

 SHIVAJI UNIVERSITY, KOLHAPUR 416 004, MAHARASHTRA PHONE : EPABX - 2609000, BOS Section - 0231-2609094, 2609487 Web : www.unishivaji.ac.in Email: bos@unishivaji.ac.in शिवजी विद्यापीठ, कोल्हापूर, ४१६ ००४, महाराष्ट्र दूरध्वनी - इपीबीएक्स - २०६०९०००, अभ्यासमंडळे विभाग : ०२३१- २६०९०९४, २६०९४८७ वेबसाईट : www.unishivaji.ac.in ईमेल : bos@unishivaji.ac.in	 
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संदर्भ/जा.क्र./शिवजी वि./अ.मं./५९०

दि. २५/०९/२०२५

प्रति,

मा. अधिविभाग प्रमुख,
शिक्षणशास्त्र अधिविभाग.,
शिवजी विद्यापीठ, कोल्हापूर.

विषय :- B. Sc. B.Ed. Part II (Integrated 4 Years degree Programme) अभ्यासक्रमाबाबत.

संदर्भ : या कार्यालयाचे पत्र क्र. 286 दि. 08/05/2025 रोजीचे पत्र.

महोदय,

उपरोक्त संदर्भित विषयास अनुसरून आपणास आदेशान्वये कळविण्यात येते की, राष्ट्रीय शैक्षणिक धोरण-2020 (NEP 2.0) नुसार शैक्षणिक वर्ष 2025-2026 पासून लागू करण्यात आलेल्या B. Sc. B.Ed. Part II (Integrated 4 Years degree Programme) या अभ्यासक्रमामध्ये **किरकोळ दुरुस्ती** करण्यात आलेली आहेत.

सोबत सदर अभ्यासक्रमाची प्रत जोडली आहे. तसेच विद्यापीठाच्या [\(NEP 2020@Suk/Online Syllabus\)](http://www.unishivaji.ac.in) या संकेतस्थळावर ठेवण्यात आला आहे.

सदर अभ्यासक्रम सर्व संबंधित विद्यार्थी व शिक्षकांच्या निदर्शनास आणून द्यावेत ही विनंती.

कळावे,

आपला विश्वासू

(डॉ. एस. एम. कुबल)
उपकुलसचिव
अभ्यास मंडळे विभाग

सोबत : अभ्यासक्रमाची प्रत.

प्रत. माहितीसाठी व पुढील योग्यत्या कार्यवाहीसाठी.

1	अधिष्ठाता, आंतर विद्याशाखीय अभ्यास विद्याशाखा	7	संलग्नता टी. 1 व टी. 2 विभागास
2	अध्यक्ष, शिक्षणशास्त्र अभ्यास मंडळ	8	पी. जी. प्रवेश विभागास
3	संचालक, परीक्षा व मुल्यापन मंडळ कार्यालयास	9	परिक्षक नियुक्ती ए व बी विभागास
4	इतर परीक्षा 02, विभागास	10	पी. जी. सेमिनार विभागास
5	पात्रता विभागास	11	नॅक विभागास
6	आय. टी. सेल विभागास		

SHIVAJI UNIVERSITY, KOLHAPUR

416 004, MAHARASHTRA

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शिवाजी विद्यापीठ, कोल्हापूर, ४१६ ००४, महाराष्ट्र

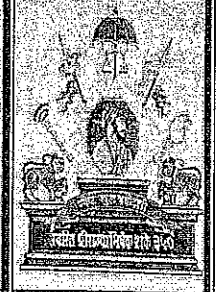
दूरध्वनी - इपीबीएक्स - २६०९०००, अभ्यासमंडळे विभागाः ०२३१-२६०९०९४, २६०९४८७

वेबसाईट : www.unishivaji.ac.in ईमेल : bos@unishivaji.ac.in

Estd. 1962

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).

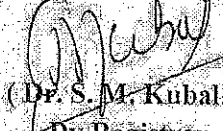
This syllabus, nature of question and equivalence shall be implemented from the academic year **2025-2026** onwards. A soft copy containing the syllabus is attached herewith and it is also available on university website www.unishivaji.ac.in NEP-2020 (Online Syllabus)

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. (ITEP) Four Years
Integrated Programme**

B.Sc. B.Ed. Part - II Sem III & IV

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

**Secondary Stage Specialization
(9th to 12th Standard)**

Under the Faculty of Interdisciplinary Studies

(As per NCTE -ITEP Amendment Regulations, 2019)

Introduced from Academic Year 2025-2026 Onwards

(Subject to the modifications made from time to time)

Structure of Semester-III							
Component	Code	Title		Marks	Credits	Total Hours	Hours Per Week
Foundations of Education	F-III	Child Development & Educational Psychology		100 (T60+P40)	04	60	06
Disciplinary / Inter- disciplinary Courses	D-III	Major	Major V(2)	50 (T 30+ I 20)	02	30	02
			Major VI (2)	50 (T 30+ I 20)	02	30	02
			Major P III (2):	50	02	60	04
		Minor	Minor V(2)	50 (T 30+ I 20)	02	30	02
			Minor VI (2)	50 (T 30+ I 20)	02	30	02
			Minor P III(2)	50	02	60	04
Skill Enhancement Courses (SEC)	Practicum	Practicals (Major)		50	02	60	04
Stage-Specific Content-cum- Pedagogy	SSCCP-I	Stage-Specific Content-cum- Pedagogy Courses-I		100 (T80+ I 20)	04	60	06
Self-Study	SS-I	Environment Studies		Student required to qualify the internal exam.			
Total =				550	22	420	32

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

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

Semester-III

Paper Code: F-III, Title of the Paper -Child Development and Educational Psychology

Marks	100	Credits	04
Total Hours	60	Hours Per Week	06
Internal Exam Marks	40	External Exam Marks	60
		Duration of External Examination	3 Hours

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

- describe the meaning, concept, characteristics, and factors affecting growth and development
- use the knowledge of Indian concept of self.
- apply various problem solving and learning strategies in real classroom settings.
- identify the various approaches of the process of learning.
- explain group dynamics and apply strategies to facilitate group learning.
- understand meaning ,concept and determinants of personality

UNIT - I Child Development

- Meaning and Concept of Child Development
- Understanding the process of Child Development -Biological, cognitive, socio-emotional, and moral.
- Developmental characteristics of a child during:
 - Infancy stage • Early Childhood stage • Middle to Late Childhood stage
 - Adolescence stage
- The Indian concept of self: Mind (□□□), Intellect (□□□□□), Memory (□□□□□□□). Panch-koshIya Vikas (□□□□□□□□□□□□□□□□).
- Educational Implications.

UNIT - II Developmental Process

- 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.
- d.** Tools and Techniques for Identifying Learner with different abilities.
- e.** Teachers' role and strategies to address the needs of learners with different learning abilities.

