(ITEP) B.Sc. B.Ed. → 4th SEM.

GURU JAMBHESHWAR UNIVERSITY OF SCIENCE AND TECHNOLOGY, HISAR
(Established by State Legislature Act 17 of 1995)
`A+' Grade, NAAC Accredited State Govt. University

DoE/26/966
01/01/26

Acad./AC-III/Fac.-8/2025/ 8588
Dated: 31/12/25

To

The Controller of Examinations,
GJUST, Hisar.

Sub: Approval of the scheme of examinations and syllabi of Integrated Teacher Education Programme (ITEP) B.A. B.Ed. – 4th semester and Integrated Teacher Education Programme (ITEP) B.Sc. B.Ed. – 4th semester w.e.f. academic session 2025-26 (batch 2024) onwards being run in University Teaching Department.

Sir,

I am directed to inform you that the Vice-Chancellor, on the recommendations of Dean, Faculty of Education on 12.12.2025, is pleased to approve the scheme of examinations and syllabi of Integrated Teacher Education Programme (ITEP) B.A. B.Ed. – 4th semester and Integrated Teacher Education Programme (ITEP) B.Sc. B.Ed. – 4th semester w.e.f. academic session 2025-26 (batch 2024) onwards being run in University Teaching Department under Section 11(5) of the University Act, 1995 in anticipation of approval of the Academic Council.

A copy of the scheme of examinations and syllabi of above said programme(s) is enclosed herewith.

You are therefore, requested to take further necessary action accordingly.

Yours faithfully

DA: As above

31/12/25
Assistant Registrar (Academic)
for Dean Academic Affairs

Endst. No. Acad./AC-III/Fac.- 8/2025/ 8589-92 Dated: 31/12/25

A copy of the above is forwarded to the following for information and necessary action:-

1. Dean, Faculty of Education, GJUST, Hisar.
2. Chairperson, Department of Education, GJUST, Hisar. She is requested to arrange to upload the scheme of examinations and syllabi of Integrated Teacher Education Programme (ITEP) B.A. B.Ed. – 4th semester and Integrated Teacher Education Programme (ITEP) B.Sc. B.Ed. – 4th semester w.e.f. academic session 2025-26 (batch 2024) onwards being run in University Teaching Department on the website of the University on the priority basis.
3. OSD to Vice-Chancellor (for kind information of the Vice-Chancellor), GJUST, Hisar.
4. P.A. to Registrar (for kind information of the Registrar), GJUST, Hisar.

31/12/25
Assistant Registrar (Academic)

GURU JAMBHESHWAR UNIVERSITY
OF
SCIENCE & TECHNOLOGY, HISAR,
HARYANA

Department of Education

Curricular Structure of Integrated Teacher Education Programme (ITEP)

B.Sc. B.Ed.

Semester -4

Session: 2025-2026 onwards
(Batch 2024)

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Department of Education
Guru Jambheshwar University
of Science & Technology, Hisar

Guru Jambheshwar University of Science and Technology
Hisar-125001, Haryana
('A+' NAAC Accredited State Govt. University)

Scheme of Examination for Integrated Teacher Education Programme
Name of the Programme: B.A. BEd.
According to NCTE and National Education Policy-2020

Second Year

SEMESTER-4							
Type of Course	**Subject**	**Course Code**	**Nomenclature of Paper/Course**	**Credits**	**Contact Hours**	**External Marks**	**Internal Marks**
Core Course	**Foundation of Education**	24FOE0401T	Philosophical & Sociological Perspectives of Education -I	4	4	70	30
DSC Choose Any One	**Physics**	24PHY0401T	Waves and Optics	3	3	50	20
		24PHY0401P	Waves and Optics Lab	1	2	20	10
		24PHY0405T	Electromagnetic Theory	3	3	50	20
		24PHY0405P	Electromagnetic Theory Lab	1	2	20	10
		24PHY0406T	Elements of Modern Physics	4	4	70	30
	Chemistry	24CHE0405T	Inorganic Chemistry – II	3	3	50	20
		24CHE0405P	Inorganic Chemistry – II Lab	1	2	20	10
		24CHE0406T	Organic Chemistry – II	3	3	50	20
		24CHE0406P	Organic Chemistry – II Lab	1	2	20	10
		24CHE0407T	Physical Chemistry – II	3	3	50	20
		24CHE0407P	Physical Chemistry – II Lab	1	2	20	10
	Zoology	24ZOO0403T	Aquaculture	3	3	50	20
		24ZOO0403P	Aquaculture Lab	1	2	20	10
		24ZOO0404T	Pest Management	3	3	50	20
		24ZOO0404P	Pest Management Lab	1	2	20	10
		24ZOO0405T	Biodiversity and Wildlife Management	3	3	50	20
		24ZOO0405P	Biodiversity and Wildlife Management Lab	1	2	20	10
	Mathematics	24MAT0401T	Vector Calculus	4	4	70	30
		24MAT0402T	Transform Techniques	4	4	70	30
		24MAT0403T	Partial Differential Equations	4	4	70	30
	Botany	24BOT0402T	Cell Biology	3	3	50	20
		24BOT0402P	Cell Biology Lab	1	2	20	10
		24BOT0403T	Plant Embryology	3	3	50	20
		24BOT0403P	Plant Embryology Lab	1	2	20	10
		24BOT0404T	Genetics	3	3	50	20
		24BOT0404P	Genetics Lab	1	2	20	10
	Minor Course (one)		From the POOL	4	4	70	30
core Course	**Pedagogy Course any (one)**	24CCP0404T	Pedagogy of Mathematics -1	4	4	70	30
		24CCP0405T	Pedagogy of Physical Sciences-1	4	4	70	30
		24CCP0406T	Pedagogy of Biological Sciences-1	4	4	70	30
				24			

** Note: In 4TH semester, students will continue with the same minor subjects they opted for in 2nd semester

FOUNDATION OF EDUCATION

COURSE CODE: 24FOE0401T

Philosophical & Sociological Perspectives of Education -I

Maximum Marks: 100
Internal Assessment: 30
External Assessment: 70

Time Allowed: 4 hours/week
Credits: 4

Note: The examiner is required to set nine questions in all. The first question will be compulsory consisting of seven short questions covering the entire syllabus. In addition to that eight more questions will be set. Two questions from each unit. The students will be required to attempt five questions in all selecting one question from each unit in addition to compulsory question No 1. All questions shall carry equal marks.

Learner Outcomes: By the end of this course, learners will be able to:

- Develop a deep philosophical understanding of education.
- Apply philosophical and ethical insights to educational practice.
- Analyze the relevance of ancient and modern educational ideas in contemporary educational contexts.
- Promote value-based, learner-centered, and reflective educational practices.

Unit-I

Education and Philosophy: Conceptual clarity, nature and relationships, Aims of studying philosophical perspective of education. Branches of Philosophy and their educational implications

Unit-II

Philosophical Schools and Education: Conceptual Clarity of the following schools of thoughts with their implications for
educational practices:

- Bharatiya: Samakhya, Yoga, Nyaya, Vaisheshika, Mimansa, Vedanta
- Western: Idealism, Naturalism, Pragmatism, Progressivism.

Unit-III

Educational Thinkers: Aims, process and educational institutions developed on thoughts of following thinkers and practitioners: Western: J. Rousse, Maria Montessori, Friedrich Froebel, John Dewey

Unit-IV

Value Education: Conceptual Clarity, Significance and Types of Values, Indian Traditional Values. Guru-Shishya-Parampara and Educational Values, Convocation message in Taittiriya Upanishad, Values enshrined in Indian Constitution, NEP, 2020 and Values with special reference to 21st Century.

Suggested Readings

- Agrawal, S. (2007). Philosophical Foundations of Education. Delhi: Authors Press
- Brubacher, J.S. (1962). Eclectic Philosophy of Education. Prentice Hall, New Jercy: Engelwood Cliffs.

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- Brubacher, J. S. (1962). Modern Philosophies of Education. New York: McGraw Hill Book Company Inc.
- Dhavan, M. L (2005). Philosophy of Education. Delhi: Isha Books.
- Kilpatrick, W.H. Source Book in the Philosophy of Education. New York: McMillan and Company.
- Kneller, G.F. (1963). Foundations of Education. London and New York: John Wiley and Sons, Inc.
- Pandey, R.S. (1997). East West Thoughts on Education. Allahabad: Horizon Publishers. Park, J. (1961). The Philosophy of Education. New York: Macmillan Company.
- Phenix, P.H. (1960). Philosophy of Education. New York: Holt, Rinehart and Winst
- Sharma, A.P. (1997). An Approach to Philosophy of Education. Delhi: Indian Publications.
- Sodhi, T.S. & Suri, A. (2003). Philosophical and Sociological Foundation of Education. Patiala: Bawa Publications.

DISCIPLINE SPECIFIC COURSES

COURSE CODE:24PHY0401T
Waves and Optics

Maximum Marks: 70
Maximum Marks: 50 **Time Allowed: 3 Hours**
Internal Assessment:20 **Credits: 3**

Note: The examiner is required to set seven questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus. In addition to those six more questions will be set. Two questions from each unit. The students will be required to attempt four questions in all selecting one question from each unit in addition to compulsory question No 1. All questions shall carry equal marks.

Course Objectives: The course covers basics of several optical phenomena including wave motions, Wave Optics consisting interference, diffraction and polarization of light.

Course Outcomes Outcome:

By the end of this course, student teachers will be able to understand the wave oscillations, interference, diffraction and polarization of light wave.

