.youtube.com/watch?v=fRbP92oScp0&list=PLJ5C_6qdAvBEJ6-TBzKoa1Ov2HwDzJfM&index=10
- Introduction to Database
  https://www.youtube.com/watch?v=mtc0HHrUKpI&list=PLJ5C_6qdAvBEJ6-TBzKoa1Ov2HwDzJfM&index=12
- Introduction to SQL
  https://www.youtube.com/watch?v=ar2naKy0aPw&list=PLJ5C_6qdAvBEJ6-TBzKoa1Ov2HwDzJfM&index=16
- Introduction to Java
  https://www.youtube.com/watch?v=OjdT2I-EZJA&list=PLfn3cNtmZdPOe3R_wO_h540QNfMkCQ0ho&index=1

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 50
Continuous Comprehensive Evaluation (CCE): Not Applicable
University Exam(UE): 50 Marks

Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test/Assignment/Presentation	Not Applicable

Part A: Introduction			
Program: **Diploma Course**	Class: **B.Sc.-IT II Year**	Year 2024	Session 2024-25

1.	Course Code	**BSCIT-3T**
2.	Course Title	**Data Communication and Networking**
3.	Course Type	**Theory**
4.	Pre-requisite (if any)	No
5.	Course Learning Outcomes (CLO)	At the end of this course, the students will be able to: • Understand the basic computer network technology • Understand and explain the data communication system and its components. • Identify the different types of network topologies and protocols. • Understand the layers of the OSI model and TCP/IP. • Expose wireless and wired LANs.
6.	**Credit Value**	**Theory: 5**
7.	**Total Marks**	**Max. Marks: 50** / **Min Passing Marks: 17**

Part B: Content of the Course		
Total Periods: 60		
Unit	**Topics**	**No. of Periods**
I	**Overview of Data Communication and Networking:** Data Communications: components, data representation, direction of data flow (simplex, half duplex , full duplex; Networks : distributed processing, network criteria , physical structure (type of connection , topology), categories of network (LAN, MAN, WAN), Protocol and standards; Reference Models: OSI & TCP/IP reference model comparative study.	12
II	**Physical layer:** Analog and Digital Transmission: Transmission Impairments, Data Rates Limits, Digital to Digital Conversion, Digital to Analog conversion, Analog To Digital Conversion: Modulation, Transmission Modes, Parallel, Serials Asynchronous and Synchronous communication; Constellation Diagram, Analog to Analog conversion, Bandwidth Utilization, Transmission Media: Multiplexing: FDM, WDM AND TDM, Guided Media: Twisted Pair, Coaxial and Fiber Optic, Unguided Media : Wireless , Radio Waves, Microwaves and Infrared.	12
III	**Data Link Layer:** Flow control: Protocols: Stop & wait ARQ, Go-Back-N ARQ, Selective repeat ARQ, HDLC; Medium Access Sub-layer: Point to point protocol, LCP, NCP, FDDI, token bus, token ring; Multiple Access Protocols: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, FDMA,TDMA,CDMA; Traditional Ethernet, Fast Ethernet.	12
IV	**Network Layer:** Internetworking Devices: Repeaters , Hubs , Bridges, Switches, Router , Gateway; Addressing: Internet address, classful address, subnetting, classless address; Routing: Techniques, static vs dynamic routing, and routing table for classful address; Routing Algorithms: Shortest path algorithm, flooding , distance vector routing , link state routing; Protocols: ARP, RARP, IP, ICMP, IPV6; Unicast and multicast routing protocols;	12

V.	**Transport Layer and Application Layer:** UDP,TCP; Congestion control algorithm: Leaky bucket algorithm, Token bucket algorithm, choke packets; Quality of service: techniques to improve Qos; DNS,SMTP, SNMP,FTP, HTTP, Firewalls; Modern Topics: Wireless LAN: IEEE 802.11;Introduction to Bluetooth,VLAN's, Cellular telephony & Satellite network.	12

Keywords: Networking Model, Communication Protocol, Transmission Media, Internetworking Devices.

Part C: Learning Resources

Text Books, Reference Books, Other Resources

Suggested Readings:

1. Data Communications and Networking, B.A. Forouzan, TMH, (Latest Edition)
2. Computer Networks, A.S. Tanenbaum, 4th Edition, Pearson Education/PHI
3. Data and Computer Communication, W. Stallings, 5th Edition, PHI/Pearson Education
4. Computer Networking – A top down approach featuring the internet, Kurose and Rose, Pearson Education.
5. Communication Networks, Walrand, TMH (Latest Edition)

E Resources:

1. NPTEL URL link for Data Communication:
   https://nptel.ac.in/courses/106105082
   Topics From SWAYAM Portal
2. Introduction to Data Communication
   https://www.youtube.com/watch?v=swtH_okidQc&list=PLUtfVcb-iqn8dG1-Cn7NTEdILR3hRVgcN&index=1
3. Layered Architecture
   https://www.youtube.com/watch?v=xHO6LjSHeo0&list=PLUtfVcb-iqn8dG1-Cn7NTEdILR3hRVgcN&index=2
4. Data and Signal
   https://www.youtube.com/watch?v=6ZGVZ7gUccE&list=PLUtfVcb-iqn8dG1-Cn7NTEdILR3hRVgcN&index=3
5. Guided Transmission Media
   https://www.youtube.com/watch?v=y7v3EAJsWXA&list=PLUtfVcb-iqn8dG1-Cn7NTEdILR3hRVgcN&index=5
6. Unguided Transmission Media
   https://www.youtube.com/watch?v=hKq1tYlVxdQ&list=PLUtfVcb-iqn8dG1-Cn7NTEdILR3hRVgcN&index=6