UNIT - III Process of Learning

- a.** Conceptual Clarity and significance of process of learning
- b.** Approaches: • 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,
- d.** Steps and Strategies in problem solving, Factors hindering problem solving.
- e.** How to Learn: Significance and Strategies

UNIT - IV Motivation and Classroom Management

- a.** Motivation • Conceptual clarity, nature, Intrinsic and Extrinsic Motivation
- b.** Strategies for Motivation
- c.** Classroom management • significance
- d.** Creating a positive learning environment
- e.** Planning space for learning • Managing behavioral problems

UNIT - V Group Dynamics:

- a.** Meaning and significance
- b.** Classroom as a social group
- c.** Characteristics of group
- d.** Understanding group interaction-sociometry
- e.** Strategies to facilitate group learning

SESSIONAL WORK:

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

- A day from different economic status (low and affluent)
- Focus on various factors: Physical, emotional, social, language, cultural and religious 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 House
Ltd. New Delhi

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

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

Dinkmeyer (1968) Child Development (The emerging self) Prentice – Hall of India
Private 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, Behaviour &
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.- New
Delhi

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

B.Sc. B.Ed. (Integrated) Four Years Programme
Semester-III

PHYSICS Major Paper-V

Title of the Paper: Thermal Physics

Marks	50	Credits	2
Total Hours	30	Hours Per Week	2
Internal Exam Marks	20	External Exam Marks	30
		Duration of External Examination	1.5 Hours

- Learning Outcomes:

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

1. Student understands basic laws of thermodynamics. Student is able to describe the laws of thermodynamics from both microscopic and macroscopic point of view. Student can also apply these laws to understand real physical systems.
2. Students know the concept of heat engine and refrigerator. Students are able to compute efficiency of Carnot heat engine and coefficient of performance of refrigerator.
3. Students understand theory of transport phenomena. Students are able to derive expressions related to transport of momentum, transport of thermal energy and transport of mass.
4. Students understand the concept of fourth thermodynamic variable that is entropy.
5. Students learn use of entropy to define third law of thermodynamics.

Unit No.	Topics	Total Lectures
Unit I	Laws of Thermodynamics I Thermodynamic Systems, Thermodynamic variables, Thermodynamic equilibrium, Zeroth Law of Thermodynamics, Equation of State, Internal Energy, First Law of Thermodynamics and its differential form, Thermodynamic processes: Isothermal process, Adiabatic process, Work done during an Isothermal process and Adiabatic process, Reversible and Irreversible Processes & their Examples.	08
Unit II	Laws of Thermodynamics II Concept of Heat and Work, Carnot's Heat Engine and Carnot's Cycle, Second Law of Thermodynamics: Kelvin Planck & Clausius Statements, Concept of Entropy, Physical significance of Entropy, Entropy changes in reversible and irreversible process with examples, T-S diagram, Third law of thermodynamics: Unattainability of absolute zero.	07

Unit III	Thermodynamical Relations Extensive and Intensive variables, Thermodynamic potentials: Internal energy, Enthalpy, Helmholtz free energy, Gibbs Free energy, Maxwell's relations, Applications of Maxwell's relations: Joule Thomsons effect, Clausius Clapeyron equation, Specific heat equation $C_P - C_V$ and C_P / C_V equation (for ideal gas only), TdS equations.	09
UNIT IV	Transport Phenomenon Mean free path, Sphere of Influence and Collision cross-section, Expression for mean free path, Transport phenomenon: Transport of momentum (viscosity), Transport of thermal energy (Conductivity), Transport of mass (Diffusion).	06

Reference Books:

1. Heat and Thermodynamics, M.W. Zemansky and R. Dittman, (8th Edn) McGraw Hill.
2. Thermal Physics – S Garg, R.Bansal and Ghosh, 2nd edition,1993, Tata McGraw Hill.
3. Textbook of Heat- J.B. Rajam, S.Chand and Company Ltd.
4. A Treatise on Heat- Meghnad Saha and B.N. Srivastava, Indian Press.
5. Heat and Thermodynamics- Brijlal and N. Subramanyam, S. Chand and Company Ltd.
6. Heat Thermodynamics and Statistical Physics- J.P. Agrawal, Satya Prakash, Pragati Publication
7. Fundamentals of Heat - D. S. Mathur, S. Chand and Sons.

B.Sc. B.Ed. (Integrated) Four Years Programme
Semester-III
PHYSICS Major Paper-VI
Title of the Paper: Waves and Optics

Marks	50	Credits	2
Total Hours	30	Hours Per Week	2
Internal Exam Marks	20	External Exam Marks	30
		Duration of External Examination	1.5 Hours

- Learning Outcomes:

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

1. Understand the Fundamentals of Diffraction, Interference & Polarization & to apply the Principles of Polarization and analyze Interference Patterns.
2. Correlate Resolving Power with Wave Optics.
3. Recognize Advanced Applications and Future Trends in LASERS.
4. Recognize the Role of Fiber Optics in Emerging Technologies.

Unit No.	Topics	Total Lectures
Unit I	Wave properties of light Diffraction: Introduction, Plane diffraction grating, Theory of plane diffraction grating, its application to determine wavelength of monochromatic light. Polarization: Introduction, Brewster's law, Relation between polarizing angle and angle of reflection in denser medium, Polarimeter: Determination of specific rotation of sugar solution. Interference: Principle of superposition of waves, Division of amplitude, Division of wavefront, Interference in Wedge shaped film, Newton's rings, Biprism.	11
Unit II	Resolving power of optical instruments 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 a prism.	05

Unit III	LASER and its applications Introduction, Absorption, stimulated and spontaneous emission, Einstein's Coefficients, Population Inversion, Optical pumping techniques, Lasing Action, Properties of LASER, Types of LASERS, Construction and working of Ruby Laser and He-Ne Laser, Applications of LASER in various fields, Idea of holography	07
Unit IV	Fiber-Optic Communication Systems Introduction, Principle of optical fiber, Construction of optical fiber, Classification of fibers: Single and multimode fibers, Transmission of signal in step index fiber and graded index fiber, Acceptance angle, Numerical aperture (Definition and expression), Optical fiber communication system, Advantages of fiber optic communication, Applications of optical fibers.	07

Reference Books:

1. Optics – Ajoy Ghatak, 2021, McGraw-Hill.
2. A Textbook of Optics-N. Subrahmanyam, Brij Lal, M.N. Avadhanulu, S.Chand.
3. A Textbook of Light- D.N. Vasudeva, Atma ram and Sons.
4. Fundamentals of Optics – Devraj Singh PHI Learning.
5. Principles of Laser by O. Svelto, Springer
6. Lasers: Principles, Types and Applications by K.R. Nambiar
7. Fiber Optic Communication, J. C. Palais, Pearson Prentice Hall, 2013.
8. Optoelectronics and Photonics: Principles and Practices, S. O. Kasap, Pearson Prentice Hall, 2011.
9. An Introduction to Fiber Optic Systems, J. Powers, TMH 2010.
10. Optical Fiber Communication, G. Keiser, McGraw Hill 2013.
11. Fiber-Optic Communication Systems, G. P. Agrawal, John Wiley & Sons, 2011.
12. Optical Fiber Communications: Principles and Practice, J. M. Senior, Pearson 2011.
13. Fundamentals of Fibre Optics in Telecommunication and Sensor Systems, B. P. Pal, New Age International Publishers 2006.

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

Semester- III

PHYSICS Major Practical III

Title of the Paper : PHYSICS Major Practical III : Thermal Physics and Waves & Optics

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.

Group: I - Thermal Physics

1. To determine the coefficient of thermal conductivity by using Searl's apparatus.
2. To determine specific heat of graphite.
3. To determine the temperature coefficient of resistance using platinum resistance thermometer.
4. To determine temperature coefficient of resistance by using P.O. box.
5. To determine joule constant J by electrical method.
6. To determine mechanical equivalent of heat J by Callender and Barne's constant flow method.
7. Searls Viscometer

Group: II - Waves & Optics

1. Calibration of spectrometer.
2. To determine the resolving Power of Grating.
3. To determine wavelength of sodium light using Newton's Rings.
4. To determine the thickness of thin film.
5. To determine wavelength of sodium light using bi-prism.
6. To study angle of specific rotation of sugar using polarimeter.
7. To determination of wavelength of LASER using plane diffraction grating.