Unit 1

Simple Harmonic Oscillations: Differential equation of SHM and its solution. Simple pendulum and compound pendulum, Superposition of Collinear Harmonic oscillations: Linearity and Superposition Principle, Superposition of two collinear oscillations having (1) equal frequencies and (2) different frequencies (Beats); Superposition of N Collinear Harmonic Oscillations with (1) equal phase differences and (2) equal frequency differences. Superposition of two perpendicular Harmonic Oscillations: Graphical and Analytical Methods.

Unit II

Wave Motion: Wave Equation, Solution of wave equation, Particle and Wave Velocities, Intensity of Wave. Transverse Waves: The string as a force oscillator, Velocity of Transverse Vibrations of Stretched Strings, Reflections and transmission of waves on a string at a boundary, Reflections and transmission of Energy. Longitudinal Waves: Velocity of Longitudinal Waves in a Fluid in a Pipe, Newton's Formula for Velocity of Sound, Laplace's Correction, Reflections and transmission of sound waves at a boundary, Reflections and transmission of sound intensity, Energy distribution in sound waves.

Unit III

Interference of light waves: Intensity distribution in Young's experiment, concept of spatial and temporal coherence, coherence time and coherence length. Examples of interference by division of amplitude: interference in thin films and wedges, Newton's rings, interference by division of wavefront: Michelson Interferometers, Diffraction: Fraunhoffer and Fresnel diffraction- analytical and graphical solutions for diffraction from Single and multiple slits, Different state of Polarization.polaroids and their use.

Reference Books:

1. The Physics of Vibrations and Waves, H. J. Pain, 2013, John Wiley and Sons.
2. The Physios of Waves and Oscillations, N.K. Bajaj, 1998, Tata McGraw Hill.
3. Optics, Ajoy Ghatak, 2008, Tata McGraw Hill
4. Optics, Hetch,2008, Pearson
5. S. Fundamentals of Photonics, SPIE, Opens Source

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24PHY040LP

Waves and Optics Lab

Marks (External) : 30 | **Credits : 1 (2 Hrs)**

Marks (Internal Assessment) : 20 | **Time : 3 Hrs**

1. ***Each student should perform at-least five experiments.***
2. ***The students are required to calculate the error involved in a particular experiment.***
3. ***List of experiments may vary.***

List of Experiments:

1. To determine refractive index of the Material of a prism using sodium source.
2. To determine the dispersive power of the material of a prism using mercury source.
3. To determine wavelength of sodium light using Newton's Rings.
4. To determine the thickness of a thin paper by measuring the width of the interference fringes produced by a wedge-shaped Film.
5. To determine wavelength of laser using plane diffraction grating.
6. To determine wavelength of spectral lines of Hg source using plane diffraction grating.
7. To determine dispersive power and resolving power of a plane diffraction grating.
8. Measurement of focal length of Mirrors and Lenses

Reference Books

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
2. A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11th Ed., 2011, Kitab Mahal
3. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
4. A Laboratory Manual of Physics for undergraduate classes, D.P.Khandelwal, 1985, Vani Pub.
5. B.Sc. Practical Physics, CL Arora, S.Chand Publications

24PHY0405T: Electromagnetic Theory

Marks (Theory) : 50 | **Credits : 3 (.. lectures)**

Marks (Internal Assessment) : 20 | **Time : 2.5 Hrs**

Note: Paper setter is to set seven questions in all. Question no. 1 (compulsory based on the entire syllabus) will consist of seven short answer type questions, each of two marks. Rest of Eight questions is to be set uniformly selecting two questions from each Unit. A student is required to attempt five questions in all selecting one from each Unit and a compulsory question 1. The question paper shall contain 20% numerical problems in the relevant papers.

Course Objectives: The course on Electricity and Magnetism deals with the Electromagnetic induction, Maxwell's Equations, Electromagnetic wave propagation, Poynting's Vector and electromagnetic field transformation.	**Course Outcomes:** The student will be able to understand electromagnetic induction and it's applications, Maxwell's equations and generation of electromagnetic fields, wave propagation through vacuum and isotropic dielectric medium

UNIT-I

Motional EMF, Faraday's Law of induction, Induced electric field, Lenz's law, Inductance,Self induction of a single coil, Mutual induction of two coils, Transformers, Energy stored in magnetic field,

Maxwell`sequations: Maxwell's fixing of Ampere's law, Displacement current, Maxwell's equations in vacuum.

UNIT-II

Maxwell's equations in matter, Boundary Conditions, Continuity equation, Poynting Theorem and Poynting vector, Maxwell Stress tensor, Conservation of Momentum and angular momentum in electromagnetic field, Energydensity in electromagnetic field.

UNIT-III

The wave equation, Sinusoidal waves, Wave equations for **E** and **B** fields, Electromagnetic wave propagation through vacuum and isotropic dielectric medium, transverse natureof EMwaves, Energy and momentum in EM waves, Propagation in linear media, Reflection and transmission at Normal and Oblique incidence, Brewster's angle, Scalar and vector potential for electromagnetic fields, Gauge Transformation, Coulomb Gauge, Lorentz Gauge.

Reference Books:

- D.J. Griffiths, Introduction to Electrodynamics, 3rd Edn, 1998, Benjamin Cummings.
- ElectricityandMagnetism,EdwardM.Purcell,1986,McGraw-HillEducation..
- Electricity and Magnetism, J.H. Fewkes & J. Yarwood. Vol. I, 1991, Oxford Univ. Press.
- University Physics, Ronald Lane Reese, 2003, ThomsonBrooks/Cole.

24PHY0405P

ELECTROMAGNETIC THEORY LAB

Marks (External) : 30 Credits : 1 (... Hrs)

Marks (Internal Assessment) : 20 Time : ... Hrs

1. Each student should perform at-least eight experiments.
2. The students are required to calculate the error involved in a particular experiment.
3. List of experiments may vary.

List of Experiments:

1. To study the characteristics of a series RC Circuit.
2. To determine an unknown Low Resistance using Potentiometer.
3. To determine an unknown Low Resistance using Carey Foster's Bridge.
4. Measurement of Planck's constant using black body radiation and photo-detector
5. Photo-electric effect: photo current versus intensity and wavelength of light; maximum energy of photo-electrons versus frequency of light
6. To determine the Planck's constant using LEDs of at least 4 different colours.
7. Study the characteristics of Photodiodes

Reference Books

1) Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
2) A Text Book of Practical Physics, I.Prakash& Ramakrishna, 11th Ed., 2011, Kitab Mahal
3) A Laboratory Manual of Physics for undergraduate classes, D.P.Khandelwal, 1985, Vani Pub
4) B.Sc. Practical Physics, CL Arora, S.Chand Publications

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24PHY0406T (DSC-A6): ELEMENTS OF MODERN PHYSICS

Marks (Theory): 70 | Credits: 4 (60 Hrs)

Marks (Internal Assessment): 30 | Time: 3 Hrs

Note: Paper setter is to set nine questions in all. Question no. 1 (compulsory based on the entire syllabus) will consist of seven short answer type questions, each of two marks. Rest of Eight questions is to be set uniformly selecting two questions from each Unit. A student is required to attempt five questions in all selecting one from each Unit and a compulsory question 1. The question paper shall contain 20% numerical problems.

Course Objective: The aim of the course is to give students a flavor of developments in physics in the last century by introducing the concepts of quantization, dual nature of matter, basic quantum mechanics and cosmology.	**Course Outcomes:** Course Outcome: Students will be aware of foundations of modern physics, experiments forming basis of quantum mechanics, Atomic structure, wave concepts, uncertainty principle and basic idea of cosmology.

UNIT – I

Introduction to electromagnetic waves and spectra, Spectral Distribution of Blackbody Radiation, Stefan-Boltzmann Law and Wien's Distribution and Rayleigh-Jean's Law, Ultraviolet Catastrophe, Planck's postulates of black body radiation, Planck's Law of Blackbody Radiation, and its experimental verification. Photoelectric effect, Einstein's explanation, and its experimental verification. Compton scattering. Pair production and annihilation, Bremsstrahlung effect, Cherenkov radiation. X-ray Spectra of atoms and its production, Photons and Gravity.

UNIT – II

Atomic structure: Rutherford scattering, Rutherford's model and its drawbacks, Bohr atomic model; quantization rule, atomic stability, calculation of energy levels for hydrogen like atoms and their spectra, effect of nuclear mass on spectra, Correspondence principle, Franck- Hertz experiment.

Wave properties of matter: De-Broglie wavelength and matter waves; Wave-particle duality, Davison and Germer experiment, wave packets, phase velocity, group velocity and their relations Electron microscope.

Uncertainty principle: Heisenberg's uncertainty principle; Estimating minimum energy of a confined particle using uncertainty principle, Energy-time uncertainty principle. Applications

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UNIT – III

Two slit interference experiment with photons, atoms, and particles; linear superposition principle as a consequence. Matter waves and wave amplitude. Schrodinger equation for non-relativistic particle. Momentum and Energy operators; stationary states, physical interpretation of a wave function, probabilities and normalization. Probability and probability current density in one dimension.

Application of Schrodinger equation: particle in a box, finite potential well, tunnel effect and harmonic oscillator.

UNIT – IV

Cosmology: The Expansion of the Universe, The Cosmic Microwave Background Radiation, Dark Matter, The General Theory of Relativity, Tests of General Relativity, Stellar Evolution and Black Holes, Cosmology and General Relativity, The Big Bang Cosmology, The Formation of Nuclei and Atoms, Experimental Cosmology.