Part D: Assessment and Evaluation

Maximum Marks: 50

Part A: Introduction				
Program: **Diploma Course**		Class: **B.Sc.-IT II Year**	Year: 2024	Session: 2024-25
1.	Course Code	**BSCIT-4T**		
2.	Course Title	**Web Technology and Java**		
3.	Course Type	**Theory**		
4.	Pre-requisite (if any)	Basic understanding of programming concepts and programming language		
5.	Course Learning Outcomes (CLO)	At the end of this course, the students will be able to: • Create applications using HTML, CSS and Java Script. • Understand fundamental tools and technologies for web design. • Specify design rules in constructing web pages and sites. • Understand how Web pages are designed and created. • Design console-based GUI based and Web based application. • Front end designing using html, CSS, java script and bootstrap. • Develop server-side programs in the form of Servlet. • Designing Web application by using JSP as a server-side programming. • Design and implement dynamic websites with good aesthetic sense of designing and latest technical know-how's Create web pages using HTML and Cascading Styles sheets. • Analyze a web page and identify its elements and attributes Create dynamic web pages using JavaScript. • Build web applications using jsp and Servlet.		
6.	**Credit Value**	**Theory:4**		
7.	**Total Marks**	**Max. Marks: 50**	**Min Passing Marks : 17**	

Part B: Content of the Course		
Total Periods: 60		
Unit	**Topics**	**No. of Periods**
I	**Introduction:** Overview of WWW, Web page, Web browsers, HTTP, URL, Hypertext, Web server, Tools for web site development, hosting options and domain name registration. **Markup language:** Introduction, DTD, Creating Web pages, Headings, Paragraphs, Lists, Hyperlinks, Tables, Web forms, Input Types, Input Attributes, Inserting images, Frames, Basics of DHTML, XML , XHTML.	12
II	**Web Development:** CSS-Introduction, Syntax, measurement units, colors, Backgrounds, Font, Text, position, Align, Images, Link, Table, List, Padding. **JavaScript:** Overview, syntax, Variables, Operators, Decision control statement, Looping statement, JavaScript functions, Java script Events, Cookies, Page Redirect, and Validation. **Bootstrap:** Introduction, Grid system, typography, tables, images, dropdowns, jumbotron, them, template and forms. **PHP:** Introduction, syntax, variables, operators, functions, include, get method, post method, cookies, session, PHP form validation, exception.	12

III	**JAVA:** Primitive Data Types, Variables, Array, operators, control statements, classes and objects, Abstract Classes, Polymorphism, Inheritance, Method Over-writing, method overriding, constructor, super keyword, this keyword, final static, package and interface, Multi-threading and Exception Handling, Collection Framework, Introduction to applet.	12
IV.	**Java Server Page (JSP):** Basics of Servlet, writing simple program in Servlet, Introduction to Java Server Page (JSP), Embedding Java Code into HTML, Implicit JSP Objects, Overview of the JSP Tags, Directives, Declarations, Expressions, Deploying Servlet and JSP, JSTL, JSP Action elements: jsp:forward, jsp:include, JSP Request, JSP Response, JSP Config, JSP Session, Cookies, JSP Exception Handling.	12
V.	**Database Using JDBC:** Concept, JDBC Driver Types, JDBC package, establishing a database connection and executing SQL Statements.	12
Keywords: Web Designing, Collection Framework, Servlet, JSP, JDBC, Database Connectivity.		

Part C: Learning Resources

Text Books, Reference Books, Other Resources

Suggested Readings:

1. The Complete Reference JAVA, Herbert Scheldt, Tata McGraw Hill publication, 5° Edition.
2. Advance JAVA, Gajendra Gupta, Firewall Media, 1" Edition, 2006.
3. JAVA network programming, Elliotte Rusty Harold, O'Reilly Publication, 3" Edition.
4. Core Java for Beginners, Rashmi Kanta Das, Vikas Publishing House Pvt. Ltd.
5. Internet and Internet Engineering, Daniel Minoli, TMH (Latest Edition)
6. Java Script, Gosslin, Vikas (Latest Edition)
7. HTML The Definite Guide, Chuck musiano& Bill Kenndy, O Reilly (Latest Edition).

E Resources:

1. Introduction to web-app
   https://www.youtube.com/watch?v=IZnp3tRRTzw&list=PLJ5C_6qdAvBEJ6-TBzKoa1Ov21lwDzJfM&index=22
2. Building web-app
   https://www.youtube.com/watch?v=kIEn4LqAQlE&list=PLJ5C_6qdAvBEJ6-TBzKoa1Ov21lwDzJfM&index=3
3. Introduction to Java Script
   https://www.youtube.com/watch?v=fRbP92oScp0&list=PLJ5C_6qdAvBEJ6-TBzKoa1Ov21lwDzJfM&index=10
4. Introduction to Database
   https://www.youtube.com/watch?v=mtc0HHrUKpI&list=PLJ5C_6qdAvBEJ6-TBzKoa1Ov21lwDzJfM&index=12
5. Introduction to SQL
   https://www.youtube.com/watch?v=ar2naKy0aPw&list=PLJ5C_6qdAvBEJ6-TBzKoa1Ov21lwDzJfM&index=16
6. Introduction to Java
   https://www.youtube.com/watch?v=0jdT2I-EZJA&list=PLfn3cNtmZdPOe3R_wO_h540QNfMkCQ0ho&index=1
   https://www.w3schools.com/java/

7. **Introduction to Web Technology:** https://www.w3schools.com/
Part D: Assessment and Evaluation
Maximum Marks: 50

	is odd the third thread will print the value of the cube of the number. 8. Write a java program which creates a list containing ice cream flavours. On selection of any flavour price should be displayed in a text field. 9. Write a JDBC program to create a table product (id number, name varchar. Price varchar). And insert a record in the table. 10. Write a program to execute a select query using JDBC. 11. Write a program to execute an Update query using JDBC. 12. Write a server program to return the square root of a number to the client using Socket. 13. Write a server program to return Date and time to clients using socket programming. 14. Write a JSP program for basic arithmetic functions. 15. Write a advance java program to implement registration of student by using JSP. 16. Write a program to design a web page for login form and connect to the database while using JSP and JDBC. 17. Write a program to design a simple calculator using (a) JavaScript (b) Servlet and (c) JSP. 18. A web application that lists all cookies stored in the browser on clicking "List Cookies" button. Add cookies if necessary. 19. Write a java program that connects to a database using JDBC and does add, deletes, modify and retrieve operations. 20. Develop an applet that displays a simple message.