B.Sc. B.Ed. (Integrated) Four Years Programme
Semester-III

PHYSICS Minor Paper-V

Title of the Paper: Thermodynamics

Marks	50	Credits	2
Total Hours	30	Hours Per Week	2
Internal Exam Marks	20	External Exam Marks	30
		Duration of External Examination	1.5 Hours

• Learning Outcomes:

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

1. Understand Real gases and validity of the laws of thermodynamics.
2. Visualize Merits and demerits of thermometers.
3. Apply the laws of thermodynamics to formulate the relations necessary to analyze a thermodynamic process.
4. Understand concept of entropy.

Unit No.	Topics	Total Lectures
Unit I	Ideal and Real gas: Interpretation of temperature, Andrew's curve, critical constants, Relation between critical constants and Vander Waal's constants, reduced equation of state. Degrees of freedom	07
Unit II	Thermometry: Concept of heat and temperature, Principle of thermometry, types of thermometers, Scales of temperature (Celsius, Kelvin, Fahrenheit and Rankine) and relation between them, Mercury thermometer (Principle, construction, working, errors and corrections), Seebeck effect, Principle, construction, and working of Thermoelectric thermometer and Platinum resistance thermometer.	08
Unit III	Laws of Thermodynamics-I Thermodynamic system, thermodynamic variables, thermodynamic equilibrium, Zeroth Law of thermodynamics, Internal energy, First law of thermodynamics, Specific heats (C_p and C_v), Isothermal, Adiabatic, Isochoric, and Isobaric process, Adiabatic relations, work done during isothermal and adiabatic processes,	07

UNIT IV	Laws of Thermodynamics-II Reversible and irreversible processes, Second law of thermodynamics (different statements), Heat engine, Carnot's ideal heat engine, Carnot's cycle (Working, efficiency), Carnot's theorem, Entropy (concept & significance), Third law of thermodynamics-Nernst's heat theorem.	08
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Reference Books:

1. Heat and Thermodynamics- Brijlal and N. Subramanyam, S. Chand and Company Ltd.
2. Text book of heat- J.B. Rajam, S. Chand and company Ltd
3. A treatise on Heat- Meghna d Saha and B.N. Srivastava, Indian Press
4. Heat and Thermodynamics (8th Ed), M.W. Zemansky and R. Dittman, McGraw Hill
5. Heat Thermodynamics and Statistical physics- J.P. Agrawal and Satya Prakash, Pragati Prakashan
6. Fundamentals of heat - D.S.Mathur, S.Chand and Sons publisher

B.Sc. B.Ed. (Integrated) Four Years Programme
Semester-III
PHYSICS Minor Paper-VI

Title of the Paper: Applications of Physics

Marks	50	Credits	2
Total Hours	30	Hours Per Week	2
Internal Exam Marks	20	External Exam Marks	30
		Duration of External Examination	1.5 Hours

- Learning Outcomes:

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

1. Understand concepts of geometrical optics.
2. Understand the production of Laser Light and its diverse significant applications.
3. Know X-rays as diagnostic tools and nuclear phenomena in cure of dreadful disease.
4. Know how to address or overcome the challenges of climate change.

Unit No.	Topics	Total Lectures
Unit I	Optical Devices Optical instruments: Construction, Principle and Working with ray diagram of different optical devices like Spectacle lenses, Microscope, Telescope, Camera and Binoculars.	07
Unit II	Applications of LASER Types of LASER, Construction and working of Ruby Laser and He-Ne Laser, Properties and applications of Laser in the medical field, data storage, precision cutting.	08
Unit III	Modern Physics Production of X-rays, application of X-rays in healthcare, Radioactive decay, use of Gamma rays in cancer treatment, Production of Ultrasonic Waves by piezoelectric oscillators, and their medical applications.	08
UNIT IV	Meteorology Introduction, scales in meteorology, branches and applications, causes for climate changes and it's impact on Earth's atmosphere, global radiation balance, solar energy spectrum.	07

Reference Books:

1. Application of Light Optics by Eugene Hecht
2. Fundamentals of Photonics by Bahaa E. A. Saleh and Malvin Carl Teich
3. Principles of Optics by Max Born and Emil Wolf
4. Introduction to Electrodynamics by David J. Griffiths
5. Electricity and Magnetism by Edward M. Purcell and David J. Morin
6. Electromagnetic Waves and Radiating Systems by Edward C. Jordan and Keith G. Balmain
7. Concepts of Modern Physics by Arthur Beiser
8. Introduction to Health Physics by Herman Cember
9. Medical Imaging Physics by William R. Hendee and E. Russell Ritenour
10. Meteorology Today by C. Donald Ahrens
11. Atmospheric Science: An Introductory Survey by John M. Wallace and Peter V. Hobbs
12. The Physics of Atmospheres by John Houghton

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

Semester- III

PHYSICS Minor Practical III

Title of the Paper :

PHYSICS Minor Practical III : Thermodynamics & Applications of Physics

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

1. Handle and operate various instruments in Physics laboratory.
2. Develop practical skill, instruments handling skills, observational skills.

Group: I - Thermodynamics

1. To record and analyze the cooling temperature of hot object as a function of time using a thermocouple.
2. To determine the temperature coefficient of resistance using platinum resistance Thermometer.
3. To determine the temperature coefficient of resistance using post office box.
4. To determine Joules constant by electrical method.
5. To study thermistor as a temperature transducer.
6. To determine Latent heat of fusion of ice.
7. To determine thermal coefficient of linear expansion of a metal rod.

Group: II - Applications of Physics

1. To determine the equivalent focal length of a thick lens using Newton's formula.
2. To determine the wavelength of laser using a plane diffraction grating.
3. To determine the focal length and the power of a single convex lens by displacement method.
4. To determine the refractive index of a liquid lens by auto collimation method.
5. To study the Divergence of a laser beam.
6. To Study the Indian meteorological charts (IMD) Isobaric patterns (drawing and identification) sign and symbols on IMD charts, interpretation of IMD charts
7. To study Representation of Meteorological data Graphs – line, Bar, Climograph, Hypsography.

B.Sc.-B.Ed. (Integrated) Four Years Program
Chemistry (Major)
Semester- III

Paper Code: Paper V

Title of the Paper: Physical Chemistry

Marks	50	Credits	2
Total Hours	30	Hours Per Week	2
Internal Exam Marks	20	External Exam Marks	30
		Duration of External Examination	1.5 Hours

Learning Outcomes

- a. Learning and coherent understanding of conductivity and transport number of the aqueous solutions with different applications. Experimental determination of transport number and numerical problems.
- b. Knowledge and coherent understanding of basic concepts in thermodynamics and concept of Entropy will be gained by the student.
- c. 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.
- d. 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.
- e. Learning and understanding of theoretical basis of adsorption phenomenon, dynamic nature of surface and its applications.

UNIT I: Electrolytic Conductivity and Thermodynamics (12 hours)

- a. Electrolytic Conductivity: Introduction, Migration of ions. Hittorf's rule, Transference number, determination of transport number by moving boundary method, factors affecting transport number: nature of electrolyte, concentration, temperature, complex formation and degree of hydration. Kohlrausch law of independent migration of ions and its applications such as relations between ionic conductance, ionic mobility and transport number, determination of equivalent conductance at infinite dilution of weak electrolytes, determination of degree of ionization of weak electrolyte. Conductometric titrations (only acid-base titrations). Advantages of conductometric titrations. Numerical problems.
- b. 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 as function of P & T. Entropy change in mixing of gases. Entropy change in phase transformations. Third law of thermodynamics, standard entropy, application of third law of thermodynamics in determination of absolute entropy, Entropy changes in chemical reactions. Numerical problems.