Reference Books:

1. Concepts of Modern Physics, Arthur Beiser, 2002, McGraw-Hill.
2. Introduction to Modern Physics, Rich Meyer, Kennard, Coop, 2002, Tata McGraw Hill
3. Modern Physics, Knneth S.Krane, JOHN WILEY & SONS, INC

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COURSE CODE:24CHE0405T
Inorganic Chemistry – II

Maximum Marks: 70 **Time Allowed: 3 hours/week**
Internal Assessment:20 **Credits: 3**
External Assessment:50

Note: The examiner is required to set seven questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus. In addition to those six more questions will be set. Two questions from each unit. The students will be required to attempt four questions in all selecting one question from each unit in addition to compulsory question No 1. All questions shall carry equal marks.

Learner Outcomes

By the end of this course, student teachers will be able to:

- Demonstrate an understanding of the fundamental concepts of acids and bases.
- Explain the significance and role of metal ions in biological systems.
- Illustrate the basic principles and processes involved in metallurgy.
- Describe the nomenclature, classification, methods of preparation, and applications of silicones and phosphazenes.
- Carry out qualitative inorganic analysis systematically and accurately.
- Perform laboratory experiments, interpret and evaluate the results, and confidently defend findings during viva-voce.

UNIT-I

Acids and Bases: Arrhenius, Bronsted-Lowry, Lux-flood, solvent system and Lewis concept of acids and bases, relative strength of acids and bases, effect of substituent and solvent on acid-base strengths, classification of acids and bases as hard and soft. HSAB principle and its applications, Acid-base strength and hardness and softness, Symbiosis, theoretical basis of electronegativity and hardness-softness

UNIT-II

Bioinorganic Chemistry: Role of metal ions present in biological system, classification based on action (essential, non-essential, trace, toxic), Excess and deficiency of some trace metals. Metalloporphyrins with special reference to haemoglobin and myoglobin (brief idea only). Biological roles of Na^+, K^+, Ca^{+2}, Mg^{+2} and Fe^{+2} ions

UNIT-III

Silicones and Phosphazenes: Silicones: Nomenclature and preparation of silicones, equilibration and ring opening polymerization of cyclo siloxanes, properties of silicones, silicone oils, silicone elastomers and silicone resins, Polysiloxane, copolymers. Phosphazenes: preparation and properties of poly phosphazenes, bonding in triphosphazenes.

COURSE CODE: 24CHE0405P
Inorganic Chemistry – II Lab

Maximum Marks: 30 **Time Allowed: 2 hours/Week**
Internal Assessment:10 **Credits: 1**
External Assessment:20

Exam time: 3 Hrs. **Total Marks: 30.**

Note: Student will perform at least seven experiments. The examiner will allot one practical at the time of end term examination. Candidates are required to obtain minimum passing marks separately in practical component and theory as per the University rules.

Practical:

1. To determine the acidity and alkalinity of given water sample.
2. Redox Titration: Determination of oxalate ions using KMnO 4 and/ K 2 Cr 2 O 7 .
3. Preparation of Cuprous chloride.
4. Semi-micro qualitative analysis of mixtures - not more than four ionic species (two anions and two cations, excluding insoluble and interfering salts) out of the following:

Cations: NH 4+ , Pb 2+ , Bi 3+ , Cu 2+ , Cd 2+ , Fe 3+ , Al 3+ , Co 2+ , Ni 2+ , Mn 2+ , Zn 2+ , Ba 2+ , Sr 2+ , Ca 2+ , K + , Anions: CO 3 2– , S 2– , SO 3 2– , S 2 O 3 2– , NO 2– , CH 3 COO – , Cl – , Br – , I – , NO 3 – , SO 4 2- , PO 4 3- , BO 3 3- , C 2 O 4 2-24

Books Suggested:

1. Lee, J.D. Concise Inorganic Chemistry, 5th Ed. (Reprinted 2018), Oxford University Press (2008).
2. Cotton, F.A., Wilkinson, G. & Gaus, P.L. Basic Inorganic Chemistry, 3rd Ed., Wiley (1995).
3. Huheey, J.E., Keiter, E.A., Keiter; R.L. & Medhi, O.K Inorganic Chemistry Principles of Structure and Reactivity, Pearson Education (2009).
4. Atkins, P.W., Overton, T.L., Rourke, J.P., Weller, M.T. & Armstrong, F.A. Inorganic Chemistry, 5th Ed., W. H. Freeman and Company (2010).
5. Douglas, B.E., McDaniel, D.H. & Alexander, J.J. Concepts and Models in Inorganic Chemistry, 3rd Ed., John Wiley & Sons (2006).
6. Greenwood, N.N. & Earnshaw, A. Chemistry of the Elements, 2nd Ed., Butterworth-Heinemann (1997).
7. Rodger, G.E. Inorganic and Solid State Chemistry, Cengage Learning India Ed., (2002).
8. Atkins, P., Overton, T., Rourke, J., Weller, M., Armstrong, F. & Hagerman, M. Shriver & Atkins' Inorganic Chemistry, 5th Ed., Oxford University Press (2010).
9. Svehla, G. Vogel's Qualitative Inorganic analysis, 7th Ed., Longman Scientific & Technical (1996).
10. Bassett, J., Denney, R.C., Jeffery, G.H. & Mendham, J. Vogel's Textbook of Quantitative Inorganic Analysis, 4th Ed., Longman (1978).
11. Mendham, J., Denney, R.C., Barnes, J.D. & Thomas, M.J.K. Vogel's Quantitative Chemical Analysis, 6th Ed., Pearson Education India (2000)

COURSE CODE: 24CHE0406T
Organic Chemistry – II

Maximum Marks: 70 **Time Allowed: 3 hours/week**

Internal Assessment:20 **Credits: 3**

External Assessment:50

Note: The examiner is required to set seven questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus. In addition to those six more questions will be set. Two questions from each unit. The students will be required to attempt four questions in all selecting one question from each unit in addition to compulsory question No 1. All questions shall carry equal marks.

Learner Outcomes

By the end of this course, student teachers will be able to:

- Illustrate the synthesis pathways and analyze the chemical reactions of cycloalkanes and dienes.
- Differentiate between SN1, SN2, and SNi mechanisms of nucleophilic substitution reactions and interpret E1 and E2 elimination mechanisms of alkyl halides.
- Apply the rules of nomenclature and explain the preparation methods and characteristic properties of alkyl halides, alcohols, phenols, ethers, and epoxides.
- Perform laboratory procedures for preparation and purification of organic compounds and determine their melting and boiling points accurately.
- Conduct organic chemistry experiments, evaluate experimental results, and defend findings confidently in viva-voce.

UNIT 1

Cycloalkanes and Conformational Analysis: Nomenclature, synthesis of cycloalkanes and their derivatives, - addition of carbenes to olefins, Simmons-Smith reaction, photochemical (2+2) cycloaddition reactions, Diels-Alder reaction, dehalogenationof α, ω-dihalides, Dieckmann cyclization, pyrolysis of calcium or barium salts of dicarboxylic acids, Blanc's rule, Baeyer's strain theory and its limitations, Ring strain in small rings (cyclopropane and cyclobutane), theory of strainless rings. Case of cyclopropane ring: Banana bonds.

Dienes Nomenclature, Classification, structure of butadiene, methods of preparation, polymerization, chemical reaction: Diels Alder reaction, 1,2-and 1,4-addition reactions in conjugated dienes.

UNIT-II

Halogenated Hydrocarbons: Alkyl Halides: Methods of preparation and properties, Reactions: Nitrite and Nitro formation, Nitrile and isonitrile formation, Williamson's ether synthesis. Nucleophilic substitution reactions: SN1, SN2 and SNi mechanisms with stereochemical aspects and factors affecting the rate of SN reactions.

Aryl Halides Preparations (including preparation from diazonium salts) and properties, nucleophilic aromatic substitution, Effect of substituents on reactivity of aryl halides towards nucleophilic substitution, Benzyne Mechanism. Relative reactivity of alkyl, allyl, benzyl, vinyl and aryl halides towards nucleophilic substitution reactions.

UNIT-III

Alcohols Monohydric Alcohols: Nomenclature, methods of preparation: using Grignard reagents, from alkenes (hydration, Oxymercuration- demercuration and hydroboration-oxidation), ester hydrolysis, and reduction of aldehydes, ketones, carboxylic acids and esters. Acidic nature of alcohols, chemical reactions of alcohols: with sodium, HX (Lucas test), esterification, oxidation (with PCC, alkaline KMnO 4 nd acidic dichromate).

Dihydric Alcohols: Nomenclature, methods of preparation (hydroxylation of alkenes and hydrolysis of epoxides), chemical reactions: oxidative cleavage (with PbOAc 4 and HIO 4) and pinacol-pinacolone rearrangement.

Books Suggested:

1. Graham Solomon, T.W., Fryhle, C.B. & Snyder, S.A. Organic Chemistry, 11th Ed., John Wiley & Sons (2014).
2. McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Pvt. Ltd. (2012).
3. Sykes, P. A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi (1988).
4. Finar, I.L. Organic Chemistry, Vol. 1, 6th Ed., Pearson, India (2002).
5. Finar, I.L. Organic Chemistry, Vol. 2, 5th Ed., Pearson, India (2002).
6. Morrison, R.T. & Boyd, R.N. Organic Chemistry, 6th Ed., Pearson (2016).
7. Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand (2010).
8. Furniss, B.S., Hannaford, A.J., Smith, P.W.G. & Tatchell, A.R. Vogel's Textbook of Practical Organic Chemistry, 5th Ed., Longman Scientific & Technical (1989).
9. Pavia, D.L., Lampman, G.M., Kriz, G.S., & Vyvyan, J.R. Introduction to Spectroscopy, 5th Ed., Brooks/Cole, Cengage Learning (2015).

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COURSE CODE: 24CHE0406P
Organic Chemistry – II Lab

Maximum Marks: 30
Internal Assessment:10
External Assessment:20

Time Allowed: 2 hours/Week
Credits: 1

Exam time: 3 Hrs.