Part C: Learning Resources
Text Books, Reference Books, Other Resources
Suggested Readings: 1. The Complete Reference JAVA, Herbert Scheldt, Tata McGraw Hill publication, 5th Edition. 2. Advance JAVA, Gajendra Gupta, Firewall Media, 1" Edition, 2006. 3. JAVA network programming, Elliotte Rusty Harold, O'Reilly Publication, 3" Edition. 4. Core Java for Beginners, Rashmi Kanta Das, Vikas Publishing House Pvt. Ltd. 5. Internet and Internet Engineering, Daniel Minoli, TMH (Latest Edition) 6. Java Script, Gosslin, Vikas (Latest Edition) 7. HTML The Definite Guide, Chuck musiano& Bill Kenndy, O Reilly (Latest Edition). **E Resources:**

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- Building web-app
  https://www.youtube.com/watch?v=klEn4LqAQlE&list=PLJ5C_6qdAvBEJ6-TBzKoa1Ov21lwDzJfM&index=3
- Introduction to Java Script
  https://www.youtube.com/watch?v=fRbP92oScp0&list=PLJ5C_6qdAvBEJ6-TBzKoa1Ov21lwDzJfM&index=10
- Introduction to Database
  https://www.youtube.com/watch?v=mtc0HHrUKpI&list=PLJ5C_6qdAvBEJ6-TBzKoa1Ov21lwDzJfM&index=12
- Introduction to SQL
  https://www.youtube.com/watch?v=ar2naKv0aPw&list=PLJ5C_6qdAvBEJ6-TBzKoa1Ov21lwDzJfM&index=16
- Introduction to Java
  https://www.youtube.com/watch?v=OjdT2l-EZJA&list=PLfn3cNtmZdPOe3R_wO_h540QNfMkCQ0ho&index=1

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 50
Continuous Comprehensive Evaluation (CCE): Not Applicable
University Exam(UE): 50 Marks

Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test/Assignment/Presentation	Not Applicable

Three Year (Yearly) Syllabus for Undergraduates

As recommended by Central Board of Studies of Electronics

For approval of Kuladhipati, Governor of Chhattisgarh

For Three Years 2023-26

July 2023 onwards

Class: B.Sc, Electronics

Scheme of Examination

Second Year (Under Graduate Diploma in Electronics)						
ELD-201T	Core Course-3	Operational Amplifier	50	-	100	33
ELD-202T	Core Course-4	Industrial Electronics	50	-		
ELD-203P	Core Course-3 & 4 Practical/Tutorial	Operational Amplifier and Industrial Electronics Lab	-	50	50	17

B. Sc. Part II

Paper I

ELD-201T: OPERATIONAL AMPLIFIERS

Theory: **Max. Marks : 50**

Aims & Objectives

To learn the differential amplifier, basic Op-amp circuits, various parameters of Op-amp, applications of Op-amp namely summing and difference amplifiers, Multivibrator using Op-amp.

Course Learning Outcomes:

After the completion of the course, Students will be able to

1. Define the basic concepts related to Op-amp and explain the working of op-amp based circuits.
2. To understand the applications of Op-amp namely summing, difference, voltage to current converter etc.
3. To understand the IC regulation and multivibrator.

Unit-1

Differential Amplifiers: Dual input balanced and unbalanced output, constant current bias, current mirror, cascaded differential amplifier stages with concept of level translator.

Basic Operational Amplifier: block diagram of an operational amplifier (IC 741), Inverting and non-inverting input and virtual ground

Unit-2

Op-Amp Parameters: Input offset voltage, input offset current, input bias current, differential input resistance, input capacitance, offset voltage adjustment range, input voltage range, common mode rejection ratio, slew rate, supply voltage rejection ratio.

Op-Amp Circuits: Open and closed loop configuration, Frequency response of an op-amp in open loop and closed loop configurations, Inverting, Non-inverting,

Unit-3

Op- Amp Applications Summing and difference amplifier, Integrator, Differentiator, Voltage to current converter, Current to voltage converter.

Comparators: Basic comparator, Level detector, Voltage limiters, Schmitt Trigger.

Signal Generators: Phase shift oscillator, Wien bridge oscillator, Square wave generator, triangle wave generator, saw tooth wave generator, and Voltage controlled oscillator.

22.2.2023

Unit-4

Fixed and Variable IC Regulators: IC 78xx and IC 79xx -concepts only. IC LM317- output voltage equation

Signal Conditioning Circuits: Sample and hold systems. Active filters: First order low passand high pass butterworth filter. Second order filters. Band pass filter. Band reject filter. All pass filter. Log and antilog amplifiers.

Unit-5

Multivibrators Circuit using Op-Amp: Block diagram. Astable and monostable multivibrator circuit. Applications of Monostable and Astable multivibrators, Phase locked loops (PLL): Block diagram. phase detectors. IC565.

Reference Books:

1. R. A. Gayakward. Op-Amps and Linear IC's. Pearson Education (2003)
2. R.F. Coughlin and F.F. Driscoll. Operational amplifiers and Linear Integrated circuits. Pearson Education (2001)
3. J. Millman and C.C. Halkias. Integrated Electronics. Tata McGraw-Hill (2001)

22.2.23 22-2-2023

Paper II

ELD-202T: INDUSTRIAL ELECTRONICS

Theory: **Max. Marks :50**

Aims & Objectives

To understand the industrial electronics, related devices, applications of various devices, PCB fabrications.

Course Learning Outcomes:

After the completion of the course, Students will be able to

1. Student will be able to understand basic knowledge of Thyristor family.
2. Student will be able to understand phase control operation of different power electronic devices.
3. Student will be able to understand the controlled rectifications.
4. Student will be able to understand mechanism of inverters and choppers.
5. Student will be able to understand various types of PCBs and schematic design.

Unit-1

Thyristors: Principles and operations of SCR, Voltage amplifier gate characteristics of SCR, Characteristics of two transistor models, Thyristor construction, Rectifier circuit using SCR,GTO, Operation and characteristics of DIAC, TRIAC, Silicon Controlled Switch, Silicon Unilateral Switch, Silicon Bilateral Switch, and Light activated SCR. Turn ON/OFF Mechanism: Basics of turn on and turn off methods

Unit-2

Applications of SCR: Multiple connections of SCR, Series operation, Triggering of seriesconnected SCR, Parallel operation, Triggering of parallel connected SCR, SCR di/dtcalculation, Snubber circuit, dv/dt calculation across SCR, Types of converters, Full wave controlled rectifier with resistive load, FWCR with inductive load, FWCR with free wheeling diode .

