SHIVAJI UNIVERSITY, KOLHAPUR
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शिवाजी विद्यापीठ, कोल्हापूर, ४१६ ००४, महाराष्ट्र
दूरध्वनी - इपीबीएक्स - २०६०९०००, अभ्यासमंडळे विभाग : ०२३१- २६०९०९४. २६०९४८७
वेबसाईट : www.unishivaji.ac.in ईमेल : bos@unishivaji.ac.in

Estd. 1962
"A++" Accredited by NAAC (2021)
With CGPA 3.52

Ref.: SU/BOS/ *IDS* / 286 **Date: 08 - 05- 2025**

To,
The Head,
Departments of Education,
Shivaji University, Kolhapur.

Subject : Regarding revised syllabi of **B. Sc. B. Ed. Part II** degree programme under the Faculty of Inter- Disciplinary Studies as per NEP-2020 (2.0).

Sir/Madam,

With reference to the subject mentioned above, I am directed to inform you that the university authorities have accepted and granted approval to the revised syllabi, nature of question paper and equivalence of **B. Sc. B. Ed. Part II** degree programme under the Faculty of Inter- Disciplinary Studies as per National Education Policy, 2020 (NEP 2.0).

This syllabus, nature of question and equivalence shall be implemented from the academic year **2025-2026** onwards. A soft copy containing the syllabus is attached herewith and it is also available on university website www.unishivaji.ac.in NEP-2020 (Online Syllabus)

The question papers on the pre-revised syllabi of above-mentioned course will be set for the examinations to be held in October /November 2025 & March/April 2026. These chances are available for repeater students, if any.

You are, therefore, requested to bring this to the notice of all students and teachers concerned.

Thanking you,

Yours Faithfully

(Dr. S. M. Kubal)
Dy Registrar

Encl. : As above.

Copy to: For Information and necessary action.

1	The Dean, Faculty of IDS	8	Affiliation T. 1 & T. 2 Section
2	Director, Board of Examination and Evaluation	9	Appointment A & B Section
3	The Chairman, Respective Board of Studies	10	P.G.Seminar Section
4	O. E. 3 Exam Section	11	I.T. Cell
5	Eligibility Section	12	Internal Quality Assurance Cell (IQAC)
6	Computer Centre	13	Centre for Distance Education
7	P.G.Admission Section		

"A++" Reaccredited by NAAC (2021) with CGPA 3.52

SHIVAJI UNIVERSITY, KOLHAPUR

B.Sc. B.Ed. Four Years Integrated Programme

B.Sc. B.Ed. Part II

(Dual Major Holistic Bachelor's Degree in Education & Science)

Secondary Stage Specialization
(9^{th} to 12^{th} Standard)

Under the Faculty of Inter disciplinary Studies

(As per NCTE-ITEP Amendment Regulations, 2019)

Introduced from Academic Year 2025-2026 Onwards

(Subject to the modifications made from time to time)

Semester-III						
Component	**Code**	**Title**	**Marks**	**Credits**	**Total Hours**	**Hours Per Week**
Foundations of Education	F-III	Child Development & Educational Psychology	100 (T80+P20)	04	60	06
Disciplinary / Inter- disciplinary Courses	D-III	A-Physics-VII ;Waves and Optics – I	50 (40+10)	02	30	04
		B-Chemistry-VII ; Physical Chemistry				
		C-Mathematics-VII ; Numerical Methods				
		A-Physics-VIII ; Waves and Optics – II	50 (40+10)	02	30	04
		B-Chemistry-VIII ; Analytical Chemistry				
		C-Mathematics-VIII ; Linear Algebra				
		A-Physics-IX ; Mathematical Physics and Classical Electrodynamics	50 (40+10)	02	30	04
		B-Chemistry- IX ; Inorganic Chemistry				
		C-Mathematics- IX ; Modern Algebra				
	Practicum	**Labwork-III**(Physics/Chemistry/Mathematics)	50	02	60	04
		Labwork-IV(Physics/Chemistry/Mathematics)	100	04	120	08
Stage-Specific Content-cum-Pedagogy	SSCCP-I	Stage-Specific Content-cum- Pedagogy Courses-I	100 (T 80 + P 20)	04	60	06
Ability Enhancement & Value-Added Courses	AEVC-VIII	Environmental Studies-I	50 (I 25 + E 25)	02	30	04
		Total =	**550**	**22**	**420**	**40**

Note- T: Theory, P: Practical/Practicum, I: Internal, E: External

B.Sc. B.Ed. (Integrated) Four Years Programme
Semester-III
Title of the Paper: (F-III)
Child Development and Educational Psychology

Total Marks	**100**	**Credits**	**04**
Total Hours	**60**	**Hours Per Week**	**06**
Internal Exam Marks	**20**	**External Exam Marks**	**80**
		Duration of External Examination	**3 hours**

Learning Outcomes: After completion of this course, student teachers will be able to:

a. Describe the meaning, concept, characteristics, and factors affecting growth and development.

b. Use the knowledge of Indian concept of self.

c**.** Apply various problem solving and learning strategies in real classroom settings.

d. Identify the various approaches of the process of learning.

e**.** Explain group dynamics and apply strategies to facilitate group learning.

UNIT: I Child Development **15 Lectures**

a. Meaning and significance of understanding the process of Child Development

• Biological, cognitive, socio-emotional, and moral.

b. Developmental characteristics of a child during:

• Infancy stage

• Early Childhood stage

• Middle to Late Childhood stage

• Adolescence stage

c. The Indian concept of self: Mind (मनस्), Intellect (बद्धि), Memory (चित्त). Panch-koshIyaVikas (पञ्चकोशीयविकास).

d. Educational Implications.

UNIT: II Developmental Process **15 Lectures**

a. Development across domains:

• Physical Development

• Cognitive Development

• Language Development

• Socio-Emotional Development

• Aesthetic Development

• Moral Development During each of the above-mentioned developmental stages of a child.

b. Factors affecting development.

c. Individual differences:

• Children with special needs including developmental disorders.

• Tools and Techniques for Identifying Learner with different abilities.

d. Teachers' role and strategies to address the needs of learners with different learning abilities.

UNIT:III Process of Learning **15 Lectures**

a. Conceptual Clarity and significance.

b. Approaches of Learning:

• Behaviorist

• Cognitivist

• Constructivist

• Developmental

• Information processing Model of learning

• Shri Aurobindo's Integral approach

c. Problem Solving and Learning Strategies: Inquiry and problem-based learning, Steps and Strategies in problem solving, Factors hindering problem solving.

d. How to Learn: Significance and Strategies

UNIT:IV Motivation and Classroom Management **15 Lectures**

a. Motivation

• Conceptual clarity, nature, and significance

• Intrinsic and Extrinsic Motivation

• Strategies for Motivation

b. Classroom management

• Creating a positive learning environment

• Planning space for learning

• Managing behavioral problems

c. Group dynamics:

• Classroom as a social group

• Characteristics of group

• Understanding group interaction-sociometry

• Strategies to facilitate group learning.

SESSIONAL WORK:

1. Spending day with a child and preparing a report based on our observations of childrenfor:

• A day from different economic status (low and affluent)

• Focus on various factors: Physical, emotional, social, language, cultural andreligious influencing the child on daily basis.

2. Observing children to understand the styles of children learning process.

3. Identifying the Learning Difficulties of Students in Different learning areas and the Possible Reason for them- Case Study Report.

4. Preparing Personalized Intervention plan for Students with Learning Difficulties.

5. Plan to use advanced technology to encourage talented / gifted children.

6. Encouraging gifted / talented students beyond the general school curriculum.

7. Familiarization and Reporting of Individual Psychological Tests.

TRANSACTIONAL MODE:

The course content transaction will include the following:

- Planned lecture infused with multimedia/ Power-Point presentations
- Small group discussions, panel interaction, small theme-based seminars, group discussions, cooperative teaching and team-teaching, selection from theoretical readings, case studies, analysis of educational statistics and personal field engagement with educationally marginalized communities and groups, through focus group discussions surveys, short term project works etc.

ESSENTIAL READINGS:

Aggarwal J C,(2010) Essentials of Educational Psychology, Vikas Publishing HouseLtd. New Delhi

Chauhan S S,(2009) Advanced Educational Psychology, Vikas Publishing HouseLtd. New Delhi

Dandapani S. (2000) a Textbook of Advanced Educational Psychology, AnmolPublications Pvt Ltd, New Delhi.

Dinkmeyer (1968) Child Development (The emerging self) Prentice – Hall of IndiaPrivate Limited, New Delhi 1967.

Hurlock Elizabeth (1972) Child Development, McGraw Hill Kogakusha, Ltd. Tokya.

Johnson R.C, medinn (US G.R.C. 1965), Child Psychology, Behavior &Development, John Wiley & Sons, Inc. New York.

Kale S.V. (1978) Child Psychology & Child Guidance Himalaya Publishing House,Bombay.

S.K Mangal, (2008) Advanced Educational Psychology P H I Learning Pvt. Ltd.- NewDelhi

Skinner Charles E. (2008) Educational Psychology Prentice - Hall of India PrivateLimited, New Delhi.

B.Sc. B.Ed.(Integrated) Four Years Programme
Semester-III
Title of the Paper :(D-III : PHYSICS PAPER-VII))Waves and Optics – I

Total Marks	**50**	**Credits**	**2**
Total Hours	**30**	**Hours Per Week**	**4**
Internal Exam Marks	**10**	**External Exam Marks**	**40**
		Duration of External Examination	**1 Hour, 30 Min.**

- **Learning Outcomes:**

  1: Apply superposition principle to develop mathematical model of harmonic oscillators.

  2: To develop the mathematical model for coupled oscillations.

  3: Understand the ultrasonic waves and their applications.

  4: Use of Basic principles of sound in context of acoustics of buildings.

Unit No.	Topics	Total Lectures
Unit I	**1.Superposition of Harmonic Oscillations (6 hr)** Linearity and superposition principle, Superposition of two collinear harmonic oscillations for oscillations having equal frequencies: Analytical method, oscillations having different frequencies (Beats), Superposition of two perpendicular harmonic oscillations: for oscillations having equal frequencies (Analytical method).Oscillations having different frequencies (Lissajous figures), Uses of Lissajous figures. **2. Coupled Oscillations (3hr)** Frequencies of coupled oscillatory systems, normal modes and normal co-ordinates, energy of coupled oscillations, energy transfer in coupled oscillatory system. **3. Wave Motion and Ultrasonic Waves (6hr)** Wave Motion: Transverse waves on a string, travelling and standing waves on a string, Normal modes of a string, Group velocity and Phase velocity, Plane waves, Spherical waves. Ultrasonic waves: Piezo-electric effect, Production of ultrasonic waves by Piezo-electric oscillator,	**15**

	Detection of ultrasonic waves, Properties of ultrasonic waves, Applications of ultrasonic waves.	
Unit II	**1. Sound and Acoustics of Buildings (6hr)** Sound: Transducers and their characteristics, Pressure microphone, Moving coil loudspeaker, Intensity and loudness of sound, Decibels, Intensity levels, Acoustics of buildings: Reverberation and time of reverberation, Absorption coefficient, Sabine's formula for reverberation time, Acoustic aspects of halls and auditoria. **2. Viscosity (9 hr)** Rate flow of liquid in a capillary tube - Poiseuille's formula, experimental determination of coefficient of viscosity of a liquid by Poiseuille's method, effect of temperature on viscosity of a liquid, Viscosity of liquid by rotating cylinder method, Searle's viscometer, viscosity of gases by Rankine's method (qualitative treatment only), Lubrication.	**15**

Reference Books:

1. The Physics of Waves and Oscillations- N. K. Bajaj, Tata McGraw-Hill Reprint 2022. 2. Physics of Degree Students- C. L. Arora and Dr. P. S. Hemne, S Chand & company
3. A Text Book of Sound- Khanna and Bedi, Atma Ram & Sons, Delhi.
4. Waves and Oscillations-N Subrahmanyam, BrijLal. Vikas 2nd edition, Reprint 2022
5. Elements of Properties of Matter-D.S. Mathur, S. Chand.
6. Electronic Instrumentation – H.S. KalasiMcHraw , Hill

B.Sc. B.Ed.(Integrated) Four Years Programme

Semester-III

Title of the Paper :(D-III: PHYSICS, PAPER-VIII) Waves and Optics – II

Total Marks	**50**	**Credits**	**2**
Total Hours	**30**	**Hours Per Week**	**4**
Internal Exam Marks	**10**	**External Exam Marks**	**40**
		Duration of External Examination	**1 Hour, 30 Min.**

- **Learning Outcomes:**

  1: Draw ray diagrams to demonstrate Cardinal points.

  2: Determine the resolving power of prism and grating by making use of Rayleigh criterion.

  3: Qualitatively study phenomenon of polarization of light.

  4: Apply phenomenon of interference of light for determination of its wavelength.

Unit No.	Topics	Total Lectures
Unit I	**1. Cardinal Points (6hrs)** Cardinal points of an optical system (definitions only), graphical construction of image using cardinal points, Newton's formula, relation between f and f' for any optical system, relation between lateral, axial and angular magnifications. **2. Resolving Power of Optical Instruments (4 hrs)** Resolution, resolving power (RP) of optical instruments, Rayleigh's criterion for the limit of resolution, Modified Rayleigh's criterion, comparison between magnification and resolution, RP of plane diffraction grating, RP of a prism. **3. Polarization of Light (5 hrs)** Idea of polarization, polarization by double refraction, Huygens explanation of double refraction through uniaxial crystal, Nicol prism (construction, working), production of circularly and elliptically polarized light, optical rotation - laws of rotation of plane of polarization, polarimeter.	**15**

Unit II	**1. Interference (9 hrs)** Principle of Superposition, Coherence and condition for interference, Division of amplitude and division of wave front, Lloyds single mirror (determination of wavelength of light of monochromatic source), Interference in thin parallel films (reflected light only), Wedge shaped films, Newton's rings and its application for determination of wavelength and refractive index of light. **2. Diffraction (6 hrs)** Fraunhoffer diffraction- Elementary theory of plane diffraction grating, Determination of wavelength of light using diffraction grating, Theory of Fresnel's half period zones, Zone	**15**

Reference Books:

1) Optics – AjoyGhatak, 2021, McGraw Hill.

2) A Textbook of Optics-N. Subrahnmanyam,Brij Lal, M.N. Avadhanulu, S.Chand.

3) A Textbook of Light- D.N. Vasudeva, Atma ram and Sons.

4) Waves and Optics – M. N. Avadanulu , TVS Arun Murthy, S. Chand.

5) Fundamentals of Optics – Devraj Singh PHI Learning.

B.Sc. B.Ed.(Integrated) Four Years Programme

Semester-III
Title of the Paper (D-III: PHYSICS PAPER-IX)
Mathematical Physics and Classical Electrodynamics

Total Marks	**50**	**Credits**	**2**
Total Hours	**30**	**Hours Per Week**	**4**
Internal Exam Marks	**10**	**External Exam Marks**	**40**
		Duration of External Examination	**1 Hour, 30 Min.**

- **Learning Outcomes:**
    1. Learn the curvilinear coordinates which have applications in problems with spherical and cylindrical symmetries.
    2. Learn the Dirac delta function its properties, which have applications in various branches of Physics, especially quantum mechanics.
    3. Basic course in electrostatics will equips the student with required prerequisites to understand electrodynamics phenomena.