Total Marks: 30.

Note: Student will perform at least five experiments. The examiner will allot one practical at the time of end term examination. Candidates are required to obtain minimum passing marks separately in practical component and theory as per the University rules.

Practical:

1.Purification of organic compounds by distillation.

2.Preparations: Mechanism of various reactions involved to be discussed, purification through recrystallization, determination of melting point and calculation of quantitative yields.

1.1. Bromination of Phenol
1.2. Benzoylation of phenols
1.3. Preparation of p-bromoacetanilide from acetanilide.
1.4. Preparation of S-Benzyl isothiuronium chloride from thiourea.

3.To differentiate primary, secondary and tertiary alcohols by Lucas test.

4.To study the process of sublimation of camphor.

5.Diel's Alder reaction using Anthracene and Maleic anhydride.

6.Synthesis of 4-methyl-7-hydroxycoumarin by condensation of resorcinol with ethyl acetoacetate.

COURSE CODE:24CHE0407T
Physical Chemistry – II

Maximum Marks: 70 **Time Allowed: 3 hours/week**

Internal Assessment:20 **Credits: 3**

External Assessment:50

Note: The examiner is required to set seven questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus. In addition to that six more questions will be set. Two questions from each unit. The students will be required to attempt four questions in all selecting one question from each unit in addition to compulsory question No 1. All questions shall carry equal marks.

Learner Outcomes

By the end of this course, student teachers will be able to:

By the end of the course, learners will be able to:

1. Explain the concepts of colligative properties and electrical conductance with suitable examples.
2. Differentiate between ideal and non-ideal solutions, illustrate azeotropes, and analyze the miscibility behavior of liquids.
3. Apply the Nernst distribution law to solve numerical and practical problems.
4. Demonstrate a clear understanding of the principles and applications of electrochemistry.
5. Perform laboratory experiments with accuracy, interpret the results, and defend their findings confidently in viva-voce.

UNIT-I

Solutions and Colligative Properties: Thermodynamics of ideal solutions: Ideal solutions and Raoult's law, deviations from Raoult's law – non-ideal solutions. Vapour pressure-composition and temperature composition curves of ideal and non-ideal solutions. Distillation of solutions. Azeotropes. Colligative properties of solutions. Thermodynamic derivations of relation between amount of solute and elevation in boiling point and depression in freezing point. Partial miscibility of liquids: Critical solution temperature; effect of impurity on partial miscibility of liquids. Immiscibility of liquids- Principle of steam distillation.

UNIT-II

Conductance: Conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes. Kohlrausch law of independent migration of ions. Transference number, ionic mobility. Applications of conductance measurements: determination of degree of ionization of weak electrolyte, solubility and solubility products of sparingly soluble salts, ionic product of water, hydrolysis constant of a salt. Conductometric titrations (only acid-base). Concept of pH and pKa, buffer solution, buffer action, Handerson Hazel Blac equation.

UNIT-III

Electrochemistry: Reversible and irreversible cells. Concept of EMF of a cell. Measurement of EMF of a cell. Nernst equation and its importance. Types of electrodes. Standard electrode potential. Electrochemical series. Thermodynamics of a reversible cell, calculation of thermodynamic properties: ΔG, ΔH and ΔS from EMF data. Calculation of equilibrium constant from EMF data. Concentration cells with transferenceand without transference. Liquid junction potential and salt bridge. pH determination using hydrogen electrode and quinhydrone electrode. Potentiometric titrations -qualitative treatment (acid-base and oxidation-reduction only).

COURSE CODE: 24CHE0407P
Physical Chemistry – II Lab

Maximum Marks: 30 **Time Allowed: 2 hours/Week**
Internal Assessment:10 **Credits: 1**
External Assessment:20

Exam time: 3 Hrs. **Total Marks: 30.**

Note: Student will perform at least six experiments. The examiner will allot one practical at the time of end term examination. Candidates are required to obtain minimum passing marks separately in practical component and theory as per the University rules.

Practical:

1. Determination of molecular weight of non-volatile solute by Rast Method.
2. Determination of the critical solution temperature and composition of the phenol water system and study of the effect of impurities on it.
3. Determination of cell constant.
4. Determination of equivalent conductance, degree of dissociation and dissociation constant of a weak acid.
5. Perform the following conductometric titrations: (a) Strong acid vs. strong base (b) Weak acid vs. strong base
6. Perform the following potentiometric titrations: (i) Strong acid vs. strong base (ii) Weak acid vs. strong base (iii) Potassium dichromate vs. Mohr's salt

Books Suggested:

1. Atkins, P.W & Paula, J.D. Physical Chemistry, 10th Ed., Oxford University Press (2014).
2. Castellan, G.W. Physical Chemistry, 4th Ed., Narosa (2004).
3. Mortimer, R.G. Physical Chemistry, 3rd Ed., Elsevier: Noida, UP (2009).
4. Barrow, G. M., Physical Chemistry, 5th Ed., Tata McGraw Hill: New Delhi (2006).
5. Engel, T. & Reid, P. Physical Chemistry, 3rd Ed., Prentice-Hall (2012).
6. Rogers, D.W. Concise Physical Chemistry, 1st Ed.,Wiley (2011).
7. Silbey, R.J., Alberty, R.A. & Bawendi, M.G. Physical Chemistry 4th Ed., John Wiley & Sons, Inc. (2005).
8. Kapoor, K. L. A Textbook of Physical Chemistry, Vol. 1 & 2, 6th Ed., McGraw-Hill, (2019).
9. Bahl, B.S., Tuli, G.D., & Bahl, A. Essentials of Physical Chemistry, 27th Ed., S. Chand & Co. (2019).
10. Khosla, B.D.; Garg, V.C., & Gulati, A. Senior Practical Physical Chemistry. 18th Ed., R. Chand & Co. (2018).

COURSE CODE: 24ZOO0403T
Aquaculture

Maximum Marks: 70
Internal Assessment:20
External Assessment:50

Time Allowed: 3 hours/week
Credits: 3

Note: The examiner is required to set seven questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus. In addition to that six more questions will be set. Two questions from each unit. The students will be required to attempt four questions in all selecting one question from each unit in addition to compulsory question No 1. All questions shall carry equal marks.

Learner Outcomes

By the end of this course, student teachers will be able to:

- Demonstrate an understanding of the diversity and characteristics of freshwater fishes of India.
- Describe and analyze various fishing crafts and gears used in fisheries.
- Explain the process and techniques of seed production in fishes.
- Apply knowledge of culture technologies used in fishery practices.
- Identify and classify fish specimens accurately.

Unit-I

Introduction to world fisheries: Production, utilization and demand, Major species cultured Fresh Water fishes of India: River system, reservoir, pond, tank fisheries; captive and culture fisheries, cold water fisheries.

Unit-II

Fishing crafts and gears. Fin fishes, Crustaceans, Molluscs and their culture. Traits of important cultivable fish and shellfish and their culture methods – Indian major carps, exotic carps, air breathing fishes, cold water fishes, freshwater prawns, mussels

Unit-III

Seed production: Natural seed resources – its assessment, collection, Hatchery production Nutrition: Sources of food (Natural, Artificial) and feed composition (Calorie and Chemical ingredients).
Field Culture: Culture, Culture in Pond-running waters; recycled water culture, cage culture; poly culture. Culture technology: Induced breading in fishes, techniques and hormones; Fish Biotechnology (Transgenesis and Cryopreservation of gametes).

Suggested Readings:

- Arumugam N. (2014). Aquaculture and Fisheries, Saras Publication
- Bardach, JE, Ryther & McLarney, Wo (1972) Aquaculture, New York: Wiley-Interscience. 896pp.
- Lagler, KF, Bardach, JE, Miller, RR & Passino, DRM (1977) Ichthyology, 21nd Edition, New York, Wiley, 506 pp.
- Khanna S S, & Singh H R (2014). Textbook of Fish Biology and Fisheries 3rd edn. Narendra Publishing House

Deepak Ver

COURSE CODE: 24ZOO0403P

Aquaculture Lab

Maximum Marks: 30
Internal Assessment:10
External Assessment:20

Time Allowed: 2 hours/Week
Credits: 1

Exam time: 3 Hrs

Total Marks: 30

1. Identification of Catla catla, Labeo rohita, L. calbasu, Cirrhinus, mrigala, Puntius sarana, Channa punctatus, C. marulius, C. stariatus, Trichogaster fasciata, Mystus seenghala, M. cavasius, M. tengra, Callichrous pabola, C. bimaculatus, Wallago attu, Prawns, Crabs, Lobsters, Clams, Mussels & Oysters.
2. A study of the slides of fish parasites.
3. A study of the different types of nets, e.g., cast net, gill net, drift net and drag net.
4. A visit to lake/reservoir/fish breeding centre.

Note: Students/Candidates are required to obtain minimum passing marks separately in practical component and theory as per the University rules.

Suggested Readings:

- Arumugam N. (2014). Aquaculture and Fisheries, Saras Publication
- Bardach, JE, Ryther & McLarney, Wo (1972) Aquaculture, New York: Wiley-Interscience. 896pp.
- Lagler, KF, Bardach, JE, Miller, RR & Passino, DRM (1977) Ichthyology, 21nd Edition, New York, Wiley, 506 pp.
- Khanna S S, & Singh H R (2014). Textbook of Fish Biology and Fisheries 3rd edn. Narendra Publishing House

Deepika Verma

COURSE CODE: 24ZOO0404T
Pest Management

Maximum Marks: 70 **Time Allowed: 3 hours/week**
Internal Assessment:20 **Credits: 3**
External Assessment:50

Note: The examiner is required to set seven questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus. In addition to that six more questions will be set. Two questions from each unit. The students will be required to attempt four questions in all selecting one question from each unit in addition to compulsory question No 1. All questions shall carry equal marks.