Unit-3

Inverters: Types of inverters, Single phase bridge inverter, Mc Murray impulse communication inverter, Single phase half bridge voltage source inverter, Single phase fullbridge voltage inverter, Step down choppers, Step up choppers, Chopper classification.

Other Applications: Induction heating, Resistance welding, Over voltage protection, Zerovoltage switch, SMPS,UPS, DC circuit breaker, Battery charger, AC static switch, DC staticswitch, Time delay, Fan regulator using TRIAC .

Unit-4

PCB Fundamentals: PCB Advantages, components of PCB, Electronic components, IC's, Surface Mount Devices (SMD).Classification of PCB - single, double, multilayer and flexible boards. Manufacturing of PCB, PCB standards.

Schematic & Layout Design: Schematic diagram, General, Mechanical and Electricaldesign considerations, Placing and Mounting of components, Conductor spacing, routingguidelines, heat sinks and package density, Net list, creating components for library, Tracks,Pads, Vias, power plane, grounding, Lead cutting and Soldering Techniques, Testing and quality controls.PCB Technology Trends, Environmental concerns in PCB industry.

Unit-5

Analog/Digital Multimeter: Analog multimeter, AC and DC measurement, conversion of analog output to digital form (A/D), Dual ramp A/D converter, digital measuring system, multimeter block diagram, voltage, current and resistance measurements. Frequency counter: Elements of electronic counter, decade counting assembly temperature compensated crystal oscillator, universal counter, measurement modes: frequency measurement, period measurement, time interval measurement, measurement errors: gating errors, time base error, trigger level error.

Reference Books:

1. Ramamourthy " Thyristor and their applications" East-West Publishers, 2nd Edition
2. Shamir K Datta " Power Electronics and Controllers" PHI, 3rd Edition
3. Power Electronics: Devices, Circuits and Industrial Applications
4. V.R. MoorthyOxford University Press; First Edition edition
5. Printed circuit Board – Design & Technology by Walter C. Bosshart, Tata McGraw Hill.
6. Printed Circuit Board –Design, Fabrication, Assembly & Testing by R.S.Khandpur, TATA McGraw Hill Publisher
7. Electronics Instrumentation H.S.Kalsi McGraw Hill Education; 3 edition (1 July 2017)
8. Modern Electronic Instrumentation and Measurement Techniques Albert Helfrick and William D Cooper Prentice Hall India Learning Private Limited
9. Electronic Instrumentation and Measurements David A. Bell Oxford University Press India; Third edition (12 April 2013)

22.2.23 22-2-2023

ELECTRONICS LABORATORY

ELD-203P: Operational Amplifier and Industrial Electronics Lab

Min. Marks: 17 **Max. Marks 50**

A student is required to do at least 14 experiment in an academic year. The scheme of practical examination will be as follows-

The scheme of practical examination will be as follows-

Experiment	--	**30**
Viva	--	**10**
Sessional	--	**10**
Total	--	**50**

1. To design inverting amplifier using Op-amp 741 for DC voltage and calculate the voltage gain.
2. To design non-inverting amplifier using Op-amp 741 for DC voltage and calculate the voltage gain.
3. To investigate the use of an Op-amp as an Integrator.
4. To investigate the use of an Op-amp as a Differentiator.
5. Study of IC OP-AMP application, viz. adder, subtractor.
6. Study of IC OP-AMP application, viz. integrator, differentiator.
7. Study of OP Amp: Inverting and non-Inverting amplifiers of different gains.
8. To design inverting amplifier using Opamp 741 for DC voltage and calculate the voltage gain.
9. To design non-inverting amplifier using Op-amp 741 for DC voltage and calculate the voltage gain.
10. To investigate the use of an Op-amp as an Integrator.
11. To investigate the use of an Op-amp as an Differentiator.
12. Study of astable multivibrator using Op-amp.
13. Study of bistable multivibrator using Op-amp.
14. Study of function generator.
15. Study of A/D Converter
16. Study of D/A Converter.
17. Study of SCR characteristics.
18. Study of Diac and Triac characteristics.
19. Study of UJT characteristics.
20. Study of UJT as a relaxation oscillator.

Design and Fabrication of Printed Circuit Boards

21. Design automation, Design Rule Checking: Exporting Drill and Gerber Files; Drills; Footprints and Libraries Adding and Editing Pins, copper clad laminates materials of copper clad laminates, properties of laminates (electrical & physical).
22. Study of soldering techniques. Film master preparation, Image transfer, photo printing, Screen Printing, Plating techniques etching techniques.
23. Study of Mechanical Machining operations, Lead cutting and Soldering Techniques, Testing and quality controls.
24. Study of Lead cutting and Soldering Techniques, Testing and quality controls.

Note:

1. Out of above mentioned twenty four experiments at least fourteen experiments should be done, use of bread board and soldering is expected for at least four experiment.
2. Other experiments of equal standard may also be set.

22.2.23 22-2-2023

Course curriculum B.Sc.-Subject -FORESTRY		
2nd Year		
6.	**Paper-First**(Forest Management & Forest Mensuration)	**18-25**
7.	**Paper-Second**(Wood anatomy & Minor Forest Produce)	**26-33**
8.	**Laboratory/practical**	**34-34**

Part A: Introduction				
Program: **Undergraduate Diploma**		Class: **B.Sc. 2nd Year, Paper-1**	Year: 2024	Session: 2024-25
1	Course Code	**BSLF21T**		
2	Course Title	**Forest Management &Forest Mensuration**		
3	Course Type	**Core Course (Theory)**		
4	Pre-requisite (if any)			
5	Course Learning . Outcomes (CLO)	The graduates should be able to demonstrate the acquisition of: ▪ Understand the forest growing stock and sustainable yield and know the objectives of forest management ▪ Learn the scope and aims of Social and joint forest management ▪ Know the concept forest organizationand forest tree measurement principle and technique. ▪ At the end of this course, the students will be able understand the concept of forest organization, management and forest tree measurement techniques for forest growth assessment.		
6	Credit Value	Theory : 4		
7	Total Marks	Max. Marks: 10+40	Min Passing Marks : 17	