UNIT II: Chemical kinetics and States of Matter (12 hours)

- a.** Chemical Kinetics: Introduction. Third order reactions: derivation of rate constant considering reaction with Equal initial concentration, characteristics, and examples of third order reaction. Determination of order of reaction by: i) Integration method, ii) Graphical method and iii) Half-life method. Effect of temperature on rate of reaction, Arrhenius equation. Concept of energy of activation. Numerical problems.
- b.** States of Matter: 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 behavior, compressibility factor, causes of deviation. Van der Waals equation of state for real gases. Explanation of real gas behavior by Van der Waal's equation, Boyle temperature (derivation not required). Critical Phenomena: PV-isotherms of real gases (Andrew's isotherms), Continuity of state, Critical constants and their calculation from Vander Waals equation. Liquid state: Liquid crystals: Difference between liquid crystal, solid and liquid. Classification, structure of nematic, smectic and cholestric liquid crystal. Numerical Problems.

UNIT III: Surface Chemistry (6 hours)

- a.** Introduction, Adsorption as a surface phenomenon, Definition of adsorption, adsorbent, adsorbate. Characteristics of adsorption. Factors affecting adsorption, Types of adsorption, Distinction between physical and chemical adsorption, Adsorption isotherms: Freundlich adsorption isotherm, Langmuir adsorption isotherm. Applications of adsorption.

Reference Books:

- 1) Barrow, G.M. Physical Chemistry Tata McGraw-Hill (2007).
- 2) Castellan G.W. Physical Chemistry 4 th Ed. Narosa (2004).
- 3) Kotz, J.C. Treichel, P.M.& Townsend, J. R. General Chemistry, Cengage Learning India 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 47ThEdison, 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
Chemistry (Major)**

Semester- III Paper Code: Paper VI

Title of the Paper: Analytical Chemistry

Marks	50	Credits	2
Total Hours	30	Hours Per Week	2
Internal Exam Marks	20	External Exam Marks	30
		Duration of External Examination	1.5 Hours

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. Knowledge about the chemical nature and cleansing action of soap.
- d. Learning and coherent understanding of column and ion exchange chromatography, copyrights and trademarks.
- e. Learning and understanding the knowledge about basic concepts in corrosion and mechanism of corrosion.

UNIT I: Gravimetric Analysis, Colorimetry and Spectrophotometry (12 hours)

- a. Gravimetric analysis: Introduction, Gravimetric analysis by precipitation: nucleation, crystal growth, digestion/ageing, filtration, drying, ignition, weighing, Optimum condition for good precipitation. Physical nature of precipitate, Purity of precipitate: co-precipitation, post-precipitation. Organic precipitates and their applications.
- b. 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.
- c. 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: Soaps and detergents and Chromatographic techniques and IPR (13 hours)

- a. Soaps and detergents: Introduction, Soaps - Raw materials, Types of soaps, Cleansing action of soap, Manufacture of soap - Boiled or Hot Process, Detergents - Raw Materials, Types of Detergents: Anionic, cationic and amphoteric, Preparation of Teepol and Deriphath, Comparisons between soaps and detergents.
- b. 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.
- c. Ion exchange chromatography: Introduction, Principle, Types and properties of ion exchangers. Methodology, Column packing, application of sample, elution, detection/analysis, Applications.
- d. IPR: Introduction to Copyright, Introduction to Trademark.

UNIT III: Corrosion (5 hours)

a. Introduction of corrosion. Electrochemical theory of corrosion, Factors affecting on corrosion -i. Position of metals in the electrochemical series on the basis of standard reduction potential ii. Purity of metal iii. Effect of moisture iv. Effect of oxygen (differential aeration principle) v. Hydrogen overvoltage, Methods of protections of metals from corrosion- alloy formation, making metal cathodic, controlling external condition, Coating-galvanizing, Tinning, electroplating, metal cladding, organic coating.

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) Chemical Process Industries by Shreve and Brink.
- 8) Industrial Chemistry by Loutfy Madkor and Helen Njenga.
- 9) Intellectual Property- A Primer for Academia by Prof. Rupinder Tewari & Ms. Mamta Bhardwaj, Publication Bureau, Panjab University, Chandigarh.
- 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 Bahl Arun, S. Chand and Company Ltd. New Delhi.
- 12) Analytical Chemistry, H. Kaur, A Pragati Prakashan Meerut.
- 13) Analytical Chemistry, Alka Gupta, A Pragati Prakashan Meerut.
- 14) Instrumental Methods of Chemical Analysis – Chatwal & Anand.

B.Sc. B.Ed. (Integrated) Four Years Program
Chemistry
(Major)
Semester- III

Title of the Paper: Chemistry Practical III

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

A] Physical Chemistry:

Perform the following Experiments (Any 8)

1. To study the hydrolysis of methyl acetate in presence of HCl and H_2SO_4 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 viscosity method (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 conductometrically.
8. To determine the specific rotation and unknown concentration of sugar solution by Polarimeter.
9. To determine the specific and molar refractions of benzene, toluene and xylene by Abbe's Refractometer and to determine the refraction of CH_2 Group (Methylene group) (Densities should be determined by students).

B) Analytical Chemistry

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).
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

Reference Books:

1. Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson 2009.
2. Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co: New Delhi (2011).
3. Findlay' Practical Physical Chemistry (Longmann)2015.
4. Practical Physical Chemistry: Gurtu (S. Chand) 2014.
5. Systematic Experimental Physical Chemistry: Rajbhoj, Chandekar (Anjali Publication) 2016.
6. Advanced Practical Chemistry by J. Singh, L. D. S. Yadav, R. K. P. Singh, I. R. Siddiqui et.al, Pragati Prakashan.
7. Vogel's Text Book of Qualitative Inorganic Analysis by A. I. Vogel. 3rd and 6th edition.
8. Practical Organic Chemistry by A. I. Vogel.
9. Hand Book of Organic Qualitative Analysis by H. T. Clarke.
10. Practical Organic Chemistry by F.G. Mann and B. C. Saunders. Low – priced Textbook. ELBS. Longman

B.Sc. B.Ed. (Integrated) Four Years Program
Chemistry (Minor)
Semester- III

Paper Code: Paper V

Title of the Paper: Applied Physical Chemistry

Marks	50	Credits	2
Total Hours	30	Hours Per Week	2
Internal Exam Marks	20	External Exam Marks	30
		Duration of External Examination	1.5 Hours

Learning Outcomes

- a. Learning and understanding the knowledge of Colloidal State, understanding of colloidal system, different types of colloidal system, preparation, properties, stability of different colloidal system, General applications of colloids.
- b. Knowledge and coherent understanding of basic concepts in thermodynamics and Entropy as state function will be gained by the student.
- c. Learning and understanding of theoretical basis of adsorption phenomenon, dynamic nature of surface and its applications.
- d. Learning and understanding the knowledge about basic concepts in reaction kinetics and third order reaction with characteristics, suitable examples, and methods for determination of order of reactions.

UNIT I: Colloidal State and Entropy (15 hours)

- a. Colloidal State: Introduction: Definition of Colloids, Colloidal state of matter, True solution, colloidal solution and Suspension, Dispersed phase and Dispersion medium, Types of Colloidal systems. Solids in liquids (Sols): preparation, purification, properties and stability, Liquids in Liquids (Emulsions): Types and Preparations. Liquids in Solids (Gels): Types and Preparations. General Applications of Colloids.
- b. Entropy: Introduction, 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 as function of P & T. Entropy change in mixing of gases. Entropy changes in phase transformations. Statement of Third law of thermodynamics and standard entropy, Numerical problems.