Learner Outcomes

By the end of this course, student teachers will be able to:

- Explain the ecological importance of insects and identify harmful insect species.
- Describe and analyze the life cycles of major crop insects.
- Demonstrate an understanding of vegetable pests and their impact on crop productivity.
- Compare and evaluate different pest control approaches.
- Identify and classify various insect and pest species accurately.

Unit-I

Study of important insect pests of crops and vegetables:

Sugarcane: (With their systematic position, habits and nature of damage caused. (a) Sugarcane leaf-hopper (*Pyrilla perpusilla*) (b) Sugarcane Whitefly (*Aleurolobus barodensis*) (c) Sugarcane top borer (*Sciropophaga nivella*) (d) Sugarcane root borer (*Emmalocera depresella*) (e) Gurdaspur borer (*Bissetia steniellus*) Life cycle and control of *Pyrilla perpusilla* only.

Cotton: (With their systematic position, habits and nature of damage caused. (a) Pink bollworm (*Pestinophora gossypfolla*) (b) Red cotton bug (*Dysdercus cingulatus*) (c) Cotton grey weevil (*Myllocerus undecimpustulatus*) (d) Cotton Jassid (*Amrasca devastans*) Life cycle and control of *Pectinophore gossypiella*

Unit-II

Wheat: Wheat stem borer (*Sesamia inferens*) with its systematics position, habits, nature of damage caused. Life cycle and control methods.

Paddy: (With their systematic position, habits and nature of damage caused) (a) Gundhi bug (*Leptocorisa acuta*) (b) Rice grasshopper (*Hieroglyphus banian*) (c) Rice stem borer (*Scirpophaga incertullus*) (d) Rice Hispa (*Diceladispa armigera*). Life cycle and control of *Loptocorisa acuta* only.

Vegetables: (Their systematics position, habits and nature of damage caused).

(a) The Red pumpkin beetle(*Aulacophora faveicollis*). (b) The pumpkin fruit fly (*Dacus cucurbitas*). (c) The vegetable mite(*Tetranychus tecarius*). (d) The Hadda beetle(*Epilachna*).

Life cycle and control of *Aulacophora faveicollis*

Unit-III

Stored grains: (Their systematic position, habits and nature of damage caused. (a) Pulse beetle (*Callosobruchus maculatus*) (b) Rice weevil (*Sitophilus oryzae*) (c) Wheat weevil (*Trogoderma granarium*) (d) Rust Red Flour beetles (*Tribolium castaneum*) (e) Lesser grain borer (*Rhizopertha dominica*) (f) Grain & Flour moth (*Sitotroga cerealella*) Life cycle and control of *Trogoderma granarium*.

Important bird and rodent pests of agriculture & their management.

Pest control: Biological control, its history, requirement and precautions and feasibility of biological agents for control.

Chemical control: History, Categories of pesticides, important pesticides from each category to pests against which they can be used, insect repellants and attractants. Integrated pest management

COURSE CODE: 24ZOO0404P

Pest Management Lab

Maximum Marks: 30
Internal Assessment:10
External Assessment:20

Time Allowed: 2 hours/Week
Credits: 1

Exam time: 3 Hrs

Total Marks: 30

External morphology, identification marks, nature of damage and host of the following pests:-

(i) **Sugarcane:** Sugarcane leaf-hopper, Sugarcance whitefly, Sugarcance top borer, Sugarcane root borer, Gurdaspur borer (any two).

(ii) **Cotton:** Red Cotton bug

(iii) **Wheat:** Wheat stem borer

(iv) **Paddy:** Gundhi bug, Rice grasshopper, Rice stem borer, Rice hispa (any one).

(v) **Vegetables:** *Aulocophora faveicollis*, *Dacus cucurbitas*, *Tetranychus tecarious*, *Epilachna* (any three).

(vi) **Pests of stored grains:** Pulse beetle, Rice weevil, Grain & Flour moth, Rust-red flour beetle, lesser grain borer (any three).

Suggested Readings:

1. David Dent , Richard Binks (2020). Insect Pest Management CABI Publishing; 3rd edition

2. Larry P Pedigo , Marlin E. Rice (2014) Entomology and Pest Management. Waveland Pr Inc; 6th edition

3. John R. Ruberson (2019) Handbook of Pest Management, CRC Press; 1st edition

4. Kalatia M.K. (2021) Introduction to principles of pest and disease management; Walnut Publication

5. Smith K M (2013) A Textbook of Agricultural Entomology by Hill, Cambridge University Pres

COURSE CODE: 24ZOO0405T

Biodiversity and Wildlife Management

Maximum Marks: 70 **Time Allowed: 3 hours/week**

Internal Assessment:20 **Credits: 3**

External Assessment:50

Note: The examiner is required to set seven questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus. In addition to those six more questions will be set. Two questions from each unit. The students will be required to attempt four questions in all selecting one question from each unit in addition to compulsory question No 1. All questions shall carry equal marks.

Learner Outcomes

By the end of this course, student teachers will be able to:

- Describe the major wildlife zones of India.
- Explain the concept and significance of the Protected Area System.
- Demonstrate an understanding of IUCN categories and their relevance to conservation.
- Analyze the mechanisms and causes of biodiversity threats.
- Apply knowledge of wildlife management methods in conservation contexts.

Unit-I

- Concept of Bio-Diversity and Wildlife, Levels of Biodiversity. Pattern and distribution of Wildlife in India, Wildlife zones of India. Techniques of animal counts (Examples of Tiger count)

Unit-II

- Conservation of biodiversity: in-situ and ex-situ. Concept of Protected Area Systems. Important Protected Areas of India (Biosphere reserve, National Park & Wildlife sanctuaries)

Unit-III

- Red Data Book and its uses. IUCN Categories of wildlife species. Climate change and loss of biodiversity.
- Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Wildlife Tourism. Biosphere Reserves concept and Indian Biosphere Reserves; Location & Significance

Suggested Readings:

1. Hosetti, B. B., & Venkateshwarlu, M. *Trends in Wildlife Biodiversity Conservation and Management.*
2. Mathur, Reena. *Wildlife Conservation and Management.*
3. Hosetti, B. B. *Concepts of Wildlife Management.*
4. Rogers, W. A. *Techniques for Wildlife Census in India: A Field Manual.* Wildlife Institute of India, Dehradun.
5. Majupuria, T. C. *Wildlife Wealth of India.* Tecpress Services, L.P., Bangkok.
6. Ali, S., & Ripley, S. D. *Handbook of the Birds of India and Pakistan* (10 Vols.). Oxford University Press, Bombay.
7. Prater, S. H. *The Book of Indian Animals.* BNHS Publication, Bombay.
8. Saharia, V. B. *Wildlife in India.* Natraj Publishers, Dehradun.
9. Gee, E. P. *The Wildlife of India*

COURSE CODE: 24ZOO0405P

Biodiversity and Wildlife Management Lab

Maximum Marks: 30 **Time Allowed: 2 hours/Week**
Internal Assessment:10 **Credits: 1**
External Assessment:20

Exam time: 3 Hrs. **Total Marks: 30**

1. Study of biodiversity among various organisms (Listing of all the animals found in and around your house and also try to find out their Zoological names).
2. Identification and photography of various species.
3. Visits to a local animal park or zoo to identify and study the captive fauna and preparation of report.
4. Study of adaptive characteristics of various vertebrates in different climate.
5. Study of biodiversity in grassland and pond water by using Shannon -Weiner index.
6. Comparison of two species of birds belonging to same genus (Interspecific difference).

Suggested Readings:

- Hosetti, B. B., & Venkateshwarlu, M. *Trends in Wildlife Biodiversity Conservation and Management.*
- Mathur, Reena. *Wildlife Conservation and Management.*
- Hosetti, B. B. *Concepts of Wildlife Management.*
- Rogers, W. A. *Techniques for Wildlife Census in India: A Field Manual.* Wildlife Institute of India, Dehradun.
- Majupuria, T. C. *Wildlife Wealth of India.* Tecpress Services, L.P., Bangkok.
- Ali, S., & Ripley, S. D. *Handbook of the Birds of India and Pakistan* (10 Vols.). Oxford University Press, Bombay.
- Prater, S. H. *The Book of Indian Animals.* BNHS Publication, Bombay.
- Saharia, V. B. *Wildlife in India.* Natraj Publishers, Dehradun.

Semester: IV
Credits: 4-0-0
Hours/Week: 4
Course Type: DSC

Marks (External): 70
Marks (Internal): 30
Maximum Marks (Total): 100
Examination Duration: 3 Hours

Note: The examiner is required to set nine questions in all. The first question will be compulsory consisting of seven short questions covering the entire syllabus consisting of 2 marks each. In addition to that eight more questions will be set, two questions from each unit. The students shall be required to attempt five questions in all selecting one question from each unit in addition to compulsory Question No. 1. All questions shall carry equal marks.

Course Outcomes: After completing this course, the learner will be able to:

CO1: Develop general interest in directions as well as magnitude in advance level of learning of Vector Calculus.
CO2: Build on basic vector ideas by learning about gradient fields and route independent fields, as well as computing directional derivatives, gradients, and curls.
CO3: Evaluate line integral as work over a closed curve including parameterized curves.
CO4: Evaluate integral using applications of Green's theorem and stokes theorem.
CO5: Compute surface and volume integrals through surfaces such as Cylinders, Cuboids, Spheres etc., Evaluating surface integral using Gauss Divergence in a plane.