Part B: Content of the Course		
Total No. of Lectures (in hours per week): 3 hours per week Total Lectures: 60 hours		
Class - B. Sc. - 2nd year, Paper-I Course Name - Forest Management &Forest Mensuration Core Course (Theory)		
Course Code - BSLF21T		**Credit - 4**
Unit	Topics	No. of Lectures
I	**Social Forestry** 1.1 Scope, Objectives and types 1.2 Importance of social Forestry schemes 1.3 Economic benefits of social forestry	10
II	**Joint Forest Management** 2.1 Definition , Scope and Objectives 2.2 JFM - History, Objectives, Peoples participation in forest management 2.3 Constraints in obtaining people's participation	10
III	**Forest Management** 3.1 Definition, Scope and Objectives 3.2 Brief of the following – 1. Growing stock 2. Rotation 3. Sustained yield 4. Normal Forest	10
IV	**Forest Mensuration** 4.1 Definition , Scope and Objectives 4.2 Measurement of tree height 4.3 Measurement of tree diameter 4.4 Measurement of tree girth 4.5 Measurement of tree volume and age	15
V	**Forest Organization** 5.1 Geographical, climatic and functional classification 5.2 Legal classification 5.3 Territorial classification 5.4 Management (Silvicultural) classification- Working circle, felling series , cutting section , coupes and periodic Block	15
Keywords: Social Forestry, JFM, Forest management, Mensuration, Forest Organization		

Part C - Learning Resource
Text Books, Reference Books, Other Resources

Suggested Readings:

Text Books:

1. Avery, T.E. 1967. Forest Measurements. Mc Grand Hill Book Company, New York.
2. Balakathiresan, S. 1986. Essentials of Forest Management, Nataraj Publishers, Dehradun. Bhattacharya P., Kandya A.K. and Krishna Kumar (2008). Joint Forest Management in India, Aavishkar Publisher, Jaipur.
3. Chaturvedi, A.N and L.S. Khanna. 2011. Forest Mensuration and Biometry (5th edition). Khanna Bandhu. Dehra Dun. 364 pp.
4. Chaturvedi, A.N. and L.S. Kanna. 1982. A handbook on Forest Mensuration. International Book Distributors
5. Hamilton, G.L. 1988. Forest Mensuration Handbook. Periodical Expert Book Agency.
6. Husch, B., C.I. Miller and T.N. Beers. 1982. Forest Mensuration. The Ronald Press Company, New York.
7. Kumar, V. 1995. Nursery and Plantation practices in Forestry. Scientific Publishers Jodhpur.
8. Maslekar, A.R. 1990. Foresters Companions. Jugal Kishore and Co. (Publn. Dvn.), Dehra Dun. P. 603.
9. Osmaston, F.C. Management of Forests, 1984. IBD Publication, Dehradun
10. Prakash, Ram. 1986. Forest Management. International Book Distributors, Dehradun, 256p.

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks : Continuous Comprehensive Evaluation (CCE) : University Exam (UE) :		50 Marks 10 Marks 40 Marks
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	1. Class Test (1 mark/unit) : 2. Assignment/Presentation :	05 Marks 05 Marks **Total Marks: 10**
External Assessment: University Exam (UE) Time: 02.00 Hours	**Section (A):** Ten Objectives-Fill in the blanks/True & False/Match the following/MCQ **Section (B):** Three Very Short Questions (50 Words Each) **Section (C):** Four Short Questions (200 Words Each) **Section (D):** Two Long Questions (500 Words Each)	0.5 x 10 = 05 03 x 03 = 09 04 x 04 =16 02 x 05 = 10 **Total Marks: 40**

भाग एः परिचय				
पाठ्यक्रम : स्नातक डिपलोमा		कक्षा : बी.एससी. द्वितीय वर्ष, पेपर– प्रथम	वर्ष : 2024	सत्र : 2024-25
विषय : वानिकी				
1	पाठ्यक्रम कोड	**BSLF21T**		
2	पाठ्यक्रम शीर्षक	वन प्रबंधन और वनमापिकी		
3	पाठ्यक्रम प्रकार	कोर कोर्स (सिद्धांत)		
4	पूर्व–अपेक्षित (यदि कोई हो)			
5	पाठ्यक्रम अध्ययन की परिलब्धियां(CLO)	स्नातकों के अधिग्रहण का प्रदर्शन करने में सक्षम होंगे– ▪ वन बढ़ते स्टॉक और टिकाऊ उपज को समझें और वन प्रबंधन के उद्देश्यों को जानेंगे ▪ सामाजिक और संयुक्त वन प्रबंधन के दायरे और उद्देश्यों को जानें ▪ वन संगठन और वन वृक्ष माप की अवधारणा को जानें सिद्धांत और तकनीक। ▪ इस पाठ्यक्रम के अंत में, छात्र वन विकास मूल्यांकन के लिए वन संगठन, प्रबंधन और वन वृक्ष मापन तकनीकों की अवधारणा को समझने में सक्षम होंगे।		
6	क्रेडिट मान	सिद्धांत: 4		
7	कुल अंक	**अधिकतम अंक:**10+40	**न्यूनतम उत्तीर्ण अंक:**17	

भाग बी : पाठ्यक्रम की विषयवस्तु
व्याख्यानकी कुल संख्या (प्रति सप्ताह घंटों में) : प्रति सप्ताह 3 घंटे
कुल व्याख्यान : 60 घंटे
कक्षा – बी.एससी.– द्वितीय वर्ष, पेपर–प्रथम
पाठ्यक्रम का नाम –वन प्रबन्धन एवं वन मापिकी
कोर कोर्स (सिद्धांत)