UNIT II: Surface Phenomena (7 hours)

- a. Introduction, Adsorption as a surface phenomenon, Definition of adsorption, adsorbent, adsorbate. Characteristics of adsorption. Factors affecting adsorption, Types of adsorptions, Distinction between physical and chemical adsorption. Adsorption isotherms: Freundlich adsorption isotherm. Applications of adsorption.

UNIT III: Chemical kinetics (8 hours)

a. Introduction. Third order reactions: Detail derivation of rate constant considering reaction with Equal initial concentration, characteristics, and examples of third order reaction. Determination of order of reaction by: Integration method, i) Graphical method and ii) Half-life method. Effect of temperature on rate of reaction, Arrhenius equation. Concept of energy of activation.

Reference Books:

- 1) Barrow, G.M. Physical Chemistry Tata McGraw-Hill (2007).
- 2) Castellan G.W. Physical Chemistry 4 th Ed. Narosa (2004).
- 3) Kotz, J.C. Treichel, P.M.& Townsend,J.R.General Chemistry, Cengage Learning India 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 47ThEdison, 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
Chemistry (Minor)
Semester- III

Paper Code: Paper VI

Title of the Paper: Applied Analytical Chemistry

Marks	50	Credits	2
Total Hours	30	Hours Per Week	2
Internal Exam Marks	20	External Exam Marks	30
		Duration of External Examination	1.5 Hours

Learning Outcomes

- a. Knowledge about the chemical nature and cleansing action of soap and detergents.
- b. Understanding, working and applications of optical methods as an analytical tool.
- c. Learning and understanding the knowledge about basic concepts in Electroplating.
- d. Learning and coherent understanding of column, ion exchange chromatography.

UNIT I: Cleansing Agents: Soaps and Detergents and Optical methods of Analysis (16 hours)

- a. Cleansing Agents: Soaps and Detergents- Introduction, Soaps - Raw materials, Types of soaps, Cleansing action of soap, Manufacture of soap - Boiled or Hot Process, Detergents - Raw Materials, Type of detergents: Anionic, Cationic and Amphoteric, Preparation of Teepol and Deriphat, Comparisons between soaps and detergents.
- b. Optical methods of Analysis: Theory of colorimetry and spectrophotometry. Lambert Beer's law, deviation from Beer's law. Terms used in colorimetry and spectrophotometry. Photoelectric colorimeter method-Single beam photo-electric colorimeter. Determination of unknown concentration by using concentration absorbance plot. Applications of uv-visible spectrophotometry.

UNIT II: Electroplating (7 hours)

- a. Electrolysis, Faraday's Laws, Cathode Current Efficiency, Basic Principles of Electroplating, Cleaning of Articles, Electroplating of Chromium, Anodizing.

UNIT III: Column and Ion Exchange Chromatography (7 hours)

- a. 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. Ion exchange chromatography: Introduction, Principle, Types and properties of ion exchangers Methodology Column packing, application of sample, elution, detection/analysis, Applications.

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) Chemical Process Industries by Shreve and Brink.
- 8) Industrial Chemistry by Loutfy Madkor and Helen Njenga.
- 9) Intellectual Property- A Primer for Academia by Prof. Rupinder Tewari & Ms. Mamta Bhardwaj, Publication Bureau, Panjab University, Chandigarh.
- 10) Elementary Principles of Chemical Processes by Richard Felder and Ronald Rousseau, John Wiley and Sons.
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- 12) Analytical Chemistry, H. Kaur, A Pragati Prakashan Meerut.
- 13) Analytical Chemistry, Alka Gupta, A Pragati Prakashan Meerut.
- 14) Instrumental Methods of Chemical Analysis – Chatwal & Anand.

B.Sc. B.Ed. (Integrated) Four Years Program
Chemistry (Minor)
Semester- III

Title of the Paper: Chemistry Practical III

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

A] Applied Physical Chemistry:

Perform the following Experiments (Any 8)

1. To study the hydrolysis of methyl acetate in 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 viscosity method (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 conductometrically.
8. To determine the specific rotation and unknown concentration of sugar solution by Polarimeter.
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 (Methylene group) (Densities should be determined by students).

B) Applied Analytical Chemistry

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).
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 KMnO₄ solution)
5. Determination of total hardness of water using 0.01M EDTA solution. (Students should standardize the given EDTA solution by preparing 0.01M CaCl₂ solution. using CaCO₃ salt.)
6. Determination of Alkalinity of water titrimetrically using 0.02N H₂SO₄ 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.

Reference Books:

1. Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson 2009.
2. Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co: New Delhi (2011).
3. Findlay' Practical Physical Chemistry (Longmann)2015.
4. Practical Physical Chemistry: Gurtu (S. Chand) 2014.
5. Systematic Experimental Physical Chemistry: Rajbhoj, Chandekar (Anjali Publication) 2016.
6. Advanced Practical Chemistry by J. Singh, L. D. S. Yadav, R. K. P. Singh, I. R. Siddiqui et.al, Pragati Prakashan.
7. Vogel's Text Book of Qualitative Inorganic Analysis by A. I. Vogel .3rd and 6th edition.
8. Practical Organic Chemistry by A. I. Vogel.
9. Hand Book of Organic Qualitative Analysis by H. T. Clarke.
10. Practical Organic Chemistry by F.G. Mann and B. C. Saunders. Low – priced Textbook. ELBS. Longman

**B.Sc. B.Ed. Mathematics (Integrated) Four Years Programme
Semester-III**

Title of the Paper: (D-III: MATHEMATICS (Major), PAPER-V),

Differential Equations II

Total Marks	50	Credits	02
Total Hours	30	Hours Per Week	04
Internal Exam Marks	20	External Exam Marks	30
		Duration of External Examination	1.5 Hours

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

CO1: Solve differential equations of the first order but not of the first degree.

CO2: Identify types of higher order ordinary differential equations.

CO3: Solve different types of higher order ordinary differential equations.

CO4: Understand simultaneous differential equations.

Unit 1:

(15 Hrs.)

1.1 Equations of the first order but not of the first degree

1.1.1 Introduction

1.1.2 Method I: Equations solvable for p

1.1.3 Method II: Equations solvable for x

1.1.4 Method III: Equations solvable for y

1.1.5 Method IV: Equations in Clairaut's form

1.1.6 Method V: Equations reducible to Clairaut's form

1.1.7 Examples based on 1.1.2 to 1.1.6

1.2 Homogeneous linear equations or Cauchy-Euler equations

- 1.2.1 Homogeneous linear equation (Cauchy-Euler equation)
- 1.2.2 Method of solution of homogeneous linear differential equations
- 1.2.3 Working rule for solving linear homogeneous differential equations
- 1.2.4 Equations reducible to homogeneous linear form (Legendre's linear equations)
- 1.2.5 Working rule for solving Legendre's linear equations
- 1.2.6 Examples based on 1.2.3 and 1.2.5.

Unit 2: Linear differential equations of second order

(09 Hrs)

- 2.1 The general (standard) form of the linear differential equation of the second order.
- 2.2 Complete solution of $y'' + Py' + Qy = R$ in terms of one known integral belonging to the complementary function (C.F.).
- 2.3 Rules for getting an integral belonging to C.F. of $y'' + Py' + Qy = R$.
- 2.4 Working rule for finding complete primitive (solution) when an integral of C.F. is known or can be obtained.
- 2.5 Removal of first derivative (Reduction to normal form or changing the dependent variable).
- 2.6 Working rule for solving problems by changing the dependent variable.
- 2.7 Transformation of the equation by changing the independent variable.
- 2.8 Working rule for solving equations by changing the independent variable.