Unit No.	Topics	Total Lectures
Unit I	**1. Orthogonal Curvilinear Co-ordinates: (8 hours)** Introduction to Cartesian, Spherical polar and Cylindrical co-ordinate systems, Concept of orthogonal curvilinear co-ordinates, Unit tangent vectors, Arc length, Area and Volume elements in orthogonal curvilinear co-ordinate system, Gradient, Divergence, Curl, Del and Laplacian in orthogonal curvilinear co-ordinate system, Extension of gradient, divergence, curl, del and Laplacian in Cartesian, Spherical polar and Cylindrical coordinate systems. **2. Partial Differential Equation (7 hours)** Introduction to differential equations, Method of separation of variables for solving second order partial differential equations, Form of two dimensional Laplace differential equation in Cartesian coordinates and its solution, Three dimensional partial differential equation in Cartesian	**15**

	coordinates and its solution, The differential equation of progressive wave and its solution.	
Unit II	**1. Charged Particles Dynamics (8 hours)** Poisson's and Laplace's equations and their physical significance, Laplace's equation in one dimension and its solutions, Motion of charged particle - in uniform electric field E, magnetic field B, Crossed uniform electric field E and magnetic field B. **2. Maxwell's Equations (7 hours)** Biot-Savarat's law, Amperes law, Derivation of $\vec{\nabla} \cdot \vec{B} = 0$ and $\vec{\nabla} \times \vec{B} = \vec{J}$, Displacement current, Maxwell's correction to Amperes law, Maxwell's equation for time dependent electric and magnetic fields in vacuum and material medium.	**15**

Reference Books:

1. Advanced calculus, Robert C. Wrede, Murray Spiegel.
2. Differential Equations with Modeling Applications, Dennis G.Zill.
3. Partial Differential Equations, Gupta Malik and Mittal.
4. Differential Equations, Gupta Malik and Mittal.
5. Differential Equations, Ramachandra Rao,H. R. Anuradha.
6. Partial Differential Equations, N. P. Bali.
7. Differential Equations, N. Ch. S. N. Iyenger.
8. Mathematical Physics, B. S. Rajput.
9. Mathematical Methods for Physicists, G. Arfken, Weber, 2005, Elsevier.
10. Mathematical Methods for Scientists and Engineers, McQuarrie, 2003, Viva Books.
11. Mathematical Physics, H. K. Das, Rama Varma.
12. Essential Mathematical methods, K. F. Riley, M. P. Habson, 2011,Cambridge.
13. Mathematics for Physicists, Susan M.Lea, 2004, Thomson Books/Cole.
14. Concepts of Modern Physics, Arthur Beiser, McGraw Hill
15. Introduction to Special Relativity, Robert Resnick, Wiley India
16. Classical Electrodynamics, Puri S.P., Tata McGraw/Alpha Science 2011
17. Classical Electrodynamics, Jackson J. D., Wiley India , 2007
18. Electromagnetics, Laud B.B., New Age International. 2011
19. Introduction to Electrodynamics , David. J. Griffiths , Pearson Publishing

B.Sc. B.Ed.(Integrated) Four Years Programme

Semester- III

Title of the Paper :(PHYSICS, PRACTICAL- III) Laboratory Course-III

Total Marks	**50**	**Credits**	**2**
Total Hours	**60**	**Hours Per Week**	**4**
Internal Exam Marks	**-**	**External Exam Marks**	**50**
		Duration of External Examination	**3 Hours**

Learning Outcomes: After going through the course, the student should be able to

- Acquire skills in setting up experiments.
- Develop practical skills and techniques for accurate measurements.
- Acquire observational skills.
- Determine the least counts of different measuring instruments.

Sr. No.	Name of experiment
1	Resonance pendulum
2	Y by Koenig's method
3	Cardinal points by Newton's method
4	Diffraction at a Single Slit
5	Spherical aberration
6	Absorption spectrum of a liquid (KMnO4 solution)
7	Self-Inductance by Owen's Bridge/Self-inductance by Maxwell's bridge.
8	Measurement of BH , BV and θ using Earth Inductor /Hysteresis by magnetometer method

Reference Books:

1. B.Sc. Practical Physics – HarnamSingh , P.S. Hemane, S. Chand.
2. Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, Asia Publishing House.
3. Advanced level Physics Practical, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
4. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
5. B.Sc. Practical Physics, C. L. Arora, S. Chand & Company Pvt. Ltd., New Delhi.

B.Sc. B.Ed.(Integrated) Four Years Programme

Semester- III

Title of the Paper: (D-III: PRACTICUM-PHYSICS PRACTICAL-IV)

Laboratory Course- IV

Total Marks	**100**	**Credits**	**4**
Total Hours	**120**	**Hours Per Week**	**8**
Internal Exam Marks	**-**	**External Exam Marks**	**100**
		Duration of External Examination	**4+4 Hours**

Scheme of Practical Examination for B. Sc. Part II

1. Practical examination will be conducted semester wise.
2. Practical examination will be conducted for two days per batch of 16 students.
3. The examination will be conducted in two sessions per day and each session will be of three hours duration if required.
4. At least eighty percent practical should be completed by the student.

Learning Outcomes: After going through the course, the student should be able to

- Acquire skills in setting up experiments.
- Develop practical skills and techniques for accurate measurements.
- Acquire observational skills.
- Determine the least counts of different measuring instruments.

Part I (Waves and Optics-I)

Sr. No.	Name of experiment
1	To investigate the motion of coupled oscillators.
2	To determine the frequency of an electrically maintained tuning fork by Melde's experiment and to verify λ^2–T Law.
3	To study Lissajous figures using CRO.
4	To determine coefficient of viscosity of water by capillary flow method (Poiseuille's method)
5	To determine velocity of sound in air by Kundt's tube and audio oscillator or Phase shift method (CRO and microphone).

6	To determine the viscosity of liquid by Searle's viscometer.
7	To determine the velocity of sound in air by resonating bottle.
8	To determine the frequency of a crystal oscillator.

Part –II (Waves and Optics II)

Sr. No.	Name of experiment
1	To determine the resolving power of a prism.
2	To determine the resolving power of a plane diffraction grating.
3	To determine wavelength of sodium light: using straight edge / Biprism.
4	To determine wavelength of sodium light using Newton's Rings.
5	To determine thickness of thin film using interference in wedge shaped thin film.
6	Goniometer I-To study cardinal points of optical system
7	Goniometer II-To study the equivalent focal length of optical system.
8	To study angle of specific rotation of sugar using Polarimeter.

Reference Books:

1. B.Sc. Practical Physics – HarnamSingh , P.S. Hemane, S. Chand.
2. Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, Asia Publishing House.
3. Advanced level Physics Practical, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
4. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
5. B.Sc. Practical Physics, C. L. Arora, S. Chand & Company Pvt. Ltd., New Delhi.

B.Sc. B.Ed. (Integrated) Four Years Program
Semester- III
Title of the Paper: (D-III: CHEMISTERY, PAPER-VII) Physical Chemistry

Total Marks	**50**	**Credits**	**2**
Total Hours	**30**	**Hours Per Week**	**4**
Internal Exam Marks	**10**	**External Exam Marks**	**40**
		Duration of External Examination	**1 Hour, 30 Min.**

Learning Outcomes

a.Knowledge and coherent understanding of basic concepts in thermodynamics and concept of Entropy will be gained by the student.

b.Learning and understanding the knowledge about basic concepts in kinetics and third order reactions with characteristics, suitable examples, and methods for determination of order of reactions and numerical problems.

c.Learning and coherent understanding of behavior of gases, ideal gas as model system and its extension to real gases. The dependence of physical state on P, V and T. Liquid crystals are essentials in all common and research devices, hence they are introduced with suitable examples.

UNIT I: Thermodynamics and Chemical Kinetics (15 hours)

- **a.** Thermodynamics: Introduction, Concept of Entropy: Definition, mathematical expression, unit. Physical significance of Entropy. Entropy changes for reversible and irreversible processes in isolated systems. Entropy changes for an ideal gas as a function of V & T and P & T.
- **b.** Entropy changes in the mixing of gases. Entropy changes in phase transformations. Third law of thermodynamics, standard entropy, application of third law of thermodynamics in the determination of absolute entropy, Entropy changes in chemical reactions. Numerical problems.
- **c. Chemical Kinetics**: Introduction. Third order reactions: derivation of rate constant considering reaction with Determination of order of reaction by: i) Integration method, ii) Graphical method and iii) Half-life method.
- **d.** Effect of temperature on rate of reaction, Arrhenius equation. Concept of energy of activation. Numerical problems.

UNIT II: States of Matter: Gaseous and Liquid State (15 hours)

a. Introduction, States of matter and their properties. **Gaseous state**: Postulates of Kinetic Theory of Gases. Ideal and non-ideal gases, Deviation of real gases from ideal behaviour, compressibility factor, causes of deviation. Van der Waals equation of state for real gases. Explanation of real gas behaviour by Van der Waal's equation, Boyle temperature (derivation not required).

b. Critical Phenomena: PV-isotherms of real gases (Andrew's isotherms), Continuity of state, Critical constants and their calculation from Vander Waals equation.

c. **Liquid state**: Liquid crystals: Difference between liquid crystal, solid and liquid.

d. Classification, structure of hematic, smectic and cholestric liquid crystal. Numerical Problems.

Reference Books:

1) Barrow, G.M. Physical Chemistry Tata McGraw-Hill (2007).
2) Castellan G.W. Physical Chemistry 4thEd.Narosa (2004).
3) Kotz, J.C. Treichel, P.M.&Townsend,J.R.General Chemistry, Cengage LearningIndia Pvt Ltd: New Delhi (2009).
4) Mahan,B.H. University Chemistry, 3rd Ed. Narosa (1998).
5) Petrucci, R.H. General Chemistry, 5th Ed., Macmillan Publishing Co,: New York (1985).
6) Elements of Physical Chemistry, S., Glasstone, D. Lewis.(2010)
7) Principles of Physical Chemistry, Marron and Prutton. (2007).
8) Elements of Physical Chemistry, P.W. Atkins (2017-18)
9) Essentials of Physical Chemistry, Bahl and Tuli. S. Chand, 2010.
10) Physical Chemistry, Danials and Alberty (2016)
11) University General Chemistry C.N.R.Rao (2016)
12) Principals of Physical Chemistry Puri, Sharma and Pathania 47th Edition, Vishal Publishing Co. Daryaganj Delhi. 110002 (2017-18)
13) Physical Chemistry A. J. Mee.(2015)
14) Advanced Physical Chemistry Gurudeep Raj (2017-18)
15) Physical Chemistry R. A. Aleberty. (2017-18)
16) Petrucci, R.H. General Chemistry 5th Ed. Macmillan Publishing Co.: New York (1985)

B.Sc. B.Ed. (Integrated) Four Years Program
Semester- III
Title of the Paper: ((D-III: CHEMISTERY, PAPER--VIII) Analytical Chemistry

Total Marks	**50**	**Credits**	**2**
Total Hours	**30**	**Hours Per Week**	**4**
Internal Exam Marks	**10**	**External Exam Marks**	**40**
		Duration of External Examination	**1 Hour 30 Min.**

Learning Outcomes

a.Learning and understanding of basic concepts in gravimetric analysis

b.Understanding, working and applications of optical methods as an analytical tool.

c.Learning and coherent understanding of column and ion exchange chromatography.

d. Learning and understanding about copyrights and trademarks related to IPR.

UNIT I: Gravimetric Analysis, Colorimetry and Spectrophotometry (16 hours)

a. **Gravimetric analysis:** Introduction, Gravimetric analysis by precipitation: nucleation, crystal growth, digestion/ageing, filtration, drying, ignition, weighing, Optimum condition for good precipitation.
b. Physical nature of precipitate, Purity of precipitate: co-precipitation, post-precipitation. Organic precipitates and their applications.
c. **Colorimetry and Spectrophotometry:** Theory of colorimetry and spectrophotometry. Lambert Beer's law, deviation from Beer's law. Terms used in colorimetry and spectrophotometry. Classification of methods of 'colour' measurement or comparison.
d. Photoelectric colorimeter method–Single beam photo-electric colorimeter.Spectrophotometer method–Single beam direct reading spectrophotometer.Determination of unknown concentration by using concentration-absorbance plot.Applications of colorimetry and spectrophotometry.

UNIT II: Chromatographic techniques and IPR (14 hours)

a. **Chromatographic techniques:** Introduction to chromatography, classification. Column chromatography: Introduction, types, Principle of adsorption column chromatography, solvent system, stationary phases. Methodology-Column packing, applications of sample, development, detection methods, recovery of components. Applications.

b. **Ion exchange chromatography:** Introduction, Principle, Types and properties of ion exchangers. Methodology, Column packing, application of sample, elution, detection/analysis, Applications.
c. **IPR**: Copyright: Introduction to Copyright, Origin, Definition &Types of Copyright, Registration procedure, Assignment & license, Terms of Copyright.
d. Trademark: Introduction to Trademark, Origin, Meaning & Nature of Trade Marks, Types, Registration of Trade Marks.

Reference Books:

1) Principles of Physical Chemistry by Puri, Sharma and Pathania, Vishal Publishing company, Jalindhar.

2) Vogel's Textbook of Quantitative Chemical Analysis 5th Edition, Longman Scientific & Technical Ltd. UK.

3) Modern Analytical Chemistry by David Harvey, McGraw-Hill International Edition, 2000.

4) Industrial chemistry by B. K. Sharma, Goel Publishing Housing, 16th edition 2011.

5) Advanced Inorganic Chemistry, Vol. No.1, by Gurudeep Raj, Krishna Prakashan Media Ltd, Goel Publication, Meerut.

6) Analytical chemistry by B.K. Sharma, Krishna Prakashan Media Ltd, Meerut, edition 3rd 2011.

7) Principles of electroplating and electroforming by Blum and Hogaboom.

8) Chemical Process Industries by Shreve and Brink.

9) Industrial Chemistry by LoutfyMadkor and Helen Njenga.

10) Elementary Principles of Chemical Processes by Richard Felder and Ronald Rousseau, John Wiley and Sons.

11) Essential of Physical Chemistry by Bahl B.S., Tuli G.D. and BahlArun, S. Chand and Company Ltd. New Delhi.

12) Analytical Chemistry, H. Kaur, APragatiPrakashan Meerut.

13) Analytical Chemistry, Alka Gupta, APragatiPrakashan Meerut.

14) Instrumental methods of chemical analysis – Chatwal &Anand.

B.Sc. B.Ed. (Integrated) Four Years Program
Semester- III
Title of the Paper:(D-III: CHEMISTERY, PAPER-IX) Inorganic Chemistry

Total Marks	**50**	**Credits**	**2**
Total Hours	**30**	**Hours Per Week**	**4**
Internal Exam Marks	**10**	**External Exam Marks**	**40**
		Duration of External Examination	**1 Hour, 30 Min.**

Learning Outcomes

a.Learning and understanding basic concepts about coordination complexes.

b.Student will be capable of understanding the properties of 3d series elements.

c.Students will understand the formation of molecules on the basis of concept of hybridization and molecular orbital theory.

d.Students will learn the basic knowledge about the qualitative analysis of inorganic compounds.

UNIT I: Co-ordination Chemistry and Chemistry of Elements of 3d Series Elements (16 hours)

a. **Coordination Chemistry:**Introduction, Definition and formation of co-ordinate covalent bond in BF3–NH3, [NH4]+ and H2O, Terminology- Description of the terms-ligand, co-ordination number, coordination sphere. Effective atomic number rule. Distinguish between double salt and complex salt. Werner's theory. Postulates. The theory as applied to cobalt amines viz. CoCl3.6NH3, CoCl3.5NH3, CoCl3.4NH3, CoCl3. 3NH3. IUPAC nomenclature of coordination compounds. Isomerism in complexes with C. N. = 4 and C. N. = 6. Geometrical Isomerism. Optical Isomerism. Structural Isomerism, Ionization Isomerism, Hydrate Isomerism, Coordination Isomerism, Linkage Isomerism and Co-ordination position Isomerism.
b. Valance bond theory of transition metal complexes concerning, C.N. = 4, complexes of [CuCl4]2- and [Cu(CN)4]2- and C.N. = 6 complexes of [FeF6]3- and [Fe(CN)6]3-. Chelation. Definition and explanation of terms chelation, chelating agent, metal chelate and chelate effect. Difference between metal chelate and metal complex. Classification of chelating agents (with specific illustration of bidentate chelating agent).
c. **Chemistry of Elements of 3d Series Elements**: Position of elements in the periodic table

d. Characteristics of d-block elements with special reference to i) Electronic structure, ii) Oxidation states, iii) Magnetic characters, iv) Colored ions

UNIT II: Chemical Bonding and Molecular Structure, Inorganic Semi-micro Qualitative Analysis(14 hours)

a. Chemical Bonding and Molecular Structure: Valence Bond Theory (VBT)-VSEPR Theory. Concept of Hybridization: The need for hybridization, different types of hybridization, and geometry of the following molecules:Planar trigonal geometry- BF_3 (sp^2 hybridization), Tetrahedral geometry- $SiCl_4$ (sp^3 hybridization). Trigonal Bipyramidal geometry- PCl_5 (sp^3d hybridization).

b. Molecular Orbital Theory (MOT): LCAO method, formation of bonding and anti-bonding molecular orbitals. Bond order and its significance, Energy level sequence for molecular orbital when n= 1 and 2. MO diagrams for homonuclear diatomic molecules, B_2,N_2 and O_2. MO diagrams for heteronuclear diatomic molecules, CO and NO.

c. Inorganic Semi-micro–Qualitative Analysis: Theoretical principles involved in qualitative analysis. Applications of solubility product and common ion effect in the separation of cations into groups.

d. Applications of complex formation in a) Separation of II group into IIA and IIB sub-groups. b) Separation of Copper from Cadmium. c) Separation of Cobalt from Nickel. d) Separation of Cl-, Br-, I-. e) Detection of NO_2^-, NO_3^-(Brown ring test). Application of oxidation and reduction in a) Separation of Cl-, Br-, I- in mixture b) Separation of NO_2^- and NO_3^- in mixture. Spot test analysis.

Reference Books:

1. Inorganic chemistry, Principles of structure and reactivity by J. E. Huheey and et. Al
2. Inorganic Chemistry by Shriver and Atkins 5th edition.
3. Vogels text book of Qualitative Inorganic analysis by A. I. Vogel. 3rd and 6th edition.
4. Advanced Inorganic Chemistry by Agrawal Keemtilal (PragatiPrakashan).
5. Theoretical Inorganic Chemistry by C. Day & J. Selbin2nd edition.
6. Principles of inorganic chemistry by Puri Sharma &Kalia.
7. Modern Inorganic Chemistry by R. D. Madan (S. Chand).
8. Inorganic Chemistry by J. D. Lee.
9. Basic Inorganic Chemistry by F. A. Cotton, G. Wilkilson& B. L. Gauswiley.
10. Chemistry for Degree students by R. L. Madan (S. Chand Publication).
11. Concise Coordination Chemistry by Ramlingam, Ramgopalan.