Unit – I

Scalar and vector product of three vectors, Product of four vectors. Reciprocal vectors. Vector differentiation. Scalar Valued point functions, Vector valued point functions, Derivative along a curve, Directional derivatives

Unit – II

Gradient of a scalar point function, geometrical interpretation of grad Φ, character of gradient as a point function. Divergence and curl of vector point function, characters of Div $\vec{f}$ and Curl $\vec{f}$ as point function, examples. Gradient, divergence and curl of sums and product and their related vector identities. Laplacian operator.

Unit – III

Orthogonal curvilinear coordinates Conditions for orthogonality fundamental triad of mutually orthogonal unit vectors. Gradient, Divergence, Curl and Laplacian operators in terms of orthogonal curvilinear coordinates, Cylindrical co-ordinates and spherical co-ordinates.

Unit – IV

Vector integration; Line integral, Surface integral, Volume integral. Theorems of Gauss, Green & Stokes and problems based on these theorems.

Books Recommended:

1. Murrary R. Spiegal, Theory and Problems of Advanced Calculus, Schaum Publishing Company, New York (1974).
2. Murrary R. Spiegal, Vector Analysis, Schaum Publishing Company (Second Addition), New York (2009).
3. N. Saran and S.N. Nigam, Introduction to Vector Analysis (Sixth Addition), Pothishala Pvt. Ltd., Allahabad (1990).
4. Shanti Narayna, A Text Book of Vector Calculus. S. Chand & Co., New Delhi (2003).

24MAT0402T: Transform Techniques

Semester: IV
Credits: 4-0-0
Hours/Week: 4
Course Type: DSC

Marks (External): 70
Marks (Internal): 30
Maximum Marks (Total): 100
Examination Duration: 3 Hours

Note: The examiner is required to set nine questions in all. The first question will be compulsory consisting of seven short questions covering the entire syllabus consisting of 2 marks each. In addition to that eight more questions will be set, two questions from each unit. The students shall be required to attempt five questions in all selecting one question from each unit in addition to compulsory Question No. 1. All questions shall carry equal marks.

Course Outcomes: After completing this course, the learner will be able to:

CO1: Understand the basic concept of some transform techniques namely Laplace, Fourier, Mellin and Hankel transforms.
CO2: Evaluate the transforms of some elementary functions.
CO3: Solve ordinary/partial differential equations using appropriate transform techniques.
CO4: Apply the transform techniques to solve physical problems arising in various scientific fields.

Unit – I

Laplace Transforms: Definition, Laplace transform of some elementary functions, Linear property, Shifting and Scaling properties, Laplace transforms of derivatives and integrals, Differentiation and integration of Laplace transforms, Inverse Laplace transforms, Convolution theorem, Inverse Laplace transforms of derivatives and integrals, Solution of ordinary differential equations using Laplace transform.

Unit – II

Fourier Transforms: Definition, Properties of Fourier transforms: Linearity, Scaling, Shifting, Modulation; Convolution theorem, Fourier transforms of the derivatives, Relation between Fourier and Laplace transforms, Parseval's identities for Fourier transforms, Solution of partial differential equations using Fourier transforms.

Unit – III

Mellin Transform: Definition and elementary properties of Mellin transform, Mellin transforms of derivatives and integrals, Inverse Mellin transform, the Mellin inversion theorem, Convolution theorem of Mellin transform and Inverse Mellin transform.

Unit – IV

Hankel Transform: Definition and elementary properties of Hankel transform, Parseval relation for Hankel transform, Hankel transforms of derivatives of function, Hankel transforms of some elementary functions, Use of Hankel transform in the solution of partial differential equations.

Books Recommended:

1. E. Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons Inc., New York, 2006.
2. A.R. Forsyth, A Treatise on Differential Equations, 6th Edition, Macmillan and Co. Ltd., London, 1929.
3. I.N. Sneddon, The Use of Integral Transforms, 1st Edition, McGraw Hill Education, 1972.
4. M.R. Spiegel, Laplace Transforms, 1st Edition, Schaum's Outlines Series, McGraw Hill Education, 1965.
5. L. Debnath and D. Bhatta, Integral Transforms and Their Applications, 3rd Edition, CRC Press, Boca Raton, 2015.

24MAT0403T: Partial Differential Equations

Semester: IV
Credits: 4-0-0
Hours/Week: 4
Course Type: DSC

Marks (External): 70
Marks (Internal): 30
Maximum Marks (Total): 100
Examination Duration: 3 Hours

Note: The examiner is required to set nine questions in all. The first question will be compulsory consisting of seven short questions covering the entire syllabus consisting of 2 marks each. In addition to that eight more questions will be set, two questions from each unit. The students shall be required to attempt five questions in all selecting one question from each unit in addition to compulsory Question No. 1. All questions shall carry equal marks.

Course outcomes: After completing this course, the students will be able to:

CO1: construct a partial differential equation for various real life problems.
CO2: discuss Lagrange's linear equation, Lagrange's solution to the linear equations, and also solve partial differential equations using Charpit and Monge's method.
CO3: classify linear partial differential equations of second order.
CO4: solve partial differential equations such as Heat, Wave and Laplace by using the variable separable method.

Unit – I

Partial differential equations: Formation, Order and Degree, Linear and Non-Linear Partial differential equations of the first order: Complete solution, Singular solution, General solution. Solution of Lagrange's linear equations, Charpit's general method of solution. Jacobi's method.

Unit – II

Linear partial differential equations of second and higher orders, Linear homogeneous and non-homogeneous differential equations with constant coefficients, Partial differential equation with variable coefficients reducible to equations with constant coefficients, their complimentary functions and particular integrals.

Unit – III

Classification of linear partial differential equations of second order; Hyperbolic, Parabolic and Elliptic types. Reduction of second order linear partial differential equations to Canonical forms and their solutions. Monge's method for partial differential equations of second order.

Unit – IV

Cauchy's problem for second order partial differential equations, Characteristic equations and characteristic curves of second order partial differential equation, Method of separation of variables: Solution of Laplace's equation, Wave equation (one dimension), Diffusion (Heat) equation (one dimension) in Cartesian Co-ordinate system.

Books Recommended:

1. Ian N. Sneddon, Elements of Partial Differential Equations, McGraw Hill Book Company, 1988.
2. D.A. Murray, Introductory Course on Differential Equations, Orient Longman, (India), 1967.
3. J.N. Sharma and Kehar Singh, Partial Differential Equations for Engineers and Scientists, Narosa publishing house, 2009.

COURSE CODE: 24BOT0402T
Cell Biology

Maximum Marks: 70 **Time Allowed: 3 hours/week**
Internal Assessment:20 **Credits: 3**
External Assessment:50

Note: The examiner is required to set seven questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus. In addition to that six more questions will be set. Two questions from each unit. The students will be required to attempt five questions in all selecting one question from each unit in addition to compulsory question No 1. All questions shall carry equal marks.

Learner Outcomes

By the end of this course, student teachers will be able to:

- Explain the basics of structural organization, components of cells, and mechanisms of cell division and regulation.
- Describe the structure and functions of the cell, cell wall, plasma membrane, and cell organelles.
- Analyse how cellular components generate and utilize energy within the cell.
- Demonstrate an understanding of the components and functions of the cell wall and cytoskeleton.

UNIT-I

Cell as a unit of structure and function; Unique features of plant cells; Cell wall, distribution, chemical composition, functions and variations in prokaryotic and eukaryotic cells (primary and secondary wall), Glycocalyx, Cell-cell interactions/ Junctions, pit connections. Phases of eukaryotic cell cycle, mitosis and meiosis; Regulation of cell cycle-checkpoints, role of protein kinases

UNIT - II

Overview of membrane structure and functions, chemical composition of membranes; fluid mosaic model; active, passive and facilitated transport, endocytosis and exocytosis; Structural organization, function and biogenesis of mitochondria and chloroplasts; Cytoskeleton: role and structure of microtubules and microfilaments

UNIT -III

Nucleus: Structure-nuclear envelope, nuclear pore complex, nuclear lamina, molecular organization of chromatin; Nucleolus; Peroxisome and Lysosomes: Structure and function. Endoplasmic Reticulum – Structure and function of RER and SER, protein folding, processing in ER, export of proteins and lipids; Golgi Apparatus: Structure and functions

Recommended Textbooks and References:

1. *Rastogi,V. B. (2016).Introductory Cytology, Kedar Nath & RamNath, Meerut*
2. *Verma PS & Agarwal VK (2022) Cell Biology (Cytology, Biomolecules and Molecular Biology) S Chand Publication, New Delhi.*
3. *Gupta,P.K.(2017). Biomolecules and Cell Biology,Rastogi Publication, Meerut.*
4. *Kumar S. (2023). Cell biology, Pragati Prakashan, Meerut.*
5. *Sahoo,K.(2017) Biomolecules and Cell Biology, Kalyani Publishers ,New Delhi.*
6. *Tymoczko, J.L., Berg, J.M. and Stryer, L. (2012) Biochemistry: A short course, 2nded., W.H. Freeman*
7. *Nelson, D.L. and Cox, M.M.(2008) Lehninger Principles of Biochemistry,5th Edition, W.H. Freeman and Company. Cooper, G.M. and Hausman, R.E. 2009 The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.*

COURSE CODE: 24BOT0402P

Cell Biology Lab

Maximum Marks: 30 **Time Allowed: 2 hours/Week**
Internal Assessment:10 **Credits: 1**
External Assessment:20

Exam time: 3 Hrs. **Total Marks: 30**

List of Experiments

1. Study of plant cell structure using epidermal peel mounts of *Onion* / *Rhoeo*.
2. Demonstration of protoplasmic streaming in *Hydrilla* leaf.
3. Measurement of cell size using the technique of micrometry.
4. Observation of cell and its organelles with the help of electron micrographs, charts, models, or digital resources.
5. Study of plasmolysis and deplasmolysis in plant cells.
6. Examination of different stages of mitosis and meiosis using permanent slides.
7. Preparation of a permanent mount of mitotic stages from onion root tip.
8. Determination of mitotic index.