पाठ्यक्रम कोड:BSLF21T		क्रेडिट : 4
इकाई	विषय	व्याख्यान कीसंख्या
I	**सामाजिक वानिकी** 1.1 कार्यक्षेत्र, उद्देश्य और प्रकार 1.2 सामाजिक वानिकी योजनाओं का महत्व 1.3 के आर्थिक लाभ सामाजिक वानिकी	10
II	**संयुक्त वन प्रबंधन** 2.1 परिभाषा, दायरा और उद्देश्य 2.2 जेएफएम – इतिहास, उद्देश्य, वन प्रबंधन में लोगों की भागीदारी 2.3 लोगों की भागीदारी प्राप्त करने में बाधाएं	10
III	**वन प्रबंधन** 3.1 परिभाषा, दायरा और उद्देश्य 3.2 निम्नलिखित में से संक्षिप्त – 1. वन निधि(ग्रोईनग स्टॉक) 2. घूर्णन (रोटेशन) 3. सतत उपज (सस्टेनेबल ईल्ड) 4. सामान्य वन(नॉरमल फोरेस्ट)	10
IV	**वन मापन** 4.1 परिभाषा, दायरा और उद्देश्य 4.2 वृक्ष की ऊंचाई मापन 4.3 वृक्ष के व्यास मापन 4.4 वृक्ष की परिधि मापन 4.5 वृक्षों काआयतन और आयु का मापन	15
V	**वन संगठन** 5.1 भौगोलिक, जलवायु और कार्यात्मक वर्गीकरण 5.2 कानूनी वर्गीकरण 5.3 क्षेत्रीय वर्गीकरण 5.4 प्रबंधन (वनवर्धनीय) वर्गीकरण– वर्किंग सर्कल, फौलिंग सीरीज, कटिंग सेक्शन, कूप और (पीरियॉडिक बॉल्क)	15
कुंजी शब्द (कीवर्ड) :सामाजिक वानिकी, जेएफएम , वन प्रबंधन, क्षेत्रमिति, वन संगठन		

Part C - Learning Resource
Text Books, Reference Books, Other Resources

Suggested Readings:

Text /Reference Books:

11. Avery, T.E. 1967. Forest Measurements. Mc Grand Hill Book Company, New York.
12. Balakathiresan, S. 1986. Essentials of Forest Management, Nataraj Publishers, Dehradun. Bhattacharya P., Kandya A.K. and Krishna Kumar (2008). Joint Forest Management in India, Aavishkar Publisher, Jaipur.
13. Chaturvedi, A.N and L.S. Khanna. 2011. Forest Mensuration and Biometry (5th edition). Khanna Bandhu. Dehra Dun. 364 pp.
14. Chaturvedi, A.N. and L.S. Kanna. 1982. A handbook on Forest Mensuration. International Book Distributors
15. Hamilton, G.L. 1988. Forest Mensuration Handbook. Periodical Expert Book Agency.
16. Husch, B., C.I. Miller and T.N. Beers. 1982. Forest Mensuration. The Ronald Press Company, New York.
17. Kumar, V. 1995. Nursery and Plantation practices in Forestry. Scientific Publishers Jodhpur.
18. Maslekar, A.R. 1990. Foresters Companions. Jugal Kishore and Co. (Publn. Dvn.), Dehra Dun. P. 603.
19. Osmaston, F.C. Management of Forests, 1984. IBD Publication, Dehradun
20. Prakash, Ram. 1986. Forest Management. International Book Distributors, Dehradun, 256p.

भाग डी : अनुशंसित मूल्यांकन विधियाँ		
अनुशंसित सतत मूल्यांकन विधियाँ : **अधिकतम अंक :** **सतत व्यापक मूल्यांकन (CCE):** **विश्वविद्यालय परीक्षा (UE):**		 50 अंक 10 अंक 40 अंक
आंतरिक मूल्यांकन : सतत व्यापक मूल्यांकन (CCE)	1. कक्षा परीक्षा(1 अंक/ इकाई): 2. असाइनमेंट / प्रस्तुतिकरण:	05 अंक 05 अंक **कुल अंक: 10**
आकलन : विश्वविद्यालय परीक्षा (UE) समय : 02.00 घंटे	**अनुभाग (अ) :** दस वस्तुनिष्ठ प्रश्न – रिक्त स्थान भरें / सही और गलत / MCQ **अनुभाग (ब):** तीन अति लघु प्रश्न (प्रत्येक में 50 शब्द) **अनुभाग (स):** चार लघु प्रश्न (प्रत्येक 200 शब्द) **अनुभाग (द):** दो दीर्घ प्रश्न (प्रत्येक में 500 शब्द)	0.5 x 10 = 05 03 x 03 = 09 04 x 04 =16 02 x 05 = 10 **कुल अंक : 40**

Part A: Introduction				
Program: **Undergraduate Diploma**		Class: **B.Sc. 2nd Year, Paper-2**	Year: 2024	Session: 2024-25
1	Course Code	**BSLF22T**		
2	Course Title	**Wood anatomy & Minor Forest Produce**		
3	Course Type	**Core Course (Theory)**		
4	Pre-requisite (if any)			
5	Course Learning . Outcomes (CLO)	The graduates should be able to demonstrate the acquisition of: ▪ Understand the importance of forest for tribal livelihood and know about the important minor forest produce. ▪ Knowledge on forest wood based industries. ▪ Develop the concept on wood structure and wood logging ideas for feeling and conversion technique. ▪ At the end of this course, the students will be able know the importance of forest produce for livelihood of tribal and the constitutional rights of tribal on forest.		
6	Credit Value	Theory : 4		
7	Total Marks	Max. Marks: 10+40	Min Passing Marks : 17	

Part B: Content of the Course		
Total No. of Lectures (in hours per week): 3 hours per week Total Lectures: 60 hours		
Class - B. Sc. - 2nd year, Paper-2 Course Name - Wood anatomy & Minor Forest Produce Core Coursse (Theory)		
Course Code - BSLF22T		Credit - 4
Unit	Topics	No. of Lectures
I	**Wood Anatomy** 1.1 Introduction 1.2 Anatomical structure of word 1.3 Physical properties of word 1.4 Mechanical properties of word 1.5 Wood seasoning and preservation	15
II	**Logging** 2.1 Felling and conversion 2.2 Transportation of wood log 2.3 Storage 2.4 Grading of timber	10
III	**Non Wood Forest Produce (NWFPs)** 3.1 Definition of minor forest product 3.2 General idea of following NWFPs of India – 1. Fuelwood 2. Fibre and flosses 3. Grasses & Bamboos 4. Essential oils 5. TBOs 6. Tans and dyes 7. Medicinal plants	10
IV	**Wood Based Industries** 4.1 Pulp and paper 4.2 Lac and manufacture of shellac 4.3 Resin tapping and manufacture of turpentine and rosin 4.4 Charcoal manufacturing 4.5 Plywood industries 4.6 Bamboo based industries- Traditional & Modern	15
V	**Forest and Tribal** 5.1 Life and livelihood of tribal 5.2 Constitutional safeguards 5.3 Tribal welfare and development (State & Central Govt. Schemes)	10
Keywords: Wood anatomy, Logging, MFPs, Forest industries, Tribal rights		