B.Sc. B.Ed. (Integrated) Four Years Program
Semester- III
(D-III: PRACTICUM-CHEMISTRY PRACTICAL-III)
Laboratory Course- III, -Physical Chemistry

Total Marks	**50**	**Credits**	**2**
Total Hours	**60**	**Hours Per Week**	**4**
Internal Exam Marks	**-**	**External Exam Marks**	**50**
		Duration of External Examination	**3 Hours**

Perform the following Experiments (Any 8)

1. To study the hydrolysis of methyl acetate in the presence of HCl and H2SO4 and to determine the relative strength of acids.
2. To study the reaction between potassium persulphate and Potassium iodide in solution with unequal concentration of the reactants.
3. To study the effect of acid strength on hydrolysis of an ester by using 0.5M HCl and 0.25M HCl.
4. Determination of the adsorption coefficient of acetic acid-charcoal system.
5. To determine the percentage composition of a given liquid mixture by viscositymethod (Density data to be given).
6. To determine the degree of dissociation and dissociation constant of acetic acid at various dilutions and to verify Ostwald's dilution law conductometrically.
7. To determine the normality of the given strong acid by titrating it against the strong alkali coductometrically.
8. To determine the specific rotation and unknown concentration of sugarsolution.
9. To determine the specific and molar refractions of benzene, toluene and xylene by Abbe's refractometer and to determine the refraction of CH2 Group is a (Methylene group) (Densities should be determined by students).

B.Sc. B.Ed. (Integrated) Four Years Program
Semester- III
(D-III: PRACTICUM-CHEMISTRY PRACTICAL-IV)
Laboratory Course- IV: CHEMISTRY, Analytical chemistry

Total Marks	**100**	**Credits**	**4**
Total Hours	**120**	**Hours Per Week**	**8**
Internal Exam Marks	**-**	**External Exam Marks**	**100**
		Duration of External Examination	**4+4 Hours**

Perform the following Experiments (Any 8)

1. Fertilizer analysis: To determine the percentage of nitrogen in the given sample of a nitrogenous fertilizer (ammonium sulphate). Known weight of the sample tobe taken by the student. For preparing its solution which is to be refluxed with known excess of alkali.Standard HCl solution to be supplied.
2. Analysis of Synthetic /Commercial Sample: To estimate Magnesium from talcum powder.
3. Determination of alkali content from antacid tablet using HCl solution.
4. Estimation of Calcium from chalk: To estimate amount of calcium from the chalk by titrimetric method. (By redox titration using $KMnO_4$ solution).
5. Determination of total hardness of water using 0.01M EDTA solution. (Students should standardize the given EDTA solution by preparing 0.01M $CaCl_2$ solution using $CaCO_3$ salt.)
6. Determination of Alkalinity of water titrimetrically using 0.02N H_2SO_4 using methyl orange and phenolphthalein indicator.
7. Estimation of acetone.
8. Estimation of Vitamin C from given tablet.
9. Estimation of Phenol by Bromination method.

Gravimetric Analysis (Any two)

i) Gravimetric estimation of iron as Fe_2O_3 from a solution containing Ferrous ammonium sulphate and free sulphuric acid.

ii) Gravimetric estimation of barium as $BaSO_4$ from a solution containing barium chloride and free hydrochloric acid.

iii) Gravimetric estimation of nickel as $Ni(DMG)_2$ from a solution containing$NiSO_4.7H_2O$ and free sulphuric acid.

Inorganic Preparations (Any Two)

i) Preparations of sodium cuprous thiosulphate.

ii) Preparation of tris (ethylenediamine) nickel(II) thiosulphate.

iii) Preparation of hexamine nickel(II)chloride.

Semi-micro Qualitative Analysis

Analysis of binary mixtures with non interfering cations and anions

(at least 4 mixtures to be analyzed)

iv) Following anions are to be given:

Cl-, Br-, I-, NO3-, CO3--, SO4--, S--, (insoluble CO3—may be given)

v) Following cations are to be given:

Cu2+, Cd2+ , Al+3, Fe+3, Cr+3 . Zn+2, Mn+2 Ni+2, Co+2,

Ca+2, Ba+2. Mg+2, NH4+, K+

Note:-Use of spot tests to be made whenever possible.

Reference Books:

1) Vogel's Quantitative Chemical Analysis, Pearson 2009.

2) Vogel's text book of Qualitative Inorganic analysis by A. I. Vogel .3rd and 6th edition

3) Vogel's text book of Quantitative Inorganic Chemistry by A. I. Vogel.

4) Physical Chemistry of Inorganic qualitative analysis by Kuricose&Rajaram.

5) Practical manual in water Analysis by Goyal & Trivedi

6) Practical Organic Chemistry by A.I. Vogel.

7) Hand book of Organic qualitative analysis by H.T. Clarke.

8) A Laboratory Hand Book of Organic qualitative analysis and separation by V.S. Kulkarni.DastaneRamchandra& Co.

9) Practical Organic Chemistry by F.G. Mann and B.C. Saunders. Low – priced Text Book.ELBS. Longman

10) Advanced Practical Organic Chemistry by N.K. Vishnoi. Vikas Publishing House Private Limited.

11) Advanced practical chemistry by J. Singh, L. D. S. Yadav, R. K. P. singh, I. R. Siddiqui et.al, Pragatiprakashan.

B.Sc. B.Ed. (Integrated) Four Years Programme
Semester-III
Title of the Paper: (D-III: MATHEMATICS, PAPER-VII), Numerical Methods

Total Marks	**50**	**Credits**	**02**
Total Hours	**30**	**Hours Per Week**	**04**
Internal Exam Marks	**10**	**External Exam Marks**	**40**
		Duration of External Examination	**1 Hour, 30 Min.**

Course Learning Outcomes: This course will enable the students to:

CO1: Find numerical solutions of algebraic, transcendental & system of linear equations.

CO2: Learn about various interpolating methods to find numerical solutions.

CO3: Find numerical solutions of integration and ODE by using various methods.

CO4: Apply various numerical methods in real life problems.

Unit- 1 **(15 Hrs.)**

1.1 Solutions of Algebraic and Transcendental Equations:

1.1.1 Introduction
1.1.2. Mathematical Preliminaries
1.1.3 Bisection Method
1.1.4 Method of False position
1.1.5 Newton- Raphson method
1.1.6 Examples based on art.1.1.3 to 1.1.5

1.2 Interpolation

1.2.1 Introduction
1.2.2 Finite differences
1.2.3 Forward differences
1.2.4 Backward differences
1.2.5 Symbolic relations and Separation of symbols
1.2.6 Newton's formulae for Interpolation
    1.2.6.1 Newton's forward difference interpolation formula
    1.2.6.2 Newton's backward difference interpolation formula
1.2.7 Interpolation with Unevenly Spaced Points
    1.2.7.1 Lagrange's Interpolation Formula
1.2.8 Examples based on art.1.2.2 to 1.2.7

Unit- 2 **(15 Hrs.)**

2.1 Numerical Integration
- 2.1.1 General formula
- 2.1.2 Trapezoidal rule
- 2.1.3 Simpson's 1/3- rule
- 2.1.4 Simpson's 3/8- rule
- 2.1.5 Examples based on art. 2.1.2 to 2.1.4.

2.2 Solutions of Linear system of equations
- 2.2.1 Solutions of linear system - Direct method
  - 2.2.1.1 Gauss Elimination Method
- 2.2.2 Solutions of linear system - Iterative method
  - 2.2.2.1 Gauss-Seidel Method
- 2.2.3 Examples based on art. 2.2.1 to 2.2.2.

2.3 Numerical Solutions of ODE:
- 2.3.1 Introduction
- 2.3.2 Solution by Taylor's series method
- 2.3.3 Picard's method of successive approximation
- 2.3.4 Euler's method
- 2.3.5 Modified Euler's method
- 2.3.6 Runge-Kutta methods
  - 2.3.6.1 second order Runge-Kutta (without proof)
  - 2.3.6.2 fourth order Runge-Kutta (without proof)
- 2.3.7 Examples based on art. 2.3.2 to 2.3.6.

Recommended Book -

1. S. S. Sastry - Introductory Methods of Numerical Analysis: Fifth Edition, Prentice Hall India Learning Private Limited, New Delhi (2012).

Scope: [**Chapter-1:** 1.1(a,b,d,c,f), 1.2**; Chapter-2:** 2.1, 2.2, .2.3, 2.5; **Chapter-3:** 3.1, 3.3, 3.6, 3.9; **Chapter-6:** 6.4; **Chapter-7:** 7.5, 7.6; **Chapter-8:** 8.1, 8.2, 8.3, 8.4, 8.5]

Reference Books -

1. M. K. Jain, S. R. K. Iyengar& R. K. Jain - Numerical Methods (Problems and Solutions): Revised Second Edition, New Age International Pvt Ltd Publishers, Mumbai.
2. H. C. Saxena - Finite Differences and Numerical Analysis, S. Chand & Company Ltd.(2005).
3. Dr. B. S. Grewal, Numerical Methods in Engineering & Science, Khanna Publishers.

B.Sc. B.Ed. (Integrated) Four Years Programme
Semester-III
Title of the Paper: (D-III: MATHEMATICS, PAPER-II), Linear Algebra / Swayam Course on Algebra

Total Marks	**50**	**Credits**	**02**
Total Hours	**30**	**Hours Per Week**	**04**
Internal Exam Marks	**10**	**External Exam Marks**	**40**
		Duration of External Examination	**1 Hour 30 Min.**

Course Learning Outcomes: This course will enable the students to:

CO1: Understand the fundamental concepts in linear algebra, enabling them to analyze and manipulate vector spaces, linear transformations, matrices.
CO2: Acquire skills to perform computations related to inner product and orthogonalization techniques.
CO3: Compute Eigen values and Eigen vectors of a linear transformations.

Unit 1: Vector Spaces and Linear Transformations (15 Lect.)

Vector space, Subspace**,** Sum of subspaces, direct sum, Quotient space, Homomorphism or Linear transformation, Kernel and Range of homomorphism, Fundamental Theorem of homomorphism, Isomorphism theorems, Linear Span, Finite dimensional vector space, Linear dependence and independence, basis, dimension of vector space and subspaces.

One-one and onto Linear Transformations, rank and nullity of a linear transformation, Sylvester's Law, Algebra of Linear Transformations - Sum and scalar multiple of Linear Transformation, The vector space Hom(V,W), Product (composition) of Linear Transformations, Linear operator, Linear functional, Invertible and non-singular Linear Transformation, Matrix of Linear Transformation and its examples.

Unit 2: Inner Product Spaces, Eigen values and Eigen vectors (15 Lect.)

Inner product space, norm of a vector, Cauchy- Schwarz inequality, Orthogonality, Generalized Pythagoras Theorem, orthonormal set, Gram-Schmidt orthogonalisation process, Eigen values and Eigen vectors, Eigen space, Characteristic Polynomial of a matrix and remarks on it, similar matrices, Characteristic Polynomial of a Linear operator, Examples on eigen values and eigen vectors of matrices, Cayley Hamilton theorem (without proof), Applications of Cayley Hamilton theorem (Examples).

RECOMMENDED BOOKS

1. Khanna V. K. and Bhambri S. K., **A Course in Abstract Algebra,** Vikas Publishing House PVT Ltd., New Delhi, 2016, 5th edition,
[Scope: Chaper-10,11,12& 13]
2. Grewal, B.S., **Higher Engineering Mathematics**, 42nd Edition, Khanna Publishers, New Delhi, 2012. **[Scope: Chaper-2: Art. 2.15]**

REFERENCE BOOKS

1. **Elementary Linear Algebra** (with Supplemental Applications), H. Anton & C. Rorres; 11th Edition, Wiley India Pvt. Ltd (Wiley Student Edition), New Delhi, 2016.
2. **Linear Algebra**, S. Friedberg, A. Insel, L. Spence; 4th Edition, Prentice Hall of India, 2014.
3. **Linear Algebra,** Holfman K. and Kunze R.; Prentice Hall of India, 1978.
4. **Linear Algebra,** Lipschutz' S; Schaum's Outline Series, McGraw Hill, Singapore, 1981.

B.Sc. B.Ed. Mathematics (Integrated) Four Years Programme
Semester-III
Title of the Paper: (D-III: MATHEMATICS, PAPER-IX)
Modern Algebra/ Swayam Course on Algebra

Total Marks	**50**	**Credits**	**02**
Total Hours	**30**	**Hours Per Week**	**04**
Internal Exam Marks	**10**	**External Exam Marks**	**40**
		Duration of External Examination	**1 Hour 30 Min.**

Course Learning Outcomes: This course will enable the students to:

CO 1. Learn Group structure and its properties, Ring structure and its properties.
CO 2. Describe the difference between concepts Group and Ring.
CO 3. Understand fundamental theorem of homomorphism, isomorphism for Group and Ring.

Unit 1: Groups (15 Lect.)

Groups: Definition and examples of groups, commutative group, order of a group, Quaternion group, group of residues, Definition of subgroup and examples, Definition of centre of group G ,Normalizer of an element in G, Definition of left and right cosets and congruence relation, Lagrange's Theorem, Definition of Index of H in G,Centralizer of H, Normalizer of H, Definition of cyclic group and order of element of a group, Definition of Euler's ∅ function, Euler's Theorem, Fermat's Theorem, Examples related to Euler's ∅ function and Fermat's Theorem.

Unit 2: Normal Subgroups, Homomorphism of Groups, Ring and it's properties (15 Lect.)

Definition and examples of subgroup, simple group , quotient group, Definition the Normalizer N(H), Definition and examples of Homomorphism, Isomorphism, epimorphism, Monomorphism, Endomorphism and Automorphism, Fundamental Theorem of group homomorphism, Second Theorem of isomorphism, Third Theorem of isomorphism, Dihedral group, Permutation group, Cayley's Theorem, Definition of Alternating group, Definition and examples of a ring, Commutative ring, Ring with unity, Definition and examples of Zero divisor, Integral Domain, Division Ring, Field, Definition and examples of Boolean ring, Definition and examples of Subring, Characteristic of a ring: Definition and examples, Definition and examples of Nilpotent, Idempotent, product of rings, Definition and examples of Ideal, Definition of Sum of two ideals and examples, Definition of Simple Ring.