Unit 3: Simultaneous differential equations of the form $(dx)/P = (dy)/Q = (dz)/R$ (06 Hrs)

- 3.1 Introduction
- 3.2 The nature of solution of $(dx)/P = (dy)/Q = (dz)/R$
- 3.3 Geometrical interpretation of $(dx)/P = (dy)/Q = (dz)/R$
- 3.4 Rule I for solving $(dx)/P = (dy)/Q = (dz)/R$
- 3.5 Rule II for solving $(dx)/P = (dy)/Q = (dz)/R$
- 3.6 Rule III for solving $(dx)/P = (dy)/Q = (dz)/R$
- 3.7 Rule IV for solving $(dx)/P = (dy)/Q = (dz)/R$

Recommended Book:

1. M. D. Raisinghania, Ordinary and Partial Differential Equations, 20th Revised Edition 2022; S.Chand and Company Pvt. Ltd. New Delhi.

Scope:- Part-I Chapter 4: 4.1 to 4.11; Part-I Chapter 6: 6.1 to 6.4 and 6.9 to 6.11; Part-I Chapter 10: 10.1 to 10.4 (excluding 10.4A and 10.4B), 10.5 (excluding 10.5A), 10.6 to 10.11; Part-II Chapter 2: 2.1 to 2.11.

Reference Books:

1. D. A. Murray, Introductory Course in Differential Equations, Khosala Publishing House, Delhi.
2. Zafar Ahasan, Differential Equations and Their Applications, Second Edition, PHI2004.
3. Differential Equations, Shepley L. Ross, Third Edition 1984; John Wiley and Sons, New York.
4. Elements of Partial Differential Equations, Ian Sneddon, Seventeenth Edition, 1982; Mc- Graw-Hill International Book Company, Auckland.

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

Semester-III

Title of the Paper: (D-III: MATHEMATICS (Major), PAPER-VI),: Numerical Methods

Marks	50	Credits	02
Total Hours	30	Hours Per Week	02
Internal Exam Marks	20	External Exam Marks	30
		Duration of External Examination	1.5 Hours

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

CO1: find numerical solutions of algebraic, transcendental and 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

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.

3.1 Numerical Solutions of ODE:

- 3.1.1 Introduction
- 3.1.2 Solution by Taylor's series method
- 3.1.3 Picard's method of successive approximation
- 3.1.4 Euler's method
- 3.1.5 Modified Euler's method
- 3.1.6 Runge-Kutta methods
 - 3.1.6.1 second order Runge-Kutta (without proof)
 - 3.1.6.2 fourth order Runge-Kutta (without proof)

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.Mathematics (Integrated) Four Years Programme
Semester-III
(D-III: Practicum MATHEMATICS (Major))
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.	Differential Equations solvable for x, y and p	1
2.	Equations in Clairaut's form and Reducible to Clairaut's form	1
3.	Homogeneous Linear Differential Equations	1
4.	Legendre's linear equations	1
5.	Solution of linear differential equation of second order when one integral is known	1
6.	Solution of linear differential equation of second order by the change of dependent variable	1
7.	Solution of linear differential equation of second order by the change of independent variable	1
8.	Bisection method	1
9.	Newton Raphson method	1
10.	Newton's forward and backward interpolation formula	1
11.	Lagrange's interpolation formula	
12.	Evaluation of Numerical integration by using Simpson's 1/3rd rule	
13.	Evaluation of Numerical integration by using Simpson's 3/8th rule	1
14.	Numerical solutions of ordinary differential equations by Euler's method.	
15.	Numerical solutions of ordinary differential equations by Runge-Kutta method of second order	
	Total Practicals	

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

Semester-III

Title of the Paper: (D-III: MATHEMATICS (Minor), PAPER-V): Computational Mathematics for Sciences-I

Total Marks	50	Credits	02
Total Hours	30	Hours Per Week	04
Internal Exam Marks	20	External Exam Marks	30
		Duration of External Examination	1.5 Hours

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

1. learn the partial differentiation and Euler's theorem on homogeneous functions.
2. learn the concept of Jacobian of a transformation.
3. understand the concepts of gradient, divergence and curl of point functions in terms of cartesian co-ordinate system.
4. evaluate the gradient, divergence and curl of point functions

Unit 1: Partial differentiation

(08 Hrs.)

1. Partial differentiation
 1. Revision of Partial derivatives
 2. Partial derivatives of composite Functions
 3. Homogeneous functions: definition
 4. Euler's theorems on homogeneous functions
 1. If z is a homogeneous function of degree n in x and y , then
 - a. $x\frac{\partial z}{\partial x} + y\frac{\partial z}{\partial y} = nz$.
 - b. $x^2\frac{\partial^2 z}{\partial x^2} + 2xy\frac{\partial^2 z}{\partial x\partial y} + y^2\frac{\partial^2 z}{\partial y^2} = n(n-1)z$
 2. If z is a homogeneous function of degree n in x and y and $z=f(u)$, then
 - a. $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = nf(u)f'(u)$
 - b. $x^2\frac{\partial^2 u}{\partial x^2} + 2xy\frac{\partial^2 u}{\partial x\partial y} + y^2\frac{\partial^2 u}{\partial y^2} = g(u)u^{-1}$ where $g(u) = nf(u)f'(u)$
 5. Examples based on 1.1.2, 1.1.3, 1.1.4

Unit 2: Jacobian

(07 Hrs.)

2.1 Definition of Jacobian

2.2 Properties of Jacobians.

2.2.1 If J is Jacobian of u,v with respect to x,y and J' is Jacobian of x,y with respect to u,v then $JJ'=1$.

2.2.2 If J is Jacobian of u,v with respect to x,y and J' is Jacobian of x,y with respect to u,v then $JJ'=1$.

2.2.3 If p,q are functions of u,v and u,v are functions of x,y then prove that $(p,q)(u,v) = (p,q)(x,y)(x,y)(u,v)$.

2.2.4 If p,q,r are functions of u,v,w and u,v,w are functions of x,y,z then prove that $(p,q,r)(u,v,w) = (p,q,r)(x,y,z)(x,y,z)(u,v,w)$.

2.2.5 Jacobian of implicit functions (without proof)

Unit 3: Vector Calculus

(15 Hrs.)