COURSE CODE: 24BOT0403T
PLANT EMBRYOLOGY

Maximum Marks: 70 **Time Allowed: 3 hours/week**
Internal Assessment:20 **Credits: 3**
External Assessment:50

Note: The examiner is required to set seven questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus. In addition to that six more questions will be set. Two questions from each unit. The students will be required to attempt four questions in all selecting one question from each unit in addition to compulsory question No 1. All questions shall carry equal marks.

Learner Outcomes

By the end of this course, student teachers will be able to:

- Describe the structure and function of the anther and pollen.
- Explain the structure and function of the ovule and embryo sac.
- Demonstrate an understanding of the processes of pollination, fertilization, and mechanisms of self-incompatibility.
- Analyse the development and characteristics of endosperm, embryo, seed, polyembryony, and apomixis.

UNIT-I

Introduction about Reproductive biology and its scope
Anther wall: Structure and functions, microsporogenesis and its significance, Microgametogenesis; Pollen wall structure and functions, Number Position Character (NPC) of pollen aperture, Ultrastructure of male germ unit (MGU); A brief account of Palynology and its scope, Pollen viability, storage and germination, Pollinia

UNIT - II

General structure and types of ovules; Female gametophyte-megasporogenesis (monosporic, bisporic and tetrasporic) and megagametogenesis; Ultrastructure of female germ unit (FGU), Organization and ultrastructure of mature embryo sac;
Pollination: types and significance; Pollen-pistil interactions; Brief account of self-incompatibility

UNIT -III

Endosperm: Types, development, structure and functions
Embryo: Types of embryogeny, General pattern and comparison of development of dicot and monocot embryo; Embryo-endosperm relationship; Seed: Structure, importance and dispersal mechanisms of seed; Polyembryony and apomixis: Introduction, types, causes and applications.

Recommended Textbooks and References:

1. Singh, V., Pandey, P.C, and Jain, D.K. (2017). Reproductive Biology of Angiosperms, Rastogi Publications, Meerut
2. Bhojwani S.S., Bhatnagar S.P. & Dantu P.K. (2015). The Embryology of Angiosperms, 6th Edition. By Vikas Publication House, ISBN: 978-93259 8129-4.
3. Shivanna, K.R. (2003).Pollen Biology and Biotechnology. Oxford and IBH Publishing Co. Pvt. Ltd. Delhi.
4. Raghavan,V.(2000). Developmental Biology of Flowering plants, Springer, Netherlands.
5. Johri, B.M. (1984). Embryology of Angiosperms, Springer-Verlag, Netherlands.
6. Mishra, B.K. (2017). Reproductive Biology of Angiosperms, Kalyani Publishers, New Delhi.
7. P. Maheshwari, (2004). An introduction to the embryology of Angiosperms. Tata McGraw-Hill Edition, ISBN: 0-07-099434-X.

COURSE CODE: 24BOT0403P

PLANT EMBRYOLOGY Lab

Maximum Marks: 30
Internal Assessment:10
External Assessment:20

Time Allowed: 2 hours/Week
Credits: 1

Exam time: 3 Hrs.
Total Marks: 30

List of Experiments

1. Study of a typical flower: structure, different whorls, and their functions.
2. Comparative study of flowers from self-pollinating and cross-pollinating plants.
3. Examination of anther structure (young and mature) through temporary slide preparation and/or permanent slides.
4. Observation of microspore tetrads and pollen grain morphology (shape, sculpture, and apertures) through slide preparations.
5. Study of different types of ovules using permanent slides or models.
6. Observation of embryo sac structure through permanent slides, models, or charts.
7. Study of endosperm structure and types.
8. Isolation of monocot and dicot embryos from suitable plant material.
9. Identification of pollination types and seed dispersal mechanisms using photographs and specimens.
10. Determination of the percentage of viable germinated pollen in a given medium.

COURSE CODE: 24BOT0404T
GENETICS

Maximum Marks: 70 **Time Allowed: 3 hours/week**
Internal Assessment:20 **Credits: 3**
External Assessment:50

Note: The examiner is required to set seven questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus. In addition to that six more questions will be set. Two questions from each unit. The students will be required to attempt four questions in all selecting one question from each unit in addition to compulsory question No 1. All questions shall carry equal marks.

Learner Outcomes

By the end of this course, student teachers will be able to:

- Demonstrate a clear understanding of the fundamentals of genetics.
- Explain the principles of Mendelian and non-Mendelian inheritance traits.
- Describe genome organization in prokaryotes and analyze chromosome structure in eukaryotes.

UNIT-I

Basic Genetics: Historical developments in the field of genetics, Organisms suitable for genetic experimentation and their genetic significance. Mendelian laws of inheritance, Chromosome Theory of Heredity (Sutton- Boveri), Extra mendelian Inheritance patterns-incomplete dominance, co-dominance, pleiotropy, multiple alleles, pseudo-allele, essential and lethal genes, penetrance and expressivity. Inheritance patterns in Human (Sexlinked, Sex limited and Sex influenced), Non allelic interactions: supplementary genes, complementary genes and epistasis (dominant & recessive), Extra Chromosomal Inheritance

UNIT - II

Chromosome and Genomic Organization: Genetic organization of prokaryotic and eukaryotic genome, chromosome morphology, concept of euchromatin and heterochromatin. Packaging of DNA molecule into chromosomes, Specialized chromosomes, Transposons, Karyotyping, Genetic Linkage, Crossing Over and Chromosome Mapping: Linkage and Recombination of genes in a chromosome, Cytological basis of crossing over, Molecular mechanism of crossing over, Genetic mapping.

UNIT -III

Gene Mutations: Definition and types of mutations, Causes of mutations, Ames test for mutagenic agents, Variations in chromosomes structure - deletion, duplication, inversion and translocation (reciprocal and Robertsonian), Chromosomal aberrations in human beings, Abnormalities – Aneuploidy and Euploidy Genetic Disorders: Down, Turner and Klinefelter syndromes, chronic myeloid leukemia, cri-du-chat syndrome, cystic fibrosis

Recommended Textbooks and References:

1. Hartl, D.L. & Jones, E.W. Genetics: Principles and Analysis. Sudbury, MA: Jones and Bartlett. 1998.
2. Pierce, B.A. Genetics: a Conceptual Approach. New York: W.H. Freeman. 2005.
3. Tamarin, R.H. & Leavitt, R.W. Principles of Genetics. Dubuque, IA: Wm. C. Brown. 1991.
4. Klug, W.S., Cummings, M.R., Spencer, C.A., Palladino, M.A. & Killian, D. Concepts of Genetics (12thEd.). Pearson Education Limited: London. 2019.

COURSE CODE: 24BOT0404P:

GENETICS-Lab

Maximum Marks: 30
Internal Assessment:10
External Assessment:20

Time Allowed: 2 hours/Week
Credits: 1

Exam time: 3 Hrs.
Total Marks: 30

List of Experiments

1. Preparation and study of permanent and temporary mounts of mitosis.
2. Preparation and study of permanent and temporary mounts of meiosis.
3. Solving numericals on Mendelian deviations in dihybrid crosses.
4. Demonstration of Barr body and Rhoeo translocation.
5. Demonstration of chromosomal aberrations (structural and numerical).
6. Study of polytene chromosomes (lampbrush chromosomes and giant chromosomes).
7. Karyotyping using photographs.
8. Study of the effect of colchicine on chromosomes.
9. Demonstration of Mendelian laws using coloured marbles or beads.
10. Evaluation of segregation and random assortment using Chi-square test (test of goodness of fit).
11. Construction of genetic maps based on problems in two-factor and three-factor crosses.
12. Preparation and analysis of pedigree charts for common traits (e.g., blood group, colour blindness, PTC tasting).
13. Study of polyploidy in onion root tip by colchicine treatment.

STAGE SPECIFIC CONTENT COM PEDAGOGY

COURSE CODE:24CCP0404T
Pedagogy of Mathematics-1

Maximum Marks: 100 **Time Allowed: 4 hours/week**
Internal Assessment: 30 **Credits: 4**
External Assessment: 70

Note: The examiner is required to set nine questions in all. The first question will be compulsory consisting of seven short questions covering the entire syllabus. In addition to that eight more questions will be set. Two questions from each unit. The students will be required to attempt five questions in all selecting one question from each unit in addition to compulsory question No 1. All questions shall carry equal marks.

Learner outcomes: By the end of the course, student-teachers will be able to:

- Define "pure" vs. "applied" mathematics.
- Illustrate mathematical thinking in real-world examples.
- Summarize contributions of Aryabhata, Bhaskara II, Ramanujan.
- Explain links between mathematics and two other disciplines. Formulate three Bloom's-taxonomy objectives for a secondary topic.
- Distinguish aims from objectives per NCF-SE.