RECOMMENDED BOOKS

1. Khanna V. K. and Bhambri S. K., **A Course in Abstract Algebra,** Vikas Publishing House PVT Ltd., New Delhi, 2016, 5th edition,
[Scope: Chaper- 2,3,7]

REFERENCE BOOKS

1. Topics in Algebra, Herstein I.N.; Vikas Publishing House,1979.
2. Fundamentals of Abstract Algebra **,**Malik D. S. Morderson J. N. and Sen M. K. McGraw Hill,1997.
3. A TextBook of Modern Abstract Algebra, Shanti Narayan
4. Modern Algebra, Surjeet Sing and QuaziZameeruddin; Vikas Publishing House, 1991.
5. Lectures on Abstract Algebra, T. M. Karade, J. N. Salunkhe, K. S. Adhav, M. S. Bendre, SonuNilu, Einstein Foundation International, Nagpur 440022.
6. Basic Algebra Vol. I & II, N. Jacobson, W.H. Freeman 1980.
7. Algebra,VivekSahaiandVikasBistNaros Publishing House,1197.
8. A First Course in Abstract Algebra by John B. Fraleigh Pearson Education; Seventh edition (2014)

B.Sc. B.Ed. (Integrated) Four Years Programme
Semester-III
(D-III: Practicum MATHEMATICS)
PRACTICUM-: NUMERICAL METHODS Lab work-III

Total Marks	**50**	**Credits**	**02**
Total Hours	**60**	**Hours Per Week**	**04**
Internal Exam Marks	**–**	**External Exam Marks**	**50**
		Duration of External Examination	**3 Hours**

Pr. No	**Title of the Practical**	**No. of Practicals**
1.	Newton- Raphson method	2
2.	Newton's interpolation formula	1
3.	Lagrange's interpolation method	1
4.	Trapezoidal rule	1
5.	Simpson's rule	2
6.	Gauss Elimination method	1
7.	Gauss-Seidel method	1
8.	Taylor series method	1
9.	Picard's method	1
10.	Euler's method	1
11.	Euler's modified method	1
12.	Runge-Kutta method	2
	Total Practicals	15

B.Sc. B.Ed. (Integrated) Four Years Programme
Semester-III
(D-III: Practicum MATHEMATICS)
PRACTICUM-: LINEAR AND MODERN ALGEBRA, Lab work-IV

Total Marks	**100**	**Credits**	**04**
Total Hours	**120**	**Hours Per Week**	**08**
Internal Exam Marks	**–**	**External Exam Marks**	**100**
		Duration of External Examination	**4 + 4 Hours**

Part I

Pr.No	Title of the Practical	No. of Practicals
1.	Vector space and subspaces	1
2.	Kernel and Range of Linear Transformation	1
3.	Fundamental Theorem of Homomorphism and Isomorphism Theorem	1
4.	Linear Dependence , Independence and Linear Span	1
5.	Basis and Dimension of Vector Space	1
6.	Sylvester's Law	1
7.	Algebra of Linear Transformation	1
8.	Linear Operator and Linear Functional	1
9.	Matrix of Linear Transformation	1
10.	Inner Product Space	1
11.	Orthogonal Sets	1
12.	Orthonormal sets and Gram-Schmidt orthogonalisation process	1
13.	Eigen values and Eigen vectors	1

14.	Characteristic polynomial of linear operator	1
15.	Application of Cayley-Hamilton theorem	1
	Total Practicals	**15**

Part II

Pr.No	**Title of the Practical**	**No. of Practicals**
1.	Groups and commutative groups	1
2.	Subgroups	1
3.	Cosets and Congruence relation	1
4.	Normalize and Centralizer of subgroups	1
5.	Cyclic group and order of element	1
6.	Euler's ∅ function and Fermat's Theorem	1
7.	Simple groups	1
8.	Examples of Homomorphism, Isomorphism, Epimorphism, Monomorphism, Endomorphism and Automorphism	2
9.	Group Homomorphism and theorem of isomorphism	1
10.	Dihedral group and Permutation group	1
11.	Zero divisors and Integral domain	1
12.	Division ring	1
13.	Boolean ring, Nilpotent ring and Idempotent ring	1
14.	Sum of Ideals and simple rings	1
	Total Practicals	**15**

B.Sc. B.Ed. (Integrated) Four Years Programme
Semester-III
Title of the Paper: (S-I) Basics of Pedagogy at Secondary stage

Total Marks	**100**	**Credits**	**04**
Total Hours	**60**	**Hours Per Week**	**06**
Internal Exam Marks	**20**	**External Exam Marks**	**80**
		Duration of External Examination	**3 hours**

Learning Outcomes

After completion of this course, student teachers will be able to:

• build comprehensive understanding of secondary stage learners,

• assess the physical, mental, social, and emotional growth of secondary stage learners,

• develop skills to observe and recognize the unique capabilities and strengths of secondary stage learner,

• discuss the necessary knowledge and skills to implement effective teaching and learning strategies,

• create enriching and inclusive learning environments to foster values-based education,

• develop a deeper understanding of various pedagogical approaches and their impact on learners,

• determine the knowledge to make informed decisions about instructional practices,

• explain the crucial role of pedagogy in facilitating effective learning experiences for students,

• outline knowledge and skills necessary for continuous professional development.

Unit I: Understanding Secondary Stage Learners & Learners Background (15 hrs.)

A. Understanding the physical, mental, social, and emotional growth and characteristics of learners
B. Observing the unique capabilities of learner & Understanding the Thought processes and cognitive skills of learners
C. Understanding the Psychological and social orientations of learners

D. Understanding the Social and academic lives of learners
E. Understanding theConflicts and challenges of secondary learners

UNIT – II Understanding Strategies of Teaching and Learning (15 hrs.)

A. Concept, characteristics and functions of teaching and Making classrooms inclusive and joyful learning spaces
B. Making abstract concepts enjoyable by relating them to real-life situations,
C. Promoting multidisciplinary learning through integration of different disciplines
D. Promoting learner participation and engagement in learning and Promoting health and social sensitivities
E. Building values through art integrated activities, community engagement and Developing respect toward cultural heritage

UNIT – III: Pedagogical Approaches (15 hrs.)

A. Relationship between Aims and Values of Education, Relationship and Curriculum and Pedagogy
B. Pedagogical approaches: constructivist approach; collaborative approach; reflective approach; integrative approach, inquiry- based approach;
C. Other contemporary approaches, art-integrated learning, sports- integrated learning.
D. Types of pedagogy: social pedagogy; critical pedagogy; culturally responsive pedagogy; Socratic pedagogy in inclusive setup.
E. Role of pedagogy in effective learning: how does pedagogy impact the learner?

UNIT – IV: Continuous Professional Development of Teacher (15 hrs.)

A. Meaning and need, professional and ethical competencies
B. Need for updating content and pedagogical competencies to develop their professional competencies.
C. Professional development activities: seminars, conferences, orientation programmes, workshops, online and offline courses, competitions, publications,

development of teaching portfolio, capacity building programmes, and teacher exchange programmes.

D. Development of professional competencies to deal with gender issues, equity and inclusion, ethical issues, environmental issues, human health and well-being, population, human rights

E. Development of professional competencies related with various issues (emotional, mental, physical issues related to pandemic (for example covid-19).

TRANSACTIONAL MODE:

Lecture cum discussion, project-based method, problem solving method, experiential learning, art integrated learning, sports integrated learning, ICT integrated learning, interactive methods such as group discussions, peer tutoring, workshops, observations, and presentations

ESSENTIAL READINGS:

- National Council of Educational Research and Training. (April 2022). Mandate documents Guidelines for the development of National Curriculum Frameworks.
- National Education Policy 2020, MoE, Government of India (English and Hindi)

• National Steering Committee for National Curriculum Frameworks, (2023). Draft National Curriculum Framework for School Education.

• National Policy on Education 1968, 1986 and 2020.

REFERENCES:

Bhandala, Chadha.& Khanna. (1985). Teaching Of Science. New Delhi: Prakash Brothers Educational Publishers

Pedagogy of Biological Sciences (Part-1). (2016). Tamil Nadu Teachers Education University: Chennai

Pedagogy of Biological Sciences.(2018). Directorate of Distance Education. Maulana Azad National Urdu University: Mewat

Pedagogy of School Subject-II Biological Sciences. (2019-20). Mangalore University:

Mangalagangothri

Saroja, Maria &Priya, Michael.(2019). Teaching of Biological Sciences, Isara Solutions: New Delhi

Teaching of Biological Sciences. (2020). Directorate of Distance Education, University of Jammu: Jammu

B.Sc. B.Ed. (Integrated) Four Years Programme
Semester-III
Title of the Paper: (AEVS-VIII) Environmental Studies-I

Total Marks	**50**	**Credits**	**02**
Total Hours	**30**	**Hours Per Week**	**04**
Internal Exam Marks	**25**	**External Exam Marks**	**25**
		Duration of External Examination	

Learning Outcomes

After studying this course, student teachers will be able to:

a. To know the importance of Environment and goals of sustainable development

b. To understand different types of natural resources and its conservation

c. To understand different types of ecosystems, their importance and conservation

d. To understand Importance of biodiversity and its conservation

e. To engage with communities through Eco clubs and other activities

UNIT: INature of Environmental Studies (7 hrs.)

a. Definition, scope and importance of Environmental Studies

b. Multidisciplinary nature of environmental studies

c. Need for public awareness.

d. Concept of sustainability. Sustainable development and it's goals with Indian context.

UNIT: II Ecosystems (8 hrs.)

- **a.** Concept of an ecosystem.
- **b.** Structure and function of an ecosystem.
- **c.** Producers, consumers and decomposers.
- **d.** Energy flow in the ecosystem. Ecological succession.
- **e.** Food chains, food webs and ecological pyramids.
- **f.** Introduction, types, characteristics features, structure and function of the following ecosystem: - a) Forest ecosystem, b) Grassland ecosystem, c) Desert ecosystem, d)Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)
- **g.** Degradation of the ecosystems and it's impacts.

UNIT: III Natural Resources and Associated Problems (8 hrs.)

- **a.** Forest resources: Use and over-exploitation, deforestation, dams and their effects on forests and tribal people

b. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts
over water, dams-benefits and problems

c. Mineral resources: Usage and exploitation. Environmental effects of extracting and using mineral resources

d. Food resources: World food problem, changes caused by agriculture,effect of modern agriculture, fertilizer-pesticide problems.

e. Energy resources: Growing energy needs, renewable and non- renewable energy resources, use
of alternate energy sources. Solar energy, Biomass energy, Nuclear energy

f. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Consumerism,ecological foot prints, carbon foot prints, carbon credits

g. Role of individuals in conservation of natural resources. Equitable use of resources for sustainable lifestyles

UNIT:IVBiodiversity and its conservation (7 hrs.)

a.Introduction- Definition: genetic, species and ecosystem diversity

b. Bio-geographical classification of India

c. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic
and option values

d. India as a mega- diversity nation

e.Western Ghat as a biodiversity region. Hot-spots of biodiversity

f. Threats to biodiversity: habitat loss, poaching of wildlife, man- wildlife conflicts

g. Endangered and endemic species of India, Conservation of biodiversity: In-situand Ex- situ conservation of biodiversity. Convention on Biological Diversity.

SESSIONAL WORK:

AssignmentS

Participation in Nature Club activities/Plantation/Collection of seeds/Conservation

TRANSACTIONAL MODE:

Lectures

Field visits and project

ESSENTIAL READINGS:

Environmental studies, Shivaji University, Kolhapur

Gharpure T.N.(2000) ‘Paryavaranshastra’

Paryavaran Sahastra – Gharapure

Agarwal, K.C.2001, Environmental Biology, Nidi Pubi. Ltd., Bikaner.

Bharucha Erach, The Biodiversity of India, Mapin Publishing pvt. Ltd.,Ahmedabad 380013, India, Email:mapin@icenet.net (R)
Cunningham, W.P. Cooper, T.H.Gorhani, E. & Hepworth, M.T.2001, Environmental Encyclopedia, Jaico Publ. Hpise, Mumbai, 1196p
Down to Earth , Cebtre fir Scuebce and Environment (R)
Gleick, H.,1993, Water in crisis, Pacific Institute for studies in Dev.,Environment& Security. Stockholm Env. Institute. Oxford Univ. Press 473p
Hawkins R.e., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R)
Heywood, V.H.& Watson, R.T.1995, Global Biodiversity Assessment,Cambridge Univ. Press 1140p.
Mickinney, M.L.& School. R.M.1196, Environmental Science Systems & Solutions, Web enhanced edition, 639p.
Miller T.G.Jr., Environmental Science. Wadsworth Publications Co. (TB)
Odum, E.P.1971, Fundamentals of Ecology, W.B.Saunders Co. USA, 574p.
Survey of the Environment, The Hindu (M)
Townsend C., Harper, J. and Michael Begon, Essentials of Ecology, Blackwell Science (TB)
Trivedi R.K. Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, vol. I anfd II, Environmental Media (R)
Trivedi R.K. and P.K. Gokel, Introduction to air pollution, Tecgbi-Science Publications (TB)
Wagner K.D., 1998, Environmental management, W.B. Saunders Co. Philadelphia, USA 499p

Semester-IV						
Component	**Code**	**Title**	**Marks**	**Credits**	**Total Hours**	**Hours Per Week**
Foundations of Education	F-IV	Philosophical & Sociological Perspectives of Education-I	100 (T80+P20)	04	60	06
Disciplinary / Inter- disciplinary Courses	D-IV	A-Physics-X ; Quantum Mechanics	50 (40+10)	02	30	04
		B-Chemistry-X ; Organic Chemistry				
		C-Mathematics-X ; Real Analysis				
		A-Physics- XI ; Classical Mechanics	50 (40+10)	02	30	04
		B-Chemistry- XI ; Inorganic Chemistry				
		C-Mathematics- XI ; Integral Calculus/ Swayam on Multivariable calculus				
		A-Physics-XII ; Digital and Analog Electronics	50 (40+10)	02	30	04
		B-Chemistry- XII ; Physical Chemistry				
		C-Mathematics- XII; Integral Transform				
	Practicum	**Lab work V** (Physics/Chemistry/Mathematics)	50	02	60	04
		Lab work VI (Physics/Chemistry/Mathematics)	100	04	120	08
Stage-Specific Content-cum-Pedagogy	SSCCP-II	Stage-Specific Content-cum- Pedagogy Courses-II	100 (T80+P20)	04	60	06
Ability Enhancement & Value-Added Courses	AEVC-IX	Environmental Studies-II	50 (I 25+ E 25)	02	30	04
Total =			**550**	**22**	**420**	**40**

Note- T: Theory, P: Practical/Practicum, I: Internal, E: External

B.Sc. B.Ed. (Integrated) Four Years Programme
Semester-IV
Title of the Paper: (F-IV)
Philosophical & Sociological Perspectives of Education-I

Marks	**100**	**Credits**	**04**
Total Hours	**60**	**Hours Per Week**	**06**
Internal Exam Marks	**20**	**External Exam Marks**	**80**
		Duration of External Examination	**3 hours**

Learning Out comes: After completion of this course, student teachers will be able to:

- Explore the nature of knowledge, the nature of human beings, the nature of society and its aims and the educational implications of these understandings.
- Explore educational philosophy and relationship between Education and Philosophy.
- Read and acquaint themselves with the meaning of terms like Vidya, Avidya, Shiksha, Education etc. and to facilitate them to understand and differentiate them through reflections on these terms on the basis of ancient Indian texts.
- Engage them selves in peer groups for sharing of their real-life reflective experiences regarding socio-cultural and philosophical living and facilitate them to conceptualize the meaning of terms like philosophical, social and cultural traditions in Indian educational context.
- Read, observe and understand the vision of some great Indian and global educators and categorically reflect on vision/aim, process of education and the contemporary relevance.
- Identify Indian Values, their revival in Indian constitution and NEP 2020, their implications in 21st century.

UNIT–I Education and Philosophy (15 hrs.)

a. Education and Philosophy: Conceptual clarity, nature and relationships.
b. Aims of studying philosophical perspective of education.
c. Branches of Philosophy and their educational implications: Metaphysics(तत्त्वमीमांसा), Epistemology(ज्ञानमीमांसा), Axiology(मूल्यमीमांसा)
d. Understanding Indian Perspective of Education
    - Meaning, nature and aims of education with special reference to Vedic, Buddhist, Jain, Sikh and Islamic traditions.
    - Understanding the terms Darshana, Para and Apara Vidya, Avidya, Shiksha, Samvaad, Panchkosha, Gurukulam, Acharya, Guru, Shishya,

Upadhyaya, Jigyasa, Swadhyaya.

e. Understanding Western Perspective of Education
   - Meaning, Nature and aims of education with reference to Theories of Education : Cognitive, Behaviorist and Developmental

UNIT–II Philosophical Schools and Education (15 hrs.)

a. 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 (15 hrs.)

a. Contemplation on aims, process and educational in situations developed on thoughts of following thinkers and practitioners:
   - **Bharatiya:** Swami Vivekananda, Sri Aurobindo Ghosh, Gurudev Rabindra Nath Tagore, J. Krishnamurti, Mahamana Madan Mohan Malaviya, Mahatma Gandhi, Gijubhai Badheka.
   - **Western:** J. Rousse, Maria Montessori, Friedrich Froebel, John Dewey.

UNIT–IV Value Education (15 hrs.)

a. Value Education: Conceptual Clarity, Significance and Types of Values.
b. Indian Traditional Values.
c. Guru-Shishya-Parampara and Educational Values.
d. Convocation message in Taittiriya Upanishad.
e. Value Sen shrined in Indian Constitution.
f. NEP2020 and Values with special reference to21st Century.
g. Pedagogical Issues.

Suggestive Practicum

1. Individual/group assignments/tasks in various forms like writing small paragraphs/brief notes, conceptualizations on specific terms etc.
2. Institutional visits in small groups in coordination to institutions related to different thinker/s and preparation of a report followed by individual/group presentation.
3. Sharing of student experiences (in groups) related to readings on great thinkers help them to reshape their concept and enable them to develop vision, mission and objectives for a school and their plan to accomplish the objectives in form of a group report.
4. Identification and reporting of Indian perspective related to educational aims, student- teacher characteristics, methods, evaluation procedure, convocation etc. based on critical study of life and thoughts of thinkers.

Mode of Transaction

The course content transaction will include the following:

- Organized lectures using variety of media: Print, Multimedia, PPT, video conferencing, blended mode.
  Small group discussion, panel interactions, small theme-based seminars, group discussions, cooperative teaching and team teaching, Brain storming, engagement of in reading of primary or secondary sources of literature (Original texts, reference books etc.) related to different aspects of life and education of Great Educators, case studies, short term project work, field visits, engagement of in observation of social and cultural customs, folk art etc.

- Criticallyexaminingtheirexperiencestocarveouttheirworldandlifeviewandfurther analyze them from philosophical point of view to reshape their perspective. They will engage prospective teachers in the development of comparative educational charts related to vision, aims, process, institution etc. They will also lead to reading-based interactions and critical reflections related to process and significance of entry/admissionrituals, convocation system etc.

Suggestive Mode of Assessment

The assessment will be based on the tests and assignments, seminars, and sessional works

Suggestive Reading Materials

Teachers may suggest books/readings as per the need of the learners and learning content.