Part C - Learning Resource

Text Books, Reference Books, Other Resources

Suggested Readings:

Text Books:

1. Baldwin, R. F. 1981. Plywood manufacturing practices. Revised 2nd Ed. Miller and Freeman Publication, Inc. USA. 388p.
2. Bowyer J. L., Shmulsky, R. and Haygreen, J. G. 2007. Forest products and wood science: An introduction. 5th Ed. Blackwell publishing, Ames, IA. 496p.
3. Brown, H. P. 1985. Manual of Indian wood technology. International books and periodicals supply service, New Delhi. 121 p.
4. Brown, N. C. 2002. Principles and methods of harvesting of timber. Biotech books, Delhi. 430p.
5. FRI [Forest Research Institute]. 1976. Indian forest utilization. Volume I and II. Forest Research Institute and colleges, Dehradun. 941p.
6. Gray, J. W. 1993. Forest resource systems in developing countries. Food and agricultural organization. Rome. 259p.
7. Hakkila, P. 1989. Utilization of residual forest biomass. Springer-verlag, Berlin. 567p.
8. Hoadley, B. 2000. Understanding Wood: A Craftsman's guide to wood technology. Taunton Press. Newtown, USA. 223p.
9. Mehta, Tribhvan. 1981. A Handbook of forest utilization. International Book Distributors, Dehradun. 298p.
10. Muraleedharan, P. K. Subramanian, K. K., and Pillai, P. P. 1998. Basic readings in forest economics. Kerala Forest Research Institute and Ford Foundation, Thrissur, Kerala. 177p
11. Panshin, A. J. and De Zeeuw, C. 1980. Textbook of wood technology, 4th Ed. McGraw-Hill. New York, USA: 722p.
12. Rao, K.R. and Juneja, K.B.S. 1992. Field identification of 50 important timbers of India. ICFRE Publi. Dehradun 123 p.
13. Sharma, R. N., Sharma, R.K. 1997. Anthropology. Atlantic Publishers & Distributors.
14. Sharma, R.N. and Bakshi, S. 1984. Tribes and tribal development. Uppal Publ. House, New Delhi
15. Tewari, D. N. 1995. Marketing and trade of forest produce; International Book Distributors (Book Sellers & Publishers), Dehradun, India. 140p.
16. Thakur, D. 1986. Socio-economic development of tribes in India. Deep and Deep Publications, New Delhi
17. Wakermann, A. E. 2002. Harvesting timber crops. Biotech books, Delhi. 433p.

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks : Continuous Comprehensive Evaluation (CCE) : University Exam (UE) :		50 Marks 10 Marks 40 Marks
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	1. Class Test (1 mark/unit) : 2. Assignment/Presentation :	05 Marks 05 Marks **Total Marks: 10**
External Assessment: University Exam (UE) Time: 02.00 Hours	**Section (A):** Ten Objectives-Fill in the blanks/True & False/Match the following/MCQ **Section (B):** Three Very Short Questions (50 Words Each) **Section (C):** Four Short Questions (200 Words Each) **Section (D):** Two Long Questions (500 Words Each)	0.5 x 10 = 05 03 x 03 = 09 04 x 04 =16 02 x 05 = 10 **Total Marks: 40**

भाग ए: परिचय			
पाठ्यक्रम : स्नातक डिपलोमा	कक्षा : बी.एससी. द्वितीय वर्ष पेपर– द्वितीय	वर्ष : 2024	सत्र : 2024-25
विषय : वानिकी			

1	पाठ्यक्रम कोड	**BSLF22T**
2	पाठ्यक्रम शीर्षक	काष्ठ रचना और लघु वन उत्पाद
3	पाठ्यक्रम प्रकार	कोर कोर्स (सिद्धांत)
4	पूर्व–अपेक्षित (यदि कोई हो)	
5	पाठ्यक्रम अध्ययन की परिलब्धियां(CLO)	स्नातक निम्नलिखित के अधिग्रहण को प्रदर्शित करने में सक्षम होना चाहिए– ▪ आदिवासी आजीविका के लिए वन के महत्व और महत्वपूर्ण लघु वन उपज के बारे में जानेंगे। ▪ वन लकड़ी आधारित उद्योगों पर ज्ञान। ▪ वृक्ष कटाई और रूपांतरण तकनीक के लिए लकड़ी की संरचना और लकड़ी के लॉगिंग विचारों पर अवधारणा विकसित होगा। ▪ इस पाठ्यक्रम के अंत में, छात्र आदिवासियों की आजीविका के लिए वन उपज के महत्व और वन पर आदिवासियों के संवैधानिक अधिकारों को जान सकेंगे।
6	क्रेडिट मान	सिद्धांत: 4
7	कुल अंक	अधिकतम अंक:10+40 / न्यूनतम उत्तीर्ण अंक:17

भाग बी : पाठ्यक्रम की विषयवस्तु
व्याख्यान की कुल संख्या (प्रति सप्ताह घंटों में) : प्रति सप्ताह 3 घंटे
कुल व्याख्यान : 60 घंटे
कक्षा – बी.एससी. – द्वितीय वर्ष, पेपर– द्वितीय
पाठ्यक्रम का नाम –काष्ठ रचना और लघु वन उत्पाद
कोर कोर्स (सिद्धांत)