3.1 Partial differentiation of vectors

3.1.1 The Scalar and Vector valued Point functions

3.1.2 The Operator ∇

3.1.3 Gradient of a Scalar Point Function: definition

3.1.4 Directional derivatives of scalar and vector point functions

3.1.5 Geometrical Interpretation of $\text{grad } \phi$, where ϕ is a scalar point function

3.1.6 Divergence of vector point function: definition

3.2 Curl of vector point function: definition

3.2.1 Gradient, Divergence and Curl of sums

- i. $\text{grad}(\phi \pm \psi) = \text{grad } \phi \pm \text{grad } \psi$
- ii. $\text{div}(fg) = \text{div } f \pm \text{div } g$
- iii. $\text{curl } fg = \text{curl } f \pm \text{curl } g$

3.2.2 Gradient, Divergence and Curl of Products

- i. $\text{grad } \phi \psi = \phi \text{ grad } \psi + \psi \text{ grad } \phi$
- ii. $\text{div } \phi f = \phi \text{ div } f + (\text{grad } \phi) \cdot f$
- iii. $\text{div } f \times g = g \cdot \text{curl } f - f \cdot \text{curl } g$
- iv. $\text{curl } \phi f = \text{grad } \phi \times f + \phi \text{ curl } f$

3.2.3 Second order differential operators

- i. $\text{div grad } \phi = \nabla \cdot \nabla \phi = 2\phi \partial^2 x^2 + 2\phi \partial^2 y^2 + 2\phi \partial^2 z^2$
- ii. $\text{curl grad } \phi = \nabla \times \nabla \phi = 0$
- iii. $\text{div curl } f = \nabla \cdot \nabla \times f = 0$

3.3.4 The Laplacian Operators Δ

3.2.5 Solenoidal and Irrotational vector fields

Recommended books:

1. Differential Calculus, Shanti Narayan and P.K. Mittal, S. Chand publishing, 15th edition (2016) – For Unit 1 of the syllabus.
[Scope: Chapter -11: 11.1, 11.6, 11.7, 11.8, Chapter -12: 12.1, 12.2, 12.3]
2. A text book of Vector Calculus, Shanti Narayan & P. K. Mittal, S. Chand & CO (Pvt) Ltd, Ram nagar, New Delhi-110055.- For Unit 2 of the syllabus.
[Scope: Chapter -6: 6.1 to 6.17]

Reference books:

1. Differential Calculus, Gorakh Prasad, Pothishala Pvt. Ltd., 19th edition (2016).
2. Mathematical Physics, B. D. Gupta, Vikas Publishing House Pvt. Ltd Fourth edition (2022).
3. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, New Delhi-110002.
4. Advanced Engineering Mathematics R. K. Jain & S. R. K. Iyengar, fourth edition, Narosa Publishing House New Delhi.

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

Semester-III

Title of the Paper: (D-III: MATHEMATICS (Minor), PAPER-VI)

Improper Integrals and Special Functions

Total Marks	50	Credits	02
Total Hours	30	Hours Per Week	04
Internal Exam Marks	20	External Exam Marks	30
		Duration of External Examination	1.5 Hours

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

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

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

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 $B(m, n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}, m, n \geq 0$

1.2.2.2 $B(m, n) = \int_0^1 x^{m-1} (1-x)^{n-1} dx, m, n \geq 0$

1.2.2.3 $B(p, q) = \frac{\Gamma(p)\Gamma(q)}{\Gamma(p+q)}, p, q > -1$

1.2.2.4 $B(n, 1) = \frac{1}{n}, n > 0$

i) If n is an even positive integer, then $B(n, 1) = \frac{1}{n} = \frac{1}{2n-1} \cdot \frac{1}{2n-2} \cdot \frac{1}{2n-3} \cdot \frac{1}{2n-4} \cdots \frac{1}{3} \cdot \frac{1}{2} \cdot \frac{1}{1}$

ii) If n is an odd positive integer, then $B(n, 1) = \frac{1}{n} = \frac{1}{2n-1} \cdot \frac{1}{2n-2} \cdot \frac{1}{2n-3} \cdot \frac{1}{2n-4} \cdots \frac{1}{4} \cdot \frac{1}{3} \cdot \frac{1}{2} \cdot \frac{1}{1}$

1.2.2.5 $B(n, 1) = \frac{1}{n}, n > 0$

i) If n is an even positive integer, then $B(n, 1) = \frac{1}{n} = \frac{1}{2n-1} \cdot \frac{1}{2n-2} \cdot \frac{1}{2n-3} \cdot \frac{1}{2n-4} \cdots \frac{1}{3} \cdot \frac{1}{2} \cdot \frac{1}{1}$

ii) If n is an odd positive integer, then $B(n, 1) = \frac{1}{n} = \frac{1}{2n-1} \cdot \frac{1}{2n-2} \cdot \frac{1}{2n-3} \cdot \frac{1}{2n-4} \cdots \frac{1}{4} \cdot \frac{1}{3} \cdot \frac{1}{2} \cdot \frac{1}{1}$

1.2.2.6 $B(m, n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}, m, n > 0$

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

$B(m, n) = \frac{1}{m+n-1} \cdot \frac{1}{m+n-2} \cdots \frac{1}{m+1} \cdot \frac{1}{m} \cdot \frac{1}{n-1} \cdot \frac{1}{n-2} \cdots \frac{1}{n+1} \cdot \frac{1}{n}$

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

$$\int_0^{\pi} \sin^m x \cos^n x dx = \begin{cases} \frac{m-1}{m} \int_0^{\pi} \sin^{m-2} x \cos^n x dx & \text{if } m \text{ is even} \\ \frac{n-1}{n} \int_0^{\pi} \sin^m x \cos^{n-2} x dx & \text{if } n \text{ is even} \end{cases}$$

1.2.2.7 Relation between Beta and Gamma function

$\Gamma(m)\Gamma(n) = \Gamma(m+n) \int_0^1 x^{m-1}(1-x)^{n-1} dx$, $m, n > 0$

1.2.2.8 $\int_0^1 x^m (1-x)^n dx = \frac{m!n!}{(m+n+1)!}$

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

1.2.2.10 $\int_0^1 x^m (1-x)^n dx = \frac{m!n!}{(m+n+1)!}$

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

1.2.2.12 Duplication formula of Gamma function.

1.2.2.13 Examples based on 1.2.2

Unit 2. Differentiation under integral sign (05 Hrs.)

2.1 Leibnitz first rule of differentiation under integral sign.

2.2 Leibnitz second rule of differentiation under integral sign.

2.3 Examples based on articles 2.1 and 2.2.

Unit 3. Multiple Integrals (10 Hrs.)

3.1 Double Integral: Evaluation of double integrals.

3.2 Evaluation of double integrals in Cartesian form.

3.3 Evaluation of double integrals in Polar form.

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

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

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

3.7 Triple integrals: Evaluation of triple integrals.

3.8 Proof of $\Gamma(m)\Gamma(n) = \Gamma(m+n) \int_0^1 x^{m-1}(1-x)^{n-1} dx$, $m, n > 0$

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 & 3: P. N. Wartikar and J. N. Wartikar, A text book of Applied Mathematics, Pune Vidhyarthi Griha Prakashan, 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 Griha Prakashan, 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. Mathematics (Integrated) Four Years Programme
Semester-III
(D-III: Practicum MATHEMATICS (Minor))
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

Sr. No	Title of the Practical	No. of Practical(s)
1	Euler's theorems on homogeneous functions	02
2	Jacobians	02
3	Curl, Divergence and Gradient	02
4	Solenoidal and Irrotational vector field.	01
5	Directional Derivatives	01
6	Gamma function	02
7	Definition of beta function	01
8	Identities of Beta function	02
9	Differentiation under integral sign	02
	T O T A L	15

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

Semester-III

Paper Code: S-III - Title of the Paper: Content cum Pedagogy of Physical Sciences at Secondary Stage

Marks	50	Credits	04
Total Hours	60	Hours Per Week	06
Internal Exam Marks	40	External Exam Marks	60
		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,
- e. summarize the historical/policies perspective of Physical Sciences,
- f. examine pedagogical concerns of Physical Sciences,
- g. categorize approaches and methods of teaching learning Physical Sciences,
- h. apply appropriate pedagogy in teaching learning the concepts of Physical Sciences.

UNIT - I

Nature, Scope and Historical Perspective of Physical Sciences

- 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.

UNIT – II Aims and Objectives of Physical Sciences

- 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
- D. place of the Physical Sciences in school curriculum.
- E. Values of Physical Sciences: scientific attitude and appreciating other systems of Knowledge / alternative knowledge systems.

UNIT – III Pedagogical Aspects of Physical Sciences

- A. Implication of various approaches - inductive deductive,
- B. Constructivist, experiential learning,
- C. Art integrated learning, sports integrated learning,
- D. Blended learning,
- E. Interdisciplinary and multidisciplinary approaches in Physical Sciences.

UNIT – IV Pedagogical Aspects of Physical Sciences

- A. Analytical pedagogical concerns in teaching of Physical Sciences for Cognitive Domain
- B. Analytical pedagogical concerns in teaching of Physical Sciences for Science Processing Skills
- C. Analytical pedagogical concerns in teaching of Physical Sciences for Higher order thinking skills such as critical, creative, communication, decision making, reflective.
- D. Methods of teaching learning Physical Sciences: learner-centric
- E. Methods of teaching learning Physical Sciences: group-centric

UNIT- V: Pedagogical Approaches

- A. Activity based and discussion,
- B. problem-solving,
- C. Laboratory, stem and steam,
- D. Project based, and scientific inquiry, and hands on activity,
- E. Discovery, experimentation, concept-mapping, collaborative and cooperative learning.

Mode of Transaction

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

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.
- National Steering Committee for National Curriculum Frameworks, (2023). Draft
National Curriculum Framework for School Education.
- NCERT, Textbooks of Biological Sciences at Secondary Stage.

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

Paper Code: AVEC 4 Title of the Paper: Environmental Studies

Students required to do Self Study and at the end of semester there will be Internal 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 study local issues of environment

UNIT: I_Nature of Environmental Studies

- a.** Definition, scope and importance of Environmental Studies
- b.** Multidisciplinary nature of environmental studies
- c.** Environmental communication and need for public awareness
- d.** Human population growth, impact on environment. Human health and Environment
- e.** Concept of sustainability. Sustainable development and it's goals with Indian context.

UNIT: II Natural Resources and Associated Problems

- 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, Water Conservation Movements , resettlement and rehabilitation of people ; its problems and concerns
- 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

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

UNIT: III Ecosystems

- a.** Concept, Structure and function of an ecosystem
- b.** Producers, consumers and decomposers.
- c.** Energy flow in the ecosystem. Ecological succession.
- d.** Food chains, food webs and ecological pyramids.

- e. 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)

- f. Degradation of the ecosystems and its impacts.

SESSIONAL WORK:

Assignments

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

SESSIONAL WORK:

Field visits to local ecological sites and report writing and Submission of it. (25 Marks)

ESSENTIAL READINGS:

Environmental studies, Shivaji University, Kolhapur

Gharpure T.N.(2000) 'Paryavaranshastra'

Paryavaranshastra – Gharpure

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, Centre for Science 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 and II, Environmental Media (R)

Trivedi R.K. and P.K. Gokel, Introduction to air pollution, Tecgbi-Science Publications (TB)

Structure of Semester-IV							
Component	Code	Title		Marks	Credits	Total Hours	Hours Per Week
Foundations of Education	F-IV	Philosophical & Sociological Perspectives of Education-I		100 (T60+ I40)	04	60	06
Disciplinary / Inter-disciplinary Courses	D-IV	Major	Major VII(2)	50 (T 30+ I 20)	02	30	02
			Major VIII (2)	50 (T 30+ I 20)	02	30	02
			Major P IV (2)	50	02	60	04
		Minor	Minor VII(2)	50 (T 30+ I 20)	02	30	02
			Minor VIII (2)	50 (T 30+ I 20)	02	30	02
			Minor P IV (2)	50	02	60	04
Skill Enhancement Courses (SEC)	Practicum	Practical (Major)		50	02	60	04
Stage-Specific Content-cum- Pedagogy	SSCCP-II	Stage-Specific Content-cum- Pedagogy Courses-II		100 (T60+I 40)	04	60	06
Self-Study	SS-IV	Environment Studies		Student required to qualify the internal exam.			
Total =				550	22	420	32

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

B.Sc. B.Ed. Four Year Integrated Programme
Part-II, Semester-IV
Foundations of Education
F-IV EIE: Philosophical & Sociological Perspectives of Education -I

Marks	100	Credits	04
Total Hours (in One Semester)	60	Hours Per Week	06
Internal Exam Marks	40	Theory Exam Marks	60
		Duration of Theory Exam	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.
- Understand the implications of Indian and Western perspectives of education currant education system.
- 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 themselves 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

- 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)

UNIT –II: Indian and Western Perspectives of Education

- a. 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 Apra Vidya, Avidya, Shiksha, Samvaad, Panchkosha, Gurukulam, Acharya, Guru, Shishya, Upadhyaya, Jigyasa, Swadhyaya.
- d. Understanding Western Perspective of Education
 - Meaning, Nature and aims of education with reference to Theories of Education :Cognitive, Behaviorist and Developmental

UNIT – III:Philosophical Schools and Education

- 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 – IV: Educational Thinkers

- a. Contemplation on aims, process and educational institutions 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 – V: Value Education

- 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. Values enshrined in Indian Constitution.
- f. NEP 2020 and Values with special reference to 21st 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.

- Critically examining their experiences to carve out their world and life view and further 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/admission rituals, 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****Paper Code: D-IV****PHYSICS Major Paper-VII****Title of the Paper: Modern Physics**

Marks	50	Credits	2
Total Hours	30	Hours Per Week	2
Internal Exam Marks	20	External Exam Marks	30
		Duration of External Examination	1.5 Hours

- **Learning Outcomes:**

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

1. Understand the basic ideas of special theory of relativity like space and time are relative depending on the observer's motion. Fundamentally changing our perception of space and time depending on the reference frame.
2. Develop a critical understanding of dual nature of radiation by comprehending the significant phenomena that turned to be the milestones in the development of modern physics.
3. Explain the significance of matter waves that led to the invention of electron microscopy and also to quantify the uncertainty in the probabilistic measurements.
4. Understand the refinements in conventional atomic models that led to the modern vector atomic model. In future to develop an insight into atomic spectra exhibited by different elements.

Unit No.	Topics	Total Lectures
Unit I	Relativity Inertial and non-inertial frame of reference, Galilean transformation, ether hypothesis. Michelson- Morley experiment, postulates of the special theory of relativity, Lorentz transformations, length contraction, time dilation, velocity addition theorem, variation of mass with velocity, mass-energy equivalence relation.	07
Unit II	Particle Properties of the Wave Introduction: Ultraviolet Catastrophe, Photoelectric effect, X-rays: Production of X-rays, Continuous X- ray spectrum, Mosley's law, Duane-	08

	Hunt law, Characteristic X -ray spectrum, Compton Effect, Expression for Compton wavelength, Experimental verification of Compton Effect.	
Unit III	Wave properties of Matter De-Broglie hypothesis and derivation of wavelength of matter wave, explanation of wave packet, group velocity, phase velocity, relations between them, Davisson and Germer experiment, Bohr's quantum condition on the basis of matter waves, Heisenberg's uncertainty principle (explanation with example of non- existence of electron in the nucleus)	08
Unit IV	Vector Atom Model Review of Bohr's Atomic Model, Principal quantum number, Energy levels and emission and absorption spectra (with H ₂ ex.), Sommerfeld correction (qualitative), azimuthal quantum number, Vector atom model: Space quantization and electron spin hypothesis, quantum numbers, Pauli's exclusion principle.	07

Reference Books:

1. Introduction of Special Relativity by Robert Resnik.
2. Perspectives of