B.Sc. B.Ed.(Integrated) Four Years Programme
Semester-IV
Title of the Paper :(D-IV : PHYSICS PAPER-X) Quantum Mechanics

Total Marks	**50**	**Credits**	**2**
Total Hours	**30**	**Hours Per Week**	**4**
Internal Exam Marks	**10**	**External Exam Marks**	**40**
		Duration of External Examination	**1 Hour, 30 Min.**

- **Learning Outcomes:**
    1. Know main aspects of the inadequacies of classical mechanics and understand historical development of quantum mechanics and ability to discuss and interpret experiments that reveal the dual nature of matter.
    2. Understand the theory of quantum measurements, wave packets and uncertainty principle.
    3. Understand the central concepts of quantum mechanics: wave functions, momentum and energy operator, the Schrodinger equation, time dependent and time independent cases, probability density and the normalization techniques, skill development on problem solving e.g. one dimensional rigid box, tunneling through potential barrier, step potential, rectangular barrier.

Unit No.	Topics	Total Lectures
Unit I	**1. Matter Waves (6 hours)** Wave particle duality, De-Broglie hypothesis of matter waves, Derivation of wavelength of matter wave, Concept of wave packet, Relation between group velocity - phase velocity and group velocity-particle velocity, Davisson and Germer experiment, Uncertainty principle (statements only): position–momentum and energy- time, Application of uncertainty principle- non existence of free electrons in the nucleus. **2. Schrodinger's Wave Equation (9 hours)** Wave function and its physical interpretation, Condition of physically acceptable wave function, Normalized and orthogonal wave function,	**15**

	Schrödinger time dependent and time independent (steady state) wave equations in 1D and 3D, Probability current density (continuity equation), Eigen values and Eigen functions, Expectation values of dynamic variables.	
Unit II	**1. Operators in Quantum Mechanics (9 hours)** Definition of an operator, position operator (x), Linear momentum operator (p), Commutation relation in quantum mechanics, Commutation relation between x and p, Kinetic energy operator (T), Hamiltonian operator (H), Parity operator (π), Angular momentum operator (L) – components of angular momentum operator in cartesian and spherical polar coordinate system, Ladder operators, Eigen values of Lz and L2 (use equations for L2 and Lz in spherical polar coordinates). **2. Applications of Schrodinger Equation (06 hours)** Particle in a rigid box (infinite potential well) in one dimension and three dimension, Step potential- reflection and transmission coefficients, Potential barrier- tunneling effect (qualitative treatment), Schrodinger wave equation for Hydrogen atom in spherical polar coordinates, Separation of radial and angular parts. Solution of radial part of Schrodinger wave equation - energy eigen values.	**15**

Reference Books:

1. Modern Physics, R. Murugeshan, 1997, S. Chand and Company Ltd.

2. Atomic Physics, J B Rajam, S Chand and Co.

3. Perspectives of Modern Physics, Arthur Beiser, McGraw Hill International Editions.

4. Concepts of Modern Physics, Arthur Beiser, Ahobhit Mahajan, S. Rai Choudhury, Sixth Edition, Tata McGraw Hill Education Private Ltd.

5. Modern Physics, S. L. Kakani and Shubhra Kulkarni, 2006, Viva books Private Ltd.

6. Principles of Quantum Mechanics-I. S. Tyagi, Pearson Education.

7. Introduction to Modern Physics, F. K. Richtmyer, E. H. Kennard, John N. Cooper, Sixth Edition, Tata McGraw Hill Education Private Ltd

8. A Text book of Quantum Mechanics, P.M. Mathews & K. Venkatesan, 2nd Edn.,2010, Tata McGraw Hill,

9. Quantum Mechanics, Leonard I. Schiff, 3rdEdn. 2010, Tata McGraw Hill.

10. Quantum Mechanics Theory and Applications, A. K. Ghatak and S. Lokanathan, Third Edition.1995, Macmillan India Ltd.

11. Quantum Mechanics Theory and applications, AjoyGhatak, S. Lokanathan, 5th Ed,2017, Trinity.

12. Quantum Mechanics, Chatwal and Anand, Reprint 2010, Himalaya Publishing house.

13. Quantum Mechanics, Gupta, Kumar, Sharma, Thirteenth Edn., 2011, Jai Prakash Nath Publications.

14. Advanced Quantum Mechanics, Satya Prakash, Reprint 2011, KedarNath Ram Nath Meerut.

15. Advanced Quantum Mechanics, B. S. Rajput, Ninth Edn., 2009, PragatiPrakashan.

16. Quantum Mechanics, B. N. Srivastava, Reprint 2011, PragatiPrakashan.

17. Quantum Mechanics, P. J. E. Peebles, 2003, Prentice Hall of India.

18. Quantum Mechanics, S. P. Singh, M. K. Bagade, Kamal Singh, S. Chand & company Ltd, New Delhi

B.Sc. B.Ed.(Integrated) Four Years Programme
Semester-IV
Title of the Paper :(D-IV : PHYSICS PAPER-XI) Classical Mechanics

Total Marks	**50**	**Credits**	**2**
Total Hours	**30**	**Hours Per Week**	**4**
Internal Exam Marks	**10**	**External Exam Marks**	**40**
		Duration of External Examination	**1 Hour, 30 Min.**

- **Learning Outcomes:**
    1. Understand theNewtonian, the Lagrangian and the Hamiltonian formulations of classical mechanics and their applications in appropriate physical problems.
    2. Recapitulate and learn the special theory of relativity- postulates of the special theory of relativity, Lorentz transformations on space-time and other four vectors, four-vector notations, space-time invariant length, length contraction, time dilation, mass-energy relation, problems involving energymomentum conservations.

Unit No.	Topics	Total Lectures
Unit I	**1. Lagrangian Formulation (9 hours)** Constraints, Degrees of freedom, Generalized coordinates, Principle of virtual work, D'Alembert's principle, Lagrange's equation from D'Alembert's principle, Applications of Lagrange's equation to a particle in space, Atwood's machine and a bead sliding on uniformly rotating wire under force free condition. **2. Techniques of Calculus of Variation (6 hours)** Hamilton's principle, Deduction of Hamilton's principle from D'Alembert's principle, Deduction of Lagrange's equation from Hamilton's principle, Applications-shortest distance between two points in a plane, Brachistochrone problem.	**15**
Unit II	**1. Rigid Body Motion (5 hours)** Motion of rigid body in space, Euler's theorem, Angular momentum and kinetic energy, Euler's equations of motion.	**15**

	2. Special Theory of Relativity (10 hours) Inertial and non-inertial reference frames, Galilean transformation equations, Michelson-Morley experiment, Postulates of special theory of relativity, Lorentz transformation equations, Relativistic addition of velocities, Length contraction, Time dilation, Variation of mass with velocity, Mass-energy relation.	

Reference Books:

1. Classical Mechanics, Goldstein Herbert, NarosaPubli./ Pearson Edu. 2018
2. Classical Mechanics, Gupta, Kumar and Sharma, Pragati Prakashan.2019
3. Introduction to Classical Mechanics, Takwale R.G., Puranik P. S.,Tata McGraw 1979
4. Classical Mechanics, Panat P.V., NarosaPubli. 2016
5. Concepts of Modern Physics, Arthur Beiser, McGraw Hill
6. Introduction to Special Relativity, Robert Resnick, Wiley India.

B.Sc. B.Ed.(Integrated) Four Years Programme
Semester-IV
Title of the Paper :(D-IV: PHYSICS PAPER-XII) Digital and Analog Electronics

Total Marks	**50**	**Credits**	**2**
Total Hours	**30**	**Hours Per Week**	**4**
Internal Exam Marks	**10**	**External Exam Marks**	**40**
		Duration of External Examination	**1 Hour, 30 Min.**

- **Learning Outcomes:**

  After successfully completing this course, the student will be able to do the following:

  1. Student will be able to discuss the construction and working of CRO.
  2. Student will be able to describe various applications of CRO and illustrate it with suitable examples.
  3. Student will be able to discuss single stage common emitter amplifier with ac and dc load line.
  4. Student will be able to compare and contrast types of feedback on basis of it's advantages and disadvantages.
  5. Student will be able to solve numericals related to oscillators (frequency calculation) and amplifiers (related to open loop and closed loop gain).
  6. Student will be able to design different types of oscillator circuits of desired frequency.
  7. Student will be able to list basic logic gates and derived logic gate.
  8. Student will be able to explain De Morgan's theorems and Discuss the use of NAND and NOR gate as universal building blocks.
  9. Student will be able to understand basics of Python programming language.

Unit No.	Topics	Total Lectures
Unit I	**1. Cathode Ray Oscilloscope (05)** Principle, Construction and working of Cathode Ray Tube, Block diagram of Cathode Ray Oscilloscope, uses of Cathode Ray Oscilloscope (AC voltage measurement, DC voltage measurement, Time period measurement, frequency measurement, phase measurement, Lissajous figures)	**15**

	2. Transistor Amplifier and Oscillators (10) Transistor Amplifier: Single stage transistor CE Amplifier, DC and AC equivalent circuits, load line analysis and Q – point. Frequency Response curve of an amplifier, Positive and negative feedback. Oscillators: Types of Waveforms, Oscillations from tank circuit, theory of feedback oscillator, Barkhausen's criterion for sustained oscillations, Phase shift oscillator, Colpitts oscillator and Crystal oscillators (Qualitative treatment only).	
Unit II	**1. Digital Electronics (07)** Review of basic logic gates, Derived logic Gates (NOR, NAND, XOR and XNOR gates), DeMorgan's theorems, NAND and NOR as universal gates, R-S flip-Flop, J-K Flip- flop, half Adder,full adder and parallel binary adder. **2. Python Programming Language (08)** Brief History, Key features, Famous applications built using python. Identifier, comments, Indentation Data types: Integer, Float, List, Tuple, String, Boolean. Input-Output: print (), input () Python Operators: Arithmetic, Comparison, Logical Operator, Assignment, Membership andIdentity Operator. Expression, Statement Conditional Statement: If else, if-elif-else statement Loop: for, while	**15**

Reference Books:

1. Digital Principles & Applications, A.P. Malvino, D.P. Leach &Saha, 7th Ed. 2011, TataMcGraw Hill.

2. Microelectronic circuits, A.S. Sedra, K.C. Smith, A.N. Chandorkar, 2014, 6th Edn., OxfordUniversity Press.

3. Modern Electronic Instrumentation & Measurement Tech., Helfrick&Cooper, 1990, PHILearning.

4. Electronic Principle, Albert Malvino, 2008, Tata Mc-Graw Hill.

5. Electronics: Fundamentals and Applications, J.D. Ryder, 2004, Prentice Hall.

6. Integrated Electronics, J. Millman and C.C. Halkias, 1991, Tata Mc-Graw Hill.

7. Let Us Python, 5th Edition, YashavantKanetkar, AdityaKanetkar

8. Website Reference:

https://www.geeksforgeeks.org/python-programming-language-tutorial/

B.Sc. B.Ed.(Integrated) Four Years Programme

Semester- IV

Title of the Paper :(PHYSICS,PRACTICAL-V) Laboratory Course-V

Total Marks	**50**	**Credits**	**2**
Total Hours	**60**	**Hours Per Week**	**4**
Internal Exam Marks	**-**	**External Exam Marks**	**50**
		Duration of External Examination	**3 Hours**

Learning Outcomes: After going through the course, the student should be able to

- Acquire skills in setting up experiments.
- Develop practical skills and techniques for accurate measurements.
- Acquire observational skills.
- Determine the least counts of different measuring instruments.

Sr. No.	Name of experiment
1	To determine A. C. and D. C. sensitivity of the C. R. O. and to measure unknown frequency.
2	To design a single stage CE amplifier of a given gain using voltage divider bias.
3	To study phase shift oscillator using BJT.
4	To study Colpitt's oscillator using BJT.
5	To verify the truth tables of NAND, NOR, Ex – OR, Ex – NOR gates by using gates with IC - 74 series.
6	To verify De- morgan's theorems by using IC - 74 series.
7	Python program to find the maximum of two numbers by using if – else statement.
8	Python program to find factorial of number using for loop.

Reference Books:

1. B.Sc. Practical Physics – HarnamSingh , P.S. Hemane, S. Chand.
2. Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, Asia Publishing House.
3. Advanced level Physics Practical, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
4. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

B.Sc. B.Ed.(Integrated) Four Years Programme

Semester- IV

Title of the Paper : (PHYSICS, PRACTICAL- VI) Laboratory Course-VI

Total Marks	**100**	**Credits**	**4**
Total Hours	**120**	**Hours Per Week**	**8**
Internal Exam Marks	**-**	**External Exam Marks**	**100**
		Duration of External Examination	**4+4 Hours**

Scheme of Practical Examination for B. Sc. Part II

5. Practical examination will be conducted semester wise.
6. Practical examination will be conducted for two days per batch of 16 students.
7. The examination will be conducted in two sessions per day and each session will be of three hours duration for 50 Marks examination if required.
8. At least eighty percent practical should be completed by the student.

Learning Outcomes: After going through the course, the student should be able to

- Acquire skills in setting up experiments.
- Develop practical skills and techniques for accurate measurements.
- Acquire observational skills.
- Determine the least counts of different measuring instruments.

Part I

Sr. No.	Name of experiment
1	Mutual inductance using Ballistic galvanometer.
2	Resistance of B.G. by half deflection method
3	e/m of Electron by Thomson's Method or/ Calibration of wire by Carey Foster bridge
4	Calibration of wire by Griffith's method
5	Absolute capacity of condenser
6	I-V characteristics of Solar Cell
7	Band gap energy of semiconductor using p-n junction diode
8	Determination of Plank's constant by using LED.

Part –II

Sr. No.	Name of experiment
1	Diffraction at cylindrical obstacle
2	Study of divergence of LASER beam. Measurement of wavelength of LASER using plane diffraction grating.
3	Polar graph using photocell/photovoltaic cell.
4	Study of quantum tunneling effect using tunnel diode / Plotting of given data
5	S.T. of soap solution
6	Surface tension of mercury by Fergusson modified method
7	Refractive index of glass by Brewster's law
8	Lloyd's single mirror

Reference Books:

1. B.Sc. Practical Physics – Harnam Singh, P.S. Hemane, S. Chand.
2. Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, Asia Publishing House.
3. Advanced level Physics Practical, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
4. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
5. B.Sc. Practical Physics, C. L. Arora, S. Chand & Company Pvt. Ltd., New Delhi.

B.Sc. B.Ed.(Integrated) Four Years Programme
Semester-IV
Title of the Paper :(D-IV: CHEMISTRY PAPER-X)Organic Chemistry

Total Marks	**50**	**Credits**	**2**
Total Hours	**30**	**Hours Per Week**	**4**
Internal Exam Marks	**10**	**External Exam Marks**	**40**
		Duration of External Examination	**1 Hour, 30 Min.**

Learning Outcomes

a.To impart knowledge about the synthesis, reactivity and applications of carboxylic acids.

b.Knowledge about classification, preparation and applications of amines and diazonium salts.

c.Uunderstanding the classification, configuration and structure of carbohydrates.

d.Student will be capable of understanding the nomenclature and reactivity of aldehydes and ketones.Student will learn the basic knowledge of conformational Stereochemistry analysis compounds.

UNIT I: Carboxylic Acids and Their Derivatives, Amines and DiazoniumSalts(11 hours)

a. **Carboxylic Acids and Their Derivatives:** Monocarboxylic acid: Introduction, Methods of Formation from Alcohols, Aldehydes, Ketones, Nitriles and Alkyl benzenes. Halo acids: a) Synthesis of halo acids-Mono, Di, Tri- chloro acetic acid by HVZ reaction b) Reactions - Substitution reaction of Mono - Chloro acetic acid by Nucleophile OH-, I- , CN- and NH3 Hydroxy acids: Citric acid a) Methods of formation of Citric acid from glycerol. b) Chemical Reactions: Reaction of citric acid: acetylation by acetic anhydride, reduction by HI, action of heat.
b. Di carboxylic acids: Introduction, Method of formation of succinic acid from ethylene dibromide, maleic acid, Chemical Reactions: Action of heat, Action of NaHCO3, C2H5OH in the presence of acid. Method of formation Phthalic acid from o-xylene and Naphthalene. Chemical Reactions of Phthalic acid : Action of heat, reaction with sodalime, ammonia. Carboxylic acid derivatives: Introduction. Acid halide derivative: Acetyl chloride: i) Synthesis from acid, by action with PCl3 and SOCl2. ii) Reaction with water, alcohol (Mechanism of esterification is expected) and ammonia. Acid anhydride derivative: Synthesis of acetic anhydride by dehydration of acetic acid. Reactions with water, alcohol and ammonia.

c. **Amines and DiazoniumSalts:Amines**i) Introduction, Classification and Nomenclature ii) Methods of preparation: a) From alkyl halide by amonolysis b) By reduction of nitriles or cyanides c) From unsubstituted amides (Hoffmann degradation), d) By Gabrial synthesis (FromPhthalamide). iii) Reactions: Carbylamine reaction, Schotten-Baumann reaction, Electrophilic substitution (Aniline) - Nitration, Bromination, Sulphonation.
d. **Diazonium salt**: i) Introduction ii) Preparation of Benzene diazonium chloride. iii) Reactions of Benzene diazonium chloride. a) Replacement reaction -Sandmeyers reaction. b) Coupling reactions: Synthesis of Congo red.