पाठ्यक्रम कोड:**BSLF22T**		क्रेडिट : **4**
इकाई	**विषय**	**व्याख्यान कीसंख्या**
I	**काष्ठ रचना** 1.1 परिचय 1.2 काष्ठ संरचना 1.3 काष्ठ के भौतिक गुण 1.4 काष्ठकेयांत्रिक गुण 1.5 काष्ठका ऋतुकरणऔर संरक्षण	15
II	**लॉगिंग** 2.1 कटाई और रूपांतरण 2.2काष्ठलटठ्ठा (लॉग)का परिवहन 2.3 भंडारण 2.4 काष्ठका ग्रेडिंग	10
III	**गैर लकड़ी वन उत्पाद (एनडब्ल्यूएफपी)** 3.1 लघु वन उत्पाद की परिभाषा 3.2 भारत के निम्नलिखित एनडब्ल्यूएफपी का सामान्य अवधारणा– 1. ईंधन काष्ठ 2. रेशा और कपास 3. घांस एवं बांस 4. आवश्यक तेल 5. पेड़ पैदा तेल 6. टैन और रंजक 7.औषधीय पौधे	10
IV	**काष्ठ आधारित उद्योग** 4.1 लुगदी और कागज 4.2 लाख और चपड़ा का निर्माण 4.3 राल दोहन तारपीन और राल का निर्माण 4.4 चारकोल निर्माण 4.5 प्लाईवुड उद्योग 4.6 बांस आधारित उद्योग– पारंपरिक और आधुनिक	15
V	**काष्ठवन और जनजाति** 5.1 जनजातीय का जीवन और आजीविका 5.2 संवैधानिक सुरक्षा उपाय 5.3 जनजातीय कल्याण और विकास (राज्य और केंद्र सरकार योजनाएं)	10
कुंजी शब्द (कीवर्ड) :लकड़ी शरीर रचना विज्ञान, लॉगिंग, एमएफपी, वन उद्योग, जनजातीय अधिकार		

Part C - Learning Resource

Text Books, Reference Books, Other Resources

Suggested Readings:

Text Books:

1. Baldwin, R. F. 1981. Plywood manufacturing practices. Revised 2nd Ed. Miller and Freeman Publication, Inc. USA. 388p.
2. Bowyer J. L., Shmulsky, R. and Haygreen, J. G. 2007. Forest products and wood science: An introduction. 5th Ed. Blackwell publishing, Ames, IA. 496p.
3. Brown, H. P. 1985. Manual of Indian wood technology. International books and periodicals supply service, New Delhi. 121 p.
4. Brown, N. C. 2002. Principles and methods of harvesting of timber. Biotech books, Delhi. 430p.
5. FRI [Forest Research Institute]. 1976. Indian forest utilization. Volume I and II. Forest Research Institute and colleges, Dehradun. 941p.
6. Gray, J. W. 1993. Forest resource systems in developing countries. Food and agricultural organization. Rome. 259p.
7. Hakkila, P. 1989. Utilization of residual forest biomass. Springer-verlag, Berlin. 567p.
8. Hoadley, B. 2000. Understanding Wood: A Craftsman's guide to wood technology. Taunton Press. Newtown, USA. 223p.
9. Mehta, Tribhvan. 1981. A Handbook of forest utilization. International Book Distributors, Dehradun. 298p.
10. Muraleedharan, P. K. Subramanian, K. K., and Pillai, P. P. 1998. Basic readings in forest economics. Kerala Forest Research Institute and Ford Foundation, Thrissur, Kerala. 177p
11. Panshin, A. J. and De Zeeuw, C. 1980. Textbook of wood technology, 4th Ed. McGraw-Hill. New York, USA: 722p.
12. Rao, K.R. and Juneja, K.B.S. 1992. Field identification of 50 important timbers of India. ICFRE Publi. Dehradun 123 p.
13. Sharma, R. N., Sharma, R.K. 1997. Anthropology. Atlantic Publishers & Distributors.
14. Sharma, R.N. and Bakshi, S. 1984. Tribes and tribal development. Uppal Publ. House, New Delhi
15. Tewari, D. N. 1995. Marketing and trade of forest produce; International Book Distributors (Book Sellers & Publishers), Dehradun, India. 140p.
16. Thakur, D. 1986. Socio-economic development of tribes in India. Deep and Deep Publications, New Delhi
17. Wakermann, A. E. 2002. Harvesting timber crops. Biotech books, Delhi. 433p.

भाग डी : अनुशंसित मूल्यांकन विधियाँ		
अनुशंसित सतत मूल्यांकन विधियाँ : **अधिकतम अंक :** **सतत व्यापक मूल्यांकन (CCE):** **विश्वविद्यालय परीक्षा (UE):**		 50 अंक 10 अंक 40 अंक
आंतरिक **मूल्यांकन :** सतत व्यापक मूल्यांकन (CCE)	1. कक्षा परीक्षा(1 अंक/ इकाई): 2. असाइनमेंट / प्रस्तुतिकरण:	05 अंक 05 अंक **कुल अंक: 10**
आकलन : विश्वविद्यालय परीक्षा (UE) समय : 02.00 घंटे	**अनुभाग (अ)** : दस वस्तुनिष्ठ प्रश्न – रिक्त स्थान भरें / सही और गलत / MCQ **अनुभाग (ब):** तीन अति लघु प्रश्न (प्रत्येक में 50 शब्द) **अनुभाग (स):** चार लघु प्रश्न (प्रत्येक 200 शब्द) **अनुभाग (द):** दो दीर्घ प्रश्न (प्रत्येक में 500 शब्द)	0.5 x 10 = 05 03 x 03 = 09 04 x 04 =16 02 x 05 = 10 **कुल अंक : 40**

B Sc Subject-Forestry
2nd year, Paper-Practical/Lab work
Course Code- BSLF2P

Laboratory/Practical work

Maximum Marks: 50
Minimum Marks: 17
Total Lectures: 30
Credit: 2

1. Measurement of tree diameter, girth, height, Volume and age.
2. Nursery management – multiplication of planting material
3. Handling of nursery stock
4. Planting techniques
5. Collection of NTFPs

प्रयोगशाला / व्यावहारिक कार्य

अधिकतम अंक–50
न्यूनतम उत्तीर्ण अंक–17
कुल व्याख्यान –30
क्रेडिट–2

1. वृक्ष व्यास, परिधि, ऊंचाई, आयतन और उम्र का मापन
2. रोपणी प्रबंधन –पौध रोपन हेतु पौंधो का पर्वर्धन एवं गुणन।
3. रोपणी स्टॉक कारखरखाव
4. रोपण तकनीक
5. अकाष्टीय वन उत्पादों का संग्रह