Unit 1

Nature and Significance of Mathematics: Meaning, nature, and scope of mathematics, Characteristics of mathematical thinking (precision, abstraction, generalization, reasoning), Place and importance of mathematics in school curriculum, Contributions of Indian mathematicians (Aryabhata, Bhaskara II, Ramanujan, etc.),

Relationship of mathematics with other disciplines (science, arts, social sciences, commerce), Role of mathematics in daily life and national development

Unit 2

Aims, Objectives, and Learning Outcomes, Aims of teaching mathematics in school education, Formulation of learning objectives (knowledge, understanding, application, skills), National Curriculum Framework and NEP 2020: vision for mathematics education, Developing mathematical abilities: logical reasoning, creativity, problem-solving, critical thinking, Mathematical literacy and numeracy for life and citizenship

Unit 3

Curriculum, Content, and Pedagogical Planning: Principles and organization of the mathematics curriculum (spiral approach, topical vs. concentric approach), Review of upper primary, secondary, and senior secondary mathematics syllabi (NCERT, State Boards), Planning for teaching: annual plans, unit plans, lesson plans, Role of teaching-learning materials (TLM), mathematics laboratory, and mathematics clubs, Integration of art, storytelling, and local contexts into mathematics content

Unit 4

Methods, Approaches, and Innovations: Pedagogical methods: inductive-deductive, heuristic, problem-solving, analytic-synthetic, project-based learning, Activity-based and experiential learning in mathematics classrooms, Constructivist approach: discovery learning, inquiry, peer collaboration, Role of ICT, digital resources, and multimedia in mathematics teaching, Innovative practices: use of games, puzzles, mathematical modeling, real-life applications, and AI tools, Addressing challenges in the mathematics

classroom: misconceptions, math anxiety, and individual differences

Practicum / Field Activities (Recommended)

- Design and conduct a mathematics activity for upper primary or secondary students
- Develop low-cost or digital TLM for teaching a key mathematical concept
- Prepare a lesson plan using constructivist or activity-based approach
- Organize a small mathematics club event or competition
- Document local or indigenous mathematical knowledge (e.g., folk patterns, architectural designs)

Suggested Readings:

- Sidhu, K.S. (1990). *The Teaching of Mathematics*. Sterling Publishers.
  Aggarwal, S.M. (1990). *Teaching of Mathematics*. Dhanpat Rai & Sons..
- NCERT. (2006). *Position Paper of the National Focus Group on Teaching of Mathematics*.
- NCERT. (2005). *National Curriculum Framework (NCF) 2005.*
  Polya, G. (1957). *How to Solve It: A New Aspect of Mathematical Method.* Princeton University Press.
- NCERT. (2017). *Learning Outcomes at the Elementary Stage.*
- UNESCO. (2013). *Policy Guidelines on Mobile Learning..*
- OECD. (2010). *PISA Mathematics Framework.*
- Joseph, G.G. (1991). *The Crest of the Peacock: Non-European Roots of Mathematics*. Princeton University Press..
- Bhaskara I & II, Aryabhata, Ramanujan (translated works or biographical accounts)
- Ministry of Education, Government of India. (2020). *National Education Policy (NEP) 2020.*
- NCERT. (2023). *National Curriculum Framework for School Education (NCF-SE).*

COURSE CODE: 24CCP0405T

Pedagogy of Physical Sciences -1

Maximum Marks: 100 **Time Allowed: 4 hours/week**
Internal Assessment: 30 **Credits: 4**
External Assessment: 70

Note: The examiner is required to set nine questions in all. The first question will be compulsory consisting of seven short questions covering the entire syllabus. In addition to that eight more questions will be set. Two questions from each unit. The students will be required to attempt five questions in all selecting one question from each unit in addition to compulsory question No 1. All questions shall carry equal marks.

Learner outcomes: By the end of the course, learner will be able to:

- Understand the nature and scope of physical sciences.
- Explain the aims and objectives of teaching physical sciences at the school level.
- Apply appropriate teaching methods and approaches for different science topics.
- Develop lesson plans integrating activities, experiments, and ICT.
- Understand curriculum, content, and pedagogy alignment.

Unit 1

Meaning and nature of physical sciences (physics, chemistry). Scope of physical sciences in daily life. Role of physical sciences in the development of society. Relationship of physical sciences with other school subjects, Recent trends and developments in physical sciences.

General aims and importance of teaching science, Specific objectives of teaching physics and chemistry at the secondary level. Bloom's Taxonomy (revised): cognitive, affective, psychomotor domains. Writing learning outcomes using action verbs.

Unit 2

Curriculum and Content Analysis in Physical Sciences: Meaning and importance of curriculum in physical sciences. Principles of curriculum construction. Critical analysis of NCERT/State Board science curriculum at the secondary stage. Content analysis: identifying key concepts, processes, and skills in physical sciences. Vertical and horizontal integration in science content.

Unit 3

Approaches and Methods of Teaching Physical Sciences: Inductive and deductive approaches. Lecture-demonstration method. Heuristic method (learning by discovery). Project method. Problem-solving approach. Laboratory method. Constructivist approach (including the 5E model). Inquiry-based learning strategies.

Unit 4

Lesson Planning, Instructional Strategies: Importance and purpose of lesson planning. Yearly plan, unit plan, and daily lesson plan. Components of a science lesson plan. Micro-teaching: teaching skills (questioning, explaining, reinforcement, stimulus variation). Preparation and use of low-cost teaching aids and ICT tools.

Suggested Activities for Practice:

- Designing and presenting science lesson plans.
- Conducting micro-teaching sessions on a selected topic.
- Developing low-cost teaching aids (models, charts, working devices).
- Analysing NCERT/State Board curriculum and suggesting improvements.

- Writing learning outcomes using Bloom's taxonomy verbs.

Suggested Readings:

- Anderson, L. W., & Krathwohl, D. R. (Eds.). (2001). *A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives*. Longman.
- National Council of Educational Research and Training. (2005). *National curriculum framework 2005*. NCERT.
- Sharma, R. C. (2010). *Modern science teaching* (10th ed.). Dhanpat Rai Publishing.
- National Council of Educational Research and Training. (2006). *Position paper: National focus group on curriculum, syllabus and textbooks*. NCERT.
- Sharma, S. R. (2008). *Curriculum development*. Kanishka Publishers.
- Taba, H. (1962). *Curriculum development: Theory and practice*. Harcourt, Brace & World.
- Bybee, R. W. (2009). *The BSCS 5E instructional model: Creating teachable moments*. National Science Teachers Association Press.
- Mangal, S. K., & Mangal, S. (2009). *Teaching of physical sciences*. PHI Learning.
- Bruner, J. S. (1960). *The process of education*. Harvard University Press.
- Passi, B. K. (1976). *Becoming better teacher: Microteaching approach*. Sahitya Mudranalaya.
- Bloom, B. S. (1956). *Taxonomy of educational objectives: The classification of educational goals*. Longman.
- Mangal, S. K. (2009). *Essential of educational technology*. PHI Learnin

COURSE CODE:

Pedagogy of Biological Sciences-1

Maximum Marks: 100 **Time Allowed: 3 hours**
Internal Assessment: 30 **Credits: 4**
External Assessment: 70

Note: The examiner is required to set nine questions in all. The first question will be compulsoryconsisting of seven short questions covering the entire syllabus. In addition to those eight more questions will be set. Two questions from each unit. The students will be required to attempt five questions in all selecting one question from each unit in addition to compulsory question No 1. All questions shall carry equal marks.

Learner outcomes: By the end of the course, the student-teacher will be able to:

- Understand the role and relevance of Biological Sciences in the school curriculum and its interdisciplinary connections.
- Apply appropriate pedagogical strategies like inquiry based learning, project work, and constructivism.
- Effectively integrate ICT tools, simulations, OERs, and virtual labs into Life Science teaching.
- Design inclusive and learner-centered lesson and unit plans.
- Prepare and use varied teaching-learning materials for active engagement.
- Organize experiential learning opportunities to make Biological Science learning contextual and meaningful.

Unit I

Nature and Scope of Biological Sciences: Meaning, nature, and scope of Biological Sciences, Place of Life Sciences in the school curriculum, Values of teaching Biological Sciences Sciences – intellectual, utilitarian, aesthetic, moral, environmental, Correlation of Biological Sciences with other school subjects (Chemistry, Physics, Mathematics, Environmental Science, Health Education

Unit II

Aims and Objectives of Teaching Biological Sciences: General aims and objectives of teaching Life Sciences at secondary and senior secondary levels, Bloom's Taxonomy of Educational Objectives: cognitive, affective, and psychomotor domains, Formulation of instructional objectives in behavioural terms

Unit III

Pedagogical Approaches and Strategies: Constructivist approach in teaching Biological Sciences, Inquiry-based learning, problem-solving method, and discovery approach, Project method, cooperative learning, experiential learning. Activity-based learning and use of analogies/models, Integration of ICT, virtual labs, simulations, and digital tools in Life Science teaching

Unit IV

Planning for Teaching Biological Sciences: Importance of lesson planning and unit planning, Components of an effective Life Science lesson plan (including objectives, teaching-learning activities, teaching aids), Designing learning experiences for diverse learners, Development and use of teaching-learning materials: charts, models, specimens, multimedia content, and open educational resources (OER), Planning field trips, experiments, and outdoor learning activities

Suggested Readings

- Agarwal, D.D. (2008). *Modern Methods of Teaching Biology*. New Delhi: Sarup & Sons..
- Sharma, R.A. (2006). *Teaching of Life Sciences*. Meerut: R. Lall Book Depot.
  management in Life Sciences.
- Gupta, S.K. (2009). *Teaching of Science: Modern Methods*. New Delhi: Shipra Publications.
  teaching.
- Venkataiah, N. (2001). *Science Education in 21st Century*. New Delhi: Anmol Publishers.
- NCERT (2005). *National Curriculum Framework*. New Delhi: NCERT..
- NCERT (2006). *Position Paper on Teaching of Science*. New Delhi: NCERT..
- National Education Policy 2020 – Government of India.
- *Secondary School Science: Strategies for Developing Scientific Literacy*. Prentice Hall.
- Wellington, J., & Ireson, G. (2012). *Science Learning, Science Teaching*. Routledge.
- UNESCO (2021). *Education for Sustainable Development Goals: Learning Objectives*.