UNIT II: Carbohydrates,Carbonyl Compounds- Aldehydes and Ketones, Stereochemistry (19 hours)

a. **Carbohydrates:** Introduction. Classification of carbohydrates, reducing and non-reducing sugars. Physical properties of glucose and fructose. Killiani's synthesis of Glucose from D- Arabinose. Determination of structure of D- Glucose. a) Open chain structure of D- Glucose. b) Configuration of D- Glucose from D- Arabinose. c) Ring structure of D- Glucose. d) Size of ring in D- Glucose by methylation Method.e) Haworth projection for D- Glucose.
b. Cyclic structure of Fructose. Structures of Disachharides a) Linkage between Monosachharides b) Open chain and Haworth cyclic structures of Sucrose, Lactose and Maltose. Structures of Polysachharides: a) Starch b) Cellulose.
c. **Carbonyl Compounds- Aldehydes and Ketones:** Introduction, Nomenclature of aliphatic and aromatic aldehydes and ketones. Structure and reactivity of Carbonyl group. Reactions of Carbonyl Compounds- Mechanism and applications of - i) Aldol condensation, ii) Claisen condensation, iii) Perkins reaction, iv) Cannizaro's reaction, v) Knoevenagel condensation and vi) Reformatsky reaction.
d. **Stereochemistry:** Conformational isomerism – Introduction. Representation of conformations of ethane by using Saw-Horse, Fischer (dotted line wedge) and Newmann's projection formulae. Conformations and conformational analysis of ethane and n-butane by Newmann's Projection formula with the help of energy profile diagrams. Relative stability cycloalkanes - Baeyer's strain theory and Theory of strainless rings. Conformations and stability of Cyclohexane, Conformation and stability of Methyl Cyclohexane.

Reference Books:

1. Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd.(Pearson Education).
2. Stereochemistry conformation & Mechanism, 9th Edition, By P.S.Kalasi, Publisher: New Age International, 2017.
3. Stereochemistry of carbon compounds by Eliel.
4. Stereochemistry of Organic Compounds by D. Nasipuri.

5. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
6. Finar, I. L. Organic Chemistry (Volume 2), Dorling Kindersley (India) Pvt. Ltd.
7. Organic Chemistry. Volume I, II, III by S.M. Mukharjee, S.P. Singh and R.P. Kapoor.
Wiley Eastern Limited (New Age International)
8. Advanced Organic Chemistry by, B.S. Bahl, ArunBahl. S. Chand & Company, Ltd.
9. Chemistry by R. L. Madan, S. Chand and Company Ltd.

B.Sc. B.Ed.(Integrated) Four Years Programme
Semester-IV
Title of the Paper :(D-IV: CHEMISTRY PAPER-XI)Inorganic Chemistry

Total Marks	**50**	**Credits**	**2**
Total Hours	**30**	**Hours Per Week**	**4**
Internal Exam Marks	**10**	**External Exam Marks**	**40**
		Duration of External Examination	**1 Hour, 30 Min.**

Learning Outcomes

a.The study of non –aqueous solvents is important to learn all chemical properties of solutes and from the research point of view. Useful to understand geometry, stability and nature of bonding between metal ion and ligand in complexes.

b.The topic deals with the synthesis and the applications of the semiconductors and Superconductors in electrical and electronic devices.

c. The structure, method of preparation and the applications of organo metallic compound in various fields are explained.

d. The classification, types, mechanism and applications of catalyst in industrial fields is explained.

UNIT I: Non aqueous Solvents, Metal Ligand bonding in Transition Metal Complexes(14 hours)

- **a. Non aqueous:** 1.3.1 Introduction, definition and characteristics of solvents. 1.3.2 Classification of solvents. 1.3.3 Physical properties and Acid-Base reactions in Liquid Ammonia (NH3) and Liquid Sulphur Dioxide (SO2).
- **b. Metal Ligand bonding in Transition Metal Complexes:**Crystal field theory (CFT)Introduction: Shapes of d-orbitals, Basic assumptions of CFT. Crystal field splitting of d-orbitals of metal ion in octahedral, tetrahedral, square planar complexes and John-Teller distortion. Factors affecting the Crystal field splitting. High spin and low spin octahedral complexes w.r.t. Co (II).
- **c.** Crystal Field stabilization energy (CFSE), Calculation concerning octahedral complexes only.Limitations of CFT.
- **d.** Molecular orbital theory (MOT). Introduction. MOT of octahedral complexes with sigma bonding such as [Ti(H2O)6]3+,[CoF6]3– , [Co(NH3)6]3+. Merits and demerits of MOT.

UNIT II: Metals, Semiconductors and Superconductors, Organometallic Chemistry, Catalysis (16 hours)

a. **Metals, Semiconductors and Superconductors:**Introduction. Properties of metallic solids. Theories of bonding in metal. i. Free electron theory. ii. Molecular orbital theory (Band theory). Classification of solids as conductor, insulators and semiconductors based on band theory. Semiconductors- Types - intrinsic and extrinsic and applications of semiconductors.
b. Superconductors: Ceramic superconductors - Preparation and structures of mixed oxide YBa2Cu3O7-x. Applications of superconductors.
c. **Organometallic Chemistry:** Definition, Nomenclature of organometallic compounds. Synthesis and structural study of alkyl and aryl compounds of Be and Al. Mononuclear carbonyls -Nature of bonding in simple mononuclear carbonyls. [Ni(CO)4], [Fe(CO)5], [Cr(CO)6].
d. **Catalysis:** Introduction. Classification of catalytic reaction- Homogenous and Heterogeneous. Types of Catalysis. Characteristics of catalytic reactions. Mechanism of catalysis. i. Intermediate compound formation theory. ii. Adsorption theory. Industrial applications of catalysis.

Reference Books:

1. Concise Inorganic Chemistry (ELBS, 5th Edition) – J. D. Lee.
2. Inorganic Chemistry (ELBS, 3rd Edition) D. F. Shriver, P. W. Atkins, C. H.Lang Ford, Oxford University Press, 2nd Edition.
3. Basic Inorganic Chemistry: Cotton and Wilkinson. 4. Advanced Inorganic Chemistry (4th Edn.) Cotton and Wilkinson.
5. Concepts and Models of Inorganic Chemistry: Douglas and Mc. Daniel. 3rd Edition.John Wiley publication.
6. Structural principles in inorganic compounds. W. E. Addison.
7. Theoretical principles of Inorganic Chemistry – G. S. Manku.
8. Theoretical Inorganic Chemistry by Day and Selbine.
9. Co-ordination compounds. SFA Kettle.
10. Essentials of Nuclear Chemistry by H. J. Arnikar.
11. Nuclear Chemistry by M. N. Sastri.
12. Organometallic Chemistry by R. C. Mahrotra, A. Sing, Wiley Eastern Ltd.New Delhi.
13. Inorganic Chemistry by A. G. Sharpe, Addision – Wisley Longman – Inc.

B.Sc. B.Ed.(Integrated) Four Years Programme
Semester-IV
Title of the Paper :(D-IV: CHEMISTRY PAPER-XII)Physical Chemistry

Total Marks	**50**	**Credits**	**2**
Total Hours	**30**	**Hours Per Week**	**4**
Internal Exam Marks	**10**	**External Exam Marks**	**40**
		Duration of External Examination	**1 Hour, 30 Min.**

Learning Outcomes

- **a.** Learning and understanding quantum Chemistry, Heisenberg's uncertainty principle, concept of energy operators (Hamiltonian), learning of Schrodinger wave equation. Physical interpretation of the ψ and ψ2. Particle in a one-dimensional box.
- **b.** Learning and understanding photochemical laws, reactions and various photochemical phenomena.
- **c.** Learning the various types of solutions, relations vapour pressure, temperature relations.
- **d.** Learning and understanding the knowledge of emf measurements, types of electrodes, different types of cells, various applications of emf measurements.

UNIT I: Elementary quantum mechanics,Photochemistry(15 hours)

a. **Elementary quantum mechanics:** Introduction. Drawbacks of classical mechanics, Black body radiation, Photoelectric effect, Compton effect, Dual nature of matter and energy: De Broglie hypothesis. The Heisenberg's uncertainty principle.
b. Concept of energy operators (Hamiltonian). Derivation of Schrodinger wave equation, well behaved function. Physical interpretation of the ψ and ψ2. Particle in a one-dimensional box. Numerical problems.
c. **Photochemistry:** Introduction, Difference between thermal and photochemical processes. Laws of photochemistry: i) Grotthus - Draper law ii) Lambert law iii) Lambert – Beer's law (with derivation) iv) Stark-Einstein law. Quantum yield, Reasons for high and low quantum yield. Factors affecting Quantum yield.
d. Photosensitized reactions – Dissociation of H2, Photosynthesis. Photodimerisation of anthracene, decomposition of HI and HBr. Jablonski diagram depicting various processes occurring in the excited state: Qualitative description of fluorescence and phosphorescence. Chemiluminescence, Electroluminescence and Bioluminescence. Numerical problems.

UNIT II: Solutionsand Electromotive force(15 hours)

- **a. Solutions:**Introduction. Ideal solutions, Raoult's law, Vapour pressure of ideal and non ideal solutions of miscible liquids. Composition of liquid and vapour,vapour pressure and boiling point diagrams of miscible liquids. Distillation of miscible liquid pairs. Type I :

Systems with intermediate total vapour pressure (i.e. System in which b.p. increases regularly – Zeotropic). Type II : Systems with a maximum in the total vapour pressure (i.e. System with a b.p. minimum – Azeotropic). Type III : Systems with a minimum in the total vapour pressure (i.e. System with a b.p. Maximum – Azeotropic).

b. Solubility of partially miscible liquids. i. Maximum solution temperature type: Phenol – water system. ii. iii. Minimum solution temperature type: Triethyl amine – water system. Maximum and minimum solution temperature type: Nicotine – water system. Distillation of partially miscible liquid pairs. Vapour pressure and distillation of immiscible liquids, steam distillation.

c. **Electromotive force:** Introduction. Thermodynamics of electrode potentials, Nernst equation for electrode and cell potentials in terms of activities. E.M.F. series. Types of electrodes: Description in terms of construction, representation, half cell reaction and emf equation for i) ii) Metal – metal ion electrode. Amalgam electrode. iii) Metal – insoluble salt electrode. iv) Gas – electrode. v) Oxidation – Reduction electrode.

d. Reversible and Irreversible cells. i. Chemical cells without transference. ii. Concentration cells with and without transference. iii. Liquid – Liquid junction potential: Origin, elimination and determination. Equilibrium constant from cell emf, Determination of the thermodynamic parameters such as ΔG, ΔH and ΔS. Applications of emfmeasurements :i. Determination of pH of solution using Hydrogen electrode. ii. Solubility and solubility product of sparingly soluble salts (based on concentration cells). Numerical problems.

Reference Books:

1. Physical Chemistry by G. M. Barrow, International student Edition,McGraw Hill.
2. University General Chemistry by C.N.R. Rao, Macmillan.
3. Physical Chemistry by, R. A. Alberty, Wiley Eastern Ltd.
4. The Elements of Physical Chemistry by P. W. Atkins, Oxford.
5. Principles of Physical Chemistry by S. H. Maron, C. H. Prutton, 4thE dition.
6. Nuclear and Radiochemistry by Friedlander, Kennedy and Miller, John Wiley and Sons. Wiley International edition.
7. Essentials of Nuclear Chemistry by H. J. Arnikar, 4th edition. Wiley Eastern.
8. Principles of Physical Chemistry by Puri, Sharma, Pathania,ShobhanlalNaginchand and Company, Jalandar.
9. Instrumental methods of chemical analysis by Chatwal and Anand,5th Edition, Himalaya Publication.
10. Fundamentals of molecular spectroscopy by C. N. Banwell – Tata Mc Graw-Hill.
11. Quantum Chemistry including molecular spectroscopy by B. K. Sen,Tata Mc Graw -Hill.
12. Text Book of Physical Chemistry by S. Glasstone, Macmillan India Ltd.
13. Elements of Physical Chemistry by D. Lewis and S. Glasstone (Macmillan).
14. Principles of Physical Chemistry by Maron and Lando (Amerind).
15. Electrochemistry by S. Glasstone.
16. Physical Chemistry by W. J. Moore.
17. Basic Chemical Thermodynamics by V. V. Rao (Macmillan).
18. Essential of Physical Chemistry, Bahl and Tuli (S. Chand).
19. Text Book of Physical Chemistry, Soni and Dharmarha.
20. Advanced Physical Chemistry Gurdeep Raj GOEL Publishing House, 36th Edition

B.Sc. B.Ed. (Integrated) Four Years Program
Semester- IV
(D-IV: PRACTICUM-CHEMISTRYPRACTICAL-V)
Laboratory Course- V, - Organic chemistry

Total Marks	**50**	**Credits**	**2**
Total Hours	**60**	**Hours Per Week**	**4**
Internal Exam Marks	**-**	**External Exam Marks**	**50**
		Duration of External Examination	**3 Hours**

1) Organic Qualitative Analysis: Identification of Any Six Organic Compounds with reactions including chemical type

Acids – Succinic acid, Phthalic acid, Salicylic acid, Aspirin. (Any 2)

Phenols – Alpha-Naphthol, p-nitrophenol. (Any 1)

Bases – o - nitroaniline, p-nitroanilines, Diphenyl amine. (Any 1)

Neutrals – Urea, Acetanilide, Carbon tetrachloride, Bromobenzene, Methyl

acetate, Nitrobenzene, Naphthalene, Anthracene, Ethyl methyl ketone. (Any 2)

Note: A systematic study of an organic substance involves reactions in the determination of elements and functional groups.

2) Organic Preparations (Any two)

i) Preparation of p-nitro acetanilide from Acetanilide.

ii) Preparation of Acetanilide from Aniline using anhydrous ZnCl2 and Zn dust.

iii) Preparation of Phthalimide from Phthalic anhydride.

iv) Preparation of Benzoic acid from Benzamide.

Reference Books:

1) Vogel's Quantitative Chemical Analysis, Pearson 2009.

2) Vogel's text book of Qualitative Inorganic analysis by A. I. Vogel .3rdand 6thedition.

3) Vogel's text book of Quantitative Inorganic Chemistry by A. I. Vogel.

4) Physical Chemistry of Inorganic qualitative analysis by Kuricose&Rajaram.

5) Practical manual in water Analysis by Goyal & Trivedi

6) Practical Organic Chemistry by A.I. Vogel.

7) Hand book of Organic qualitative analysis by H.T. Clarke.

8) A Laboratory Hand Book of Organic qualitative analysis and separation by V.S. Kulkarni. DastaneRamchandra& Co.

9) Practical Organic Chemistry by F.G. Mann and B.C. Saunders. Low – priced Text Book. ELBS.Longman.

10) Advanced Practical Organic Chemistry by N.K. Vishnoi. Vikas Publishing HousePrivate Limited.

11) Advanced practical chemistry by J. Singh, L. D. S. Yadav, R. K. P. singh, I. R.Siddiqui et.al, PragatiPrakashan.

B.Sc. B.Ed. (Integrated) Four Years Program
Semester- IV
(D-IV: PRACTICUM-CHEMISTRY PRACTICAL-VI)
Laboratory Course- VI, - Inorganic and Physical chemistry

Total Marks	**100**	**Credits**	**4**
Total Hours	**120**	**Hours Per Week**	**8**
Internal Exam Marks	**-**	**External Exam Marks**	**100**
		Duration of External Examination	**4+4 Hours**

I) Gravimetric Estimations (G).

N. B. Any two experiments from G1 to G3 and any two experiment from G4 & G6.

G1. Gravimetric estimation of iron as ferric oxide (Fe_2O_3) from the given solution containing ferrous ammonium sulphate, copper sulphate and free sulphuric acid.

G2. Gravimetric estimation of zinc as zinc pyrophosphate from the given solution 40 containing zinc sulphate, ferrous ammonium sulphate and free sulphuric acid.

G3. Gravimetric estimation of barium as barium sulphate($BaSO_4$) from the given solution containing barium chloride, ferric chloride and free hydrochloric acid.

G4. Gravimetric estimation of barium as barium chromate($BaCrO_4$) from the given solution containing barium chloride, ferric chloride and free hydrochloric acid.

G5. Gravimetric estimation of nickel as bis (dimethylglyoximato) nickel (II) from the given solution containing nickel sulphate, ferrous ammonium sulphate and free Sulphuric acid.

G6. Gravimetric estimation of aluminium as aluminium oxinate potassium tris (8-hydroxy quinolato) aluminium (III) from the given solution containing potash alum ,copper sulphate and free sulphuric acid.

[For the gravimetric experiments, stock solution should be given in the range of 10 to 15 cm^3 and asked to dilute to 100 cm^3 (or the stock solution should be given in the range of 20 to 30 cm^3 and asked to dilute to 250 cm^3). Use 50 cm^3 of this diluted solution for estimation.]

II. Inorganic Preparations (P).

N. B. At least six preparations from the following with percentage yield:

P1. Preparation of potassium trioxalato aluminate (III).

P2. Preparation of Tetra ammine copper (II) chloride.

P3. Preparation of tris(thiourea) copper (I) sulphate.

P4. Preparation of potassium trioxalato ferrate (III).

P5. Preparation of chloropenta-ammine cobalt (III) chloride.

P6. Preparation of ammonium diamminetetrathiocynato chromate (III) (Reineck's salt).

P7. Preparation of Potassium hexa nitro coblatate (III).

P8. Preparation of ammonium trioxalato chromate (III).

P9. Preparation of hexathioureaplumbus (II) nitrate.

I. Non instrumental Experiments:

A. Any one of the following

i) Partition Law.
To determine the partition coefficient of CH3COOH between H2O and CCl4.
ii) Viscosity.
To determine the viscosity average molecular weight of a polymer.
iii) Adsorption.
To investigate the adsorption of oxalic acid by activated charcoal and test the validityofFreundlich& Langmuir isotherms.
iv) Solubility.
To study the effect of addition of electrolyte (NaCl or KCl) on the solubility of Benzoic
acid at room temperature.

B. Chemical kinetics. (Any four)

1. The study of energy of activation of first order reaction i.e. hydrolysis of methyl acetate
in presence of 0.5 N HCl / 0.5 N H2SO4.
2. The study of energy of activation of second order reaction i.e.
reaction between K2S2O8 and KI (Equal concentrations).
3. The study of energy of activation of second order reaction i.e.
reaction between K2S2O8 and KI (Unequal concentrations).
4. To study the hydrolysis of methyl acetate by using its two concentrations in presenceof
0.5 N HCl and hence find velocity constant of the reaction.

5. To study the effect of addition of electrolyte (KCl) on the reaction between $K_2S_2O_8$ and KI (Equal concentrations).

C. Partial molar volume.

1. To determine the partial molar volume of ethyl alcohol in a mixture of ethyl alcohol and water (Any seven mixtures be given).

II. Instrumental experiments

A. Potentiometry (Any four)

1. Titration of strong acid with strong alkali.

i) 8 to 10 ml of 1N acid solution to be given by examiner in 100 ml volumetric flask & student should dilute it to 100 ml and 10ml of this solution is taken for titration.

ii) Experiment is carried out by taking pilot run from 1 to 10 ml and then final run taking 0.2 ml reading in the range of end point.

2. Preparation of buffer solution and determination of their pH (Any five buffer solutions),

Theoretical calculation of pH values by using Henderson's equation.

3. Determination of standard electrode potential of Zn/Zn++, Cu/Cu++, Ag/Ag+ (Any two).

4. Estimate the amount of Cl-, Br- and I- in given unknown halide mixture by titrating it against standard $AgNO_3$ solution.

5. Titration of ferrous ammonium sulphate using $K_2Cr_2O_7$ solution and to calculate redox potential of Fe++, Fe+++ system.

B. Conductometry (Any three).

N.B. i) 8 to 10 ml of 1N acid solution to be given by examiner in 100 ml volumetric flask &student should dilute it to 100 ml and 10ml of this solution is taken for titration.

1. Titration of a mixture of weak acid and strong acid with strong alkali

2. To study the effect of substituent on dissociation constant of weak acid with respect to acetic acid and monochloroacetic acid (cell constant to be given).

N.B. Calculate K by using formula $K= \alpha 2.C/1- \alpha$

3. To determine the velocity constant of hydrolysis of ethyl acetate by NaOH solution by conduct metric method.

4. To determine the normality of citric acid in lemon by titrating it against standard 0.2 N NaOH solution by conduct metric method.

5. To determine $\lambda\infty$ of strong electrolyte (NaCl or KCl) and to verify Onsager equation.

C. Refractometry. (Any One)

1. To determine the percentage composition of unknown mixture by (i) graphical method and (ii) by composition law (Densities of pure liquids A & B be given).

2. To determine the molar refractivity of methyl acetate, ethyl acetate, n-hexane and carbon tetrachloride and calculate the refraction equivalents of C, H and Cl atoms.

Reference Books:

1. A text book of quantitative Inorganic Analysis - A. I. Vogel.

2. Text book of Quantitative Inorganic Analysis - Kolthoff and Sandell.

3. Experimental Inorganic Chemistry - Palmer W. G.

4. Advanced Practical Inorganic Chemistry - Adams and Raynor.

5. Manual in Dairy Chemistry - I.C.A.R. Sub-Committee on Diary Education.

6. Chemical methods for environmental analysis - R. Ramesh and M. Anbu.

7. Findlay's Practical Physical Chemistry (Longman)

8. Advanced Practical Physical Chemistry by J. B. Yadav, Goel publishing house.

9. Practical Physical Chemistry by B. D. Khosla, V. C. Garg (R. Chand and Co.)

10. Systematic experimental Physical Chemistry by Rajbhoj, Chandekar (Anjali Publicaiton) Aurangabad.

11. Practical Physical Chemistry: Nandkumari, Kothari and Lavande.

12. Practical Physical Chemistry by Gurtu (S. Chand).

13. Text Book of Qualitative Inorganic Analysis by A. I. Vogel (ELBS Longman).

B.Sc. B.Ed. (Integrated) Four Years Programme
Semester-IV
Title of the Paper: (D-IV: MATHEMATICS, PAPER-X) Real Analysis

Total Marks	**50**	**Credits**	**02**
Total Hours	**30**	**Hours Per Week**	**04**
Internal Exam Marks	**10**	**External Exam Marks**	**40**
		Duration of External Examination	**1 Hour, 30 Min.**

Course Learning Outcomes: Upon successful completion of the course students will able to:

CO 1: Understand the basic facts about functions and countability of sets

CO 2: Recognize bounded, convergent, divergent, Cauchy and monotonic sequences.

CO 3: Calculate limit superior, limit inferior, and the limit (when exists) of a sequence.

CO 4: Use different tests for convergence and absolute convergence of an infinite series of real numbers.

Unit 1: Functions and Sequence of real numbers (15 Lect.)

1.1. **Functions**

1.1.1. Definitions: Cartesian product, Function, domain and range of a function, inverse image and image of a set under a function, extension and restriction of functions, one - to - one (or 1 - 1) function, onto function.
1.1.2. Real-valued functions.
1.1.3. Equivalence and Countability.
1.1.4. Real numbers.
1.1.5. Least upper bounds.

1.2. **Sequence of real numbers**

1.2.1. Definition of sequence and subsequence.
1.2.2. Limit of a sequence.
1.2.3. Convergent sequence.
1.2.4. Divergent sequences.
1.2.5. Bounded sequences.
1.2.6. Monotone sequences.
1.2.7. Operations on convergent sequences.
1.2.8. Limit superior and limit inferior.
1.2.9. Cauchy sequences.
1.2.10. Summability of sequences.

Unit 2: Series of real numbers **(15 Lect.)**

2.1. Convergence and divergence.
2.2. Series with nonnegative terms.
2.3. Alternating series.
2.4. Conditional convergence and absolute convergence.
2.5. Tests for absolute convergence.
2.6. Series whose terms form nonincreasing sequence.
2.7. (C,1) summability of series.
2.8. The class l^2

Recommended Books:

1. R. R. Goldberg, **Methods of Real Analysis**, Indian Edition, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

Scope of Syllabus:

Unit 1: Chapter 1: Sec.: 1.3, 1.4, 1.5, 1.6, 1.7; Chapter 2: Sec.: 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 2.10, 2.11

Unit 2: Chapter 3: Sec.: 3.1, 3.2, 3.3, 3.4, 3.6, 3.7, 3.9, 3.10

Reference Books:

1. Steven G. Krantz, **Real Analysis and Foundations**, Second Edition, Chapman and Hall/CRC.

2. Shanti Narayan and M. D. Raisinghania**, Elements of Real Analysis**, Fifteenth Revised Edition, S. Chand & Company Ltd. New Delhi, 2014.

3. Kenneth. A. Ross, **Elementary Analysis: The Theory of Calculus**, Second Edition, Undergraduate Texts in Mathematics, Springer , 2013.

4. R. G. Bartle and D. R. Sherbert, **Introduction to Real Analysis**, Fourth Edition, Wiley India Pvt. Ltd., 2016.

B.Sc. B.Ed. (Integrated) Four Years Programme
Semester-IV
Title of the Paper: (D-IV: MATHEMATICS, PAPER-XI)
Integral Calculus/ Swayam on Multivariable calculus

Total Marks	**50**	**Credits**	**02**
Total Hours	**30**	**Hours Per Week**	**04**
Internal Exam Marks	**10**	**External Exam Marks**	**40**
		Duration of External Examination	**1 Hour, 30 Min.**

Course Learning Outcomes: Upon successful completion of this course students will able to:

CO1: Understand special functions.
CO2: Understand types of multiple integrals.
CO3: Apply special functions to evaluate multiple integrals.
CO4: Solve integrals using differentiation under the integral Sign

Unit 1. Special functions **(15 Hrs.)**

1.1 Gamma function.

1.1.1 Definition of Gamma function and examples.

1.1.2 Properties of Gamma function.

1.1.2.1 $\Gamma(1) = 1$

1.1.2.2 $\Gamma(n+1) = n\Gamma(n)$in general.

1.1.2.3 $\Gamma(n+1) = n!$if n is positive integer.

1.1.2.4 $\Gamma(0) = \infty, \Gamma(\infty) = \infty$

1.1.2.5 $\Gamma(n) = 2\int_0^\infty e^{-x^2}x^{2n-1}dx, n > 0$

1.1.2.6 $\Gamma(n) = k^n\int_0^\infty e^{-kx}x^{n-1}dx, n, k > 0$

1.1.2.7 Examples based on article 1.1.2.

1.2 Beta function.

1.2.1 Definition of Beta function and examples.

1.2.2 Properties of Beta function.

1.2.2.1 $\beta(m,n) = \beta(n,m); m, n \geq 0$

1.2.2.2 $\beta(m,n) = 2\int_0^{\frac{\pi}{2}} sin^{2m-1}\theta \cdot cos^{2n-1}\theta\, d\theta; m, n \geq 0$

1.2.2.3 $\int_0^{\frac{\pi}{2}} sin^p\theta \cdot cos^q\theta\, d\theta = \frac{1}{2}\beta\left(\frac{p+1}{2}, \frac{q+1}{2}\right), p, q > -1$

1.2.2.4 $\int_0^{\frac{\pi}{2}} sin^n\theta\, d\theta = \frac{1}{2}\beta\left(\frac{n+1}{2}, \frac{1}{2}\right)$

i) If n is an even positive integer, then $\int_0^{\frac{\pi}{2}} sin^n\theta\, d\theta = \frac{n-1}{n}\cdot\frac{n-3}{n-2}\cdot\frac{n-5}{n-4}\cdot \ldots \frac{3}{4}\cdot\frac{1}{2}\cdot\frac{\pi}{2}$

ii) If n is an odd positive integer, then $\int_0^{\frac{\pi}{2}} sin^n\theta\, d\theta = \frac{n-1}{n}\cdot\frac{n-3}{n-2}\cdot\frac{n-5}{n-4}\cdot \ldots \frac{4}{5}\cdot\frac{2}{3}\cdot 1$

1.2.2.5 $\int_0^{\frac{\pi}{2}} cos^n\theta\, d\theta = \frac{1}{2}\beta\left(\frac{n+1}{2}, \frac{1}{2}\right)$

i) If n is an even positive integer, then $\int_0^{\frac{\pi}{2}} cos^n\theta\, d\theta = \frac{n-1}{n}\cdot\frac{n-3}{n-2}\cdot\frac{n-5}{n-4}\cdot \ldots \frac{3}{4}\cdot\frac{1}{2}\cdot\frac{\pi}{2}$

ii) If n is an odd positive integer, then $\int_0^{\frac{\pi}{2}} cos^n\theta\, d\theta = \frac{n-1}{n}\cdot\frac{n-3}{n-2}\cdot\frac{n-5}{n-4}\cdot \ldots \frac{4}{5}\cdot\frac{2}{3}\cdot 1$

1.2.2.6 $\int_0^{\frac{\pi}{2}} sin^m\theta\cdot cos^n\theta\, d\theta = \frac{1}{2}\beta\left(\frac{m+1}{2}, \frac{n+1}{2}\right)$

i) If m and n both are even positive integers, then

$$\int_0^{\frac{\pi}{2}} sin^m\theta\cdot cos^n\theta\, d\theta = \left[\frac{[(m-1)(m-3)\ldots 2\ or\ 1][(n-1)(n-3)\ldots 2\ or\ 1]}{(m+n)(m+n-2)\ldots 3\cdot 2\cdot 1}\right]\cdot\frac{\pi}{2}$$

ii) If m or n or both are odd positive integer, then

$$\int_0^{\frac{\pi}{2}} sin^m\theta\cdot cos^n\theta\, d\theta = \left[\frac{[(m-1)(m-3)\ldots 2\ or\ 1][(n-1)(n-3)\ldots 2\ or\ 1]}{(m+n)(m+n-2)\ldots 3\cdot 2\cdot 1}\right]\cdot 1$$

1.2.2.7 Relation between Beta and Gamma function

$\beta(m,n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}; m,n > 0$

1.2.2.8 $\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$

1.2.2.9 $\beta(m,n) = \int_0^{\infty} \frac{x^{m-1}}{(1+x)^{m+n}}\, dx$

1.2.2. $\beta(m,n) = a^n b^m \int_0^{\infty} \frac{x^{m-1}}{(1+x)^{m+n}}\, dx$

1.2.2.11 $\beta(m,n) = \int_0^{1} \frac{x^{m-1}+x^{n-1}}{(1+x)^{m+n}}\, dx$

1.2.2.12 Duplication formula of Gamma function.

1.2.2.13 Examples based on 1.2.2

Unit 2. Multiple integrals (15 Hrs.)

2.1 Differentiation under integral sign

2.1.1 Leibnitz first rule of differentiation under integral sign.

2.1.2 Leibnitz second rule of differentiation under integral sign.

2.1.3 Examples based on articles 2.1.1 and 2.1.2.

2.2 Multiple Integrals

2.2.1 Double Integral: Evaluation of double integrals.

2.2.2 Evaluation of double integrals in Cartesian form.

2.2.3 Evaluation of double integrals in Polar form.

2.2.4 Evaluation of double integrals in Cartesian form over the given region.

2.2.5 Evaluation of double integrals in Cartesian form by changing order of integration.

2.2.6 Evaluation of double integrals from Cartesian form to Polar form.

2.2.7 Triple integrals: Evaluation of triple integrals.

2.2.8 Proof of $\beta(m,n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}; m,n > 0$

Recommended Book:-

Unit. 1: Shanti Narayan and Dr. P. K. Mittal, Integral Calculus, S. Chand and Company, New Delhi,2015.

Scope:- Chapter VII: 7.1 to 7.3,7.5

Unit. 2: P. N. Wartikar and J. N. Wartikar, A text book of Applied Mathematics, Pune VidhyarthiGrihaPrakashan, Pune. Vol.I, 2011.

Scope:- Chapter XVI: 16.1 to 16.5, Chapter XIX: 19.1 to 19.3

Reference Books:-

1. P. N. Wartikar and J. N. Wartikar, A text book of Applied Mathematics, Pune Vidhyarthi GrihaPrakashan, Pune. Vol.I, 2011.
2. Shanti Narayan and Dr. P. K. Mittal, Integral Calculus, S. Chand and Company, New Delhi,2015.
3. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, Delhi, 2012.
4. Gorakh Prasad, Integral Calculus, Pothishala Pvt. Ltd., Allahabad
5. Dass H. K, Advanced Engineering Mathematics, 22e, S. Chand and Company, New Delhi, 2018.

B.Sc. B.Ed. (Integrated) Four Years Programme

Semester-IV

Title of the Paper: (D-IV: MATHEMATICS, PAPER-XII)

Integral Transform

Total Marks	**50**	**Credits**	**02**
Total Hours	**30**	**Hours Per Week**	**04**
Internal Exam Marks	**10**	**External Exam Marks**	**40**
		Duration of External Examination	**1 Hour, 30 Min.**

Course Learning Outcomes: This course will enable the students to:

CO1: Understand meaning of Laplace Transform
CO2: Apply properties of LT to solve differential equations.
CO3: Understand relation between Laplace and Fourier Transform.
CO4: Understand infinite and finite Fourier Transform.

Unit: 1 Laplace and Inverse Laplace Transform. (15 Lect.)

1.1 Laplace Transform:

1.1.1 Definitions: Piecewise continuity, Function of exponential order, Function of class A and Laplace transform.
1.1.2 Existence theorem of Laplace transform.
1.1.3 Laplace transform of standard functions.
1.1.4 First shifting theorem, Second shifting theorem and Change of scale property.
1.1.5 Laplace transform of derivatives, Laplace transform of integrals.
1.1.6 Effect of Multiplication, Effect of division.
1.1.7 Laplace transform of periodic functions.
1.1.8 Laplace transform of Heaviside's unit step function and Dirac delta function.
1.1.9 Examples based on 1.1.1 to 1.1.8

1.2 Inverse Laplace Transform:

1.2.1 Inverse Laplace transform.
1.2.2 Standard results of inverse Laplace transform.
1.2.3 First shifting theorem, Second shifting theorem and Change of scale property.
1.2.4 Inverse Laplace transform of derivatives, inverse Laplace transform of integrals.
1.2.5 The Convolution theorem.
1.2.6 Effect of multiplication and division.
1.2.7 Inverse Laplace by partial fractions.
1.2.8 Examples based on 1.2.1 to 1.2.7

Unit 2 Fourier Transform (15 Lect.)

2.1.1 Infinite Fourier transform.

2.1.2 Infinite Fourier sine and cosine transform.
2.1.3 Infinite inverse Fourier sine and cosine transform.
2.1.4 Relationship between Fourier transform and Laplace transform.
2.1.5 Change of Scale Property, Modulation theorem.
2.1.6 The Derivative theorem, Extension theorem.
2.1.7 Convolution theorem.
2.1.8 Finite Fourier sine and cosine transform.
2.1.9 Finite inverse Fourier sine and cosine transform.
2.1.10 Examples based on 2.1.1 to 2.1.9.

Recommended Books:

1. J. K.Goyal, K.P.Gupta, Laplace and Fourier Transform, A PragatiPrakashan, Meerut, 2016.

Scope of Syllabus:

Unit 1: Part I: 1.0 to 1.6, Part II: 1.0 to 1.3.
Unit 2: Part I: 2.0 to 2.3, Part II: 2.0 to 2.1.

Reference Books:

1. Dr. S. Sreenadh, Fourier series and Integral Transform, S.Chand, New Delhi, 2021
2. B.Davies, Integral Transforms and Their Applications, Springer Science, 2017.
3. Murray R. Spiegel, Laplace Transforms, Schaum’soutlines , 2018

B.Sc. B.Ed. (Integrated) Four Years Programme
Semester-IV
(D-III: Practicum MATHEMATICS)
PRACTICUM-: INTEGRAL TRANSFORM,Lab work-V

Total Marks	**50**	**Credits**	**02**
Total Hours	**60**	**Hours Per Week**	**04**
Internal Exam Marks	**–**	**External Exam Marks**	**50**
		Duration of External Examination	**3 Hours**

Pr.No	Title of the Practical	No. of Practicals
1.	Evaluation of integrals using properties of Laplace transform	1
2.	Effect of multiplication	1
3.	Effect of division	1
4.	Laplace transform of integrals	1
5.	Laplace transform of periodic functions	1
6.	Inverse Laplace by using standard results	1
7.	Inverse Laplace by Convolution theorem	1
8.	Inverse Laplace by partial fractions I	1
9.	Inverse Laplace by partial fractions II	1
10.	Infinite Fourier sine transform and inverse	1
11.	Infinite Fourier cosine transform and inverse	1
12.	Change of scale property of Fourier transform	1
13.	Convolution theorem of Fourier transform	1

14.	Finite Fourier sine transform and inverse	1
15.	Finite Fourier cosine transform and inverse	1
	Total Practicals	**15**

B.Sc. B.Ed. (Integrated) Four Years Programme
Semester-IV
(D-IV: Practicum MATHEMATICS)
PRACTICUM-: SCILAB, Lab work-VI

Total Marks	**100**	**Credits**	**04**
Total Hours	**120**	**Hours Per Week**	**08**
Internal Exam Marks	**–**	**External Exam Marks**	**100**
		Duration of External Examination	**4 + 4 = 8 Hours**

Part I

Pr.No	Title of the Practical	No. of Practicals
1.	Introduction to Scilab: Overview of Scilab and its applications inmathematics. Installing Scilab, Scilab environment: Console window,Command History window, Variable Browser window, File Browserwindow, SciNotes window, Graphics window. Getting Help in Scilab.Use of Scilab as a calculator.	2
2.	Basics of Scilab: Introduction, Character Set. Data types: Integer datatype, Real data type, Complex data type, Boolean data type, String datatype. Constants and Variables in Scilab, Operators: Arithmetic,Relational, Logical. Hierarchy of Operations, Scilab Expressions, BuiltinFunctions	2
3.	Polynomial: Polynomial creation, Polynomial evaluation, Roots of aPolynomial, Polynomial Arithmetic Operations, PolynomialDifferentiation and Integration	1
4.	Basic Elements of Scilab as a Programming Language: Scilab Editor,Scilab Keywords, Predefined Variables, Input and Output Statements,Assignment statements, Simple Programs based on elementary operators.	2
5.	Conditional structure: if-else, if-elseif-else, select-case, SimplePrograms based on conditional structure.	1

6.	Looping structure: for loop, while loop, break and continue statement,Simple Programs based on Looping structure.	2
7.	Vectors and Matrices: Row matrix, column matrix, general matrix,operation on matrix addition, subtraction, product. Advanced matrix operations: Matrix functions: eye(), zero(), ones(),empty matrix, element-wise operation, determinant, inverse, trace ofmatrix &eigen values and vectors of matrix	2
8.	Functions: Defining custom functions and Programs based on it.	1
9.	Recursive Functions: Defining Recursive functions and Programsbased on it.	1
10.	Plotting graph: Creating two dimensional graphs of simple functions.	1
	Total Practicals	**15**

Part II

Pr.No	Title of the Practical	No. of Practicals
1.	Introduction to LaTeX	1
2.	Styling pages	1
3.	Formatting: bold, italic, underlining, andcomments	1
4.	Subscript and superscript	1
5.	Adding math to LaTeX	1
6.	Fractions and binomials	1
7.	Integral and limits	1
8.	Equations and its alignment	1
9.	Math Accents	1
10.	Delimeters	1
11.	Matrix	1
12.	Creating list	1

13.	Math Functions	1
14.	Creating and Using Theorems	1
15.	Drawing Diagrams	1
	Total Practicals	**15**

Reference Books:-

1) Advanced Programming in SciLab: Chetana Jain, Alpha Science International Ltd (2020).
2) Engineering and Scientific Computing with Scilab 1999th Edition by Claude Gomez (Editor), C. Bunks (Contributor), J.-P. Chancelier (Contributor), F. Delebecque (Contributor),M. Goursat (Contributor), R. Nikoukhah (Contributor), S. Steer (Contributor)
3) Introduction to Scilab: For Engineers and Scientists Book by Sandeep Nagar
4) Official Scilab Documentation: www.scilab.org.
5) Scilab: A Practical Introduction to Programming and Problem Solving Kindle Edition by TejasSheth (Author)
6) Scilab: A Hands on Introduction by Satish Annigeri.
7) Scilab: From Theory to Practice - I. Fundamentals Book by Philippe Roux

Sample problems:-

Conditional structure (if . . . else)

1. Write a program to check whether a given number is maximum / minimum.
2. Write a program to check whether a given number is odd or even.
3. Write a program to check whether a given year is leap year or not.

Looping structure (for loop)

4. Write a program to find sum of n natural numbers.
5. Write a program to find factorial of n.
6. Write a program to generate STAR pattern.
7. Write a program to generate Pascal triangle.
8. Write a program to find exp(x), sin(x), cos(x) using series expansion.

Looping structure (while loop)

9. Write a program to find sum of n natural numbers.
10. Write a program to find factorial of n.
11. Write a program to check whether a given number is prime or not.
12. Write a program to find prime GCD of the given numbers.
13. Write a program to find reverse the given number.
14. Write a program to find prime factors of the given number.

Function and Recursive Function

15. Write a function to find factorial of number and use it to find $\binom{n}{k}$.
16. Write a recursive function to find factorial of number and use it to find $\binom{n}{k}$.

17. Using recursive function write a program that convert given decimal number tobinary number.

Reference books:-

1. "LaTeX Tutorials - A Primer" by Indian TeX Users Group, Trivandrum, India 2003Sept. Link: https://www.tug.org/twg/mactex/tutorials/ltxprimer-1.0.pdf
2. The Not So Short Introduction to LATEX, Tobias Oetiker, Marcin Serwin Hubert Partl, Irene Hyna and Elisabeth Schlegl.
   Link https://tobi.oetiker.ch/lshort/lshort.pdf
3. LaTeXWikibookLink: https://upload.wikimedia.org/wikipedia/commons/2/2d/LaTeX.pdf

B.Sc. B.Ed. (Integrated) Four Years Programme
Semester-IV
Title of the Paper: (S-II)
Content cum Pedagogy of Physical Sciences at Secondary Stage-II

Marks	**100**	**Credits**	**04**
Total Hours	**60**	**Hours Per Week**	**06**
Internal Exam Marks	**20**	**External Exam Marks**	**80**
		Duration of External Examination	**3 hours**

Learning Outcomes: After completion of this course, student teachers will be able to:

a. explain nature, scope and importance of Physical Sciences,
b. illustrate aims and objectives of teaching Physical Sciences for sustainable development of society,
c. outline linkages between Physical Sciences and other subjects,
d. • identify the values and importance of Physical Sciences and alternative knowledge systems, summarize the historical/policies perspective of Physical Sciences,
e. examine pedagogical concerns of Physical Sciences,
f. categorize approaches and methods of teaching learning Physical Sciences,
g. apply appropriate pedagogy in teaching learning the concepts of Physical Sciences.

UNIT - I Nature, Scope and Historical Perspective of Physical Sciences (15 hrs.)

A. Nature, scope, and importance of Physical Sciences.
B. Historical perspective of Physical Sciences.
C. Contributions of Indian (ancient and modern) and other scientists.
D. Physical Sciences, society and human and sustainable development.
E. Recommendations/suggestions of various committees, commissions, and policies in reference to Physical Sciences. (Woods Dispatch, Hunter Commission, University Commission, Kothari Commission, Mudaliyaar Commission, NEP 1986, 2020,)

UNIT - II Aims and Objectives of Physical Sciences (15 hrs.)

A. Aims and objectives of teaching Physical Sciences.

B. Learning outcomes and competencies of teaching Physical Sciences at secondary stage.

C. Linkages of Physical Sciences with other school subjects and place of the Physical Sciences in school curriculum.

D. Values of Physical Sciences: scientific attitude and appreciating other systems of knowledge / alternative knowledge systems.

UNIT - III Pedagogical Aspects of Physical Sciences (15 hrs.)

A. Implication of various approaches - inductive deductive, constructivist, experiential learning, art integrated learning, sports integrated learning, blended learning, interdisciplinary and multidisciplinary approaches in Physical Sciences.

B. Analytical pedagogical concerns in teaching of Physical Sciences for higher order thinking skills such as critical, creative, communication, decision making, reflective.

Unit –IV Methods and Techniques of Teaching Learning Physical Sciences (15 hrs.)

A. Methods of teaching learning Physical Sciences: learner-centric and group-centric,

B. Lecture cum demonstration, activity based, discussion, problem-solving, laboratory, stem and steam, project based, scientific inquiry,

C. Hands on activity, discovery, experimentation, concept-mapping,

D. Collaborative and cooperative learning.

Suggestive Practicum (Any Three)

1. Explore contributions of Indian scientists in the development of Physical Sciences and make presentations on historical development of Physical Sciences.
2. Analyze recommendations of policies/commissions in context of Physical Sciences.
3. Develop concept maps on different concepts of Physical Sciences.
4. Identify and integrate values in Physical Sciences concepts.
5. Demonstrate different pedagogical approaches and strategies for transacting concepts of Physical Sciences.
6. Prepare write-ups on the teaching of science using interdisciplinary and multidisciplinary approaches as recommended in NEP 2020.

7. Any other project assigned by HEI

Suggestive Mode of Transaction

Lecture cum discussion/demonstration, hands-on activities, experiential learning, art and environment integrated learning, sports integrated learning.

Suggestive Mode of Assessment

Written tests, classroom presentations, workshops, seminars, assignments, practicums, sessional and terminal semester examinations (as per UGC norms).

Suggestive Reading Material

• National Council of Educational Research and Training. (April 2022). Mandate documents Guidelines for the development of National Curriculum Frameworks.

• National Education Policy 2020, MoE, Government of India.

• National Steering Committee for National Curriculum Frameworks, (2023). Draft National Curriculum Framework for School Education.

• NCERT, Textbooks of Physical Sciences at Secondary Stage.

*Teachers may also suggest books/readings as per the need of the learners and learning content.

B.Sc. B.Ed. (Integrated) Four Years Programme
Semester-IV
Title of the Paper: (AEVS-IX) Environmental Studies-II

Total Marks	**50**	**Credits**	**02**
Total Hours	**30**	**Hours Per Week**	**04**
Internal Exam Marks	**25**	**External Exam Marks**	**25**
		Duration of External Examination	

Learning Outcomes: After studying this course, student teachers will be able to:

a. To study different types of pollutions, their effects and control measures.
b. To study local issues of environment.
c. To study the environmental protection policies and practices
d. To visit local areas of environmental concern and document the present status through project reports.

UNIT: I Environmental Pollution (15 hrs.)

a. Definition: Causes, effects and control measures of: Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards
b. Global Warming and Climate change, acid rain, Ozone layer depletion, Nuclear accidents and holocaust.
c. Solid waste Management: Causes, effects and control Measures of urban and industrial wastes. Solid waste management and control rule
d. Role of an individual in prevention of pollution.

UNIT: II Social Issues and the Environment (15 hrs.)

a. Human population growth, impact on environment. Human health and Environment
b. Environment ethics: Role of Indian religious traditions and culture in conservation of environment
c. Environmental Movements- Chipko movement, Appiko Movement ,Silent valley, Save Western Ghat movement, Water Conservation Movements , resettlement and rehabilitation of people ; its problems and concerns
d. Disaster Management: Floods, earthquake, cyclone Tsunami and landslides. Wasteland reclamation
e. Environmental communication and public awareness, case studies

UNIT: III Environment Protection -Policies and Practices (15 hrs.)

a. Environment Protection Act
b. Air (Prevention and Control of Pollution) Act

c. Water (Prevention and Control of Pollution) Act
d. Wildlife Protection Act
e. Forest Conservation Act
f. National and International Conventions and Agreement on Environment.
g. Introduction to Environmental Audit and Environmental Impact Assessment

UNIT: IV Field work **(15 hrs.)**

a. Visit to local area to document environmental assets: River/forest/grassland/hill/mountain

OR

b. Visit to local polluted site- Urban/Rural /Industry/ Agriculture

OR

c. Study of local plants and animals

OR

d. Study of ecosystems e.g. Ponds, River, Hill slopes, Plateaus etc.

SESSIONAL WORK:

Project Report writing.

TRANSACTIONAL MODE:

Lectures

Field visits and project

ESSENTIAL READINGS:

Environmental studies, Shivaji University, Kolhapur
Gharpure T.N. (2000) 'Paryavaranshastra'
Parya varan Sahastra – Gharapure
Bharucha Erach, The Biodiversity of India, Mapin Publishing pvt. Ltd., Ahmedabad 380013, India, Email: mapin@icenet.net (R)
Brunner R.C.,1989, Hazardous Waste Incineration, McGraw Hill Inc., 480p
Clank R.S. Marine Pollution, Clanderson Press Oxford (TB)
Cunningham, W.P. Cooper, T.H. Gorhani, E. & Hepworth, M.T.2001, Environmental Encyclopedia, Jaico Publ. Hpise, Mumbai, 1196p
De A.K., Environmental Chemistry, Wiley Wastern Ltd.
Down to Earth, Cebtre fir Scuebce and Environment (R)
Gleick, H.,1993, Water in crisis, Pacific Institute for studies in Dev., Environment & Security. Stockholm Env. Institute. Oxford Univ. Press 473p
Hawkins R.e., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R)
Jadhav, H.& Bhosale, V.M.1995, Environmental Protection and Laws, Himalaya Pub. Hcuse, Delhi 284p.
Mickinney, M.L.& School. R.M.1196, Environmental Science Systems &

Solutions, Web enhanced edition, 639p.
Mhaskar A.K., Mastter Hazardous, Techno-Science Publications (TB)
Miller T.G.Jr., Environmental Science. Wadsworth Publications Co. (TB)
Rao M.N.& Datta, A.K.1987, Waste Water Treatment, Oxford & IBH Publ. Co. Pvt. Ltd., 345p
Sharma B.K., 2001, Environmental Chemistry, Gokel Publ. Hkouse, Meerut
Survey of the Environment, The Hindu (M)
Trivedi R.K. Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, vol. I anfd II, Environmental Media (R)
Trivedi R.K. and P.K. Gokel, Introduction to air pollution, Tecgbi-Science Publications (TB)
Wagner K.D., 1998, Environmental management, W.B. Saunders Co.Philadelphia, USA 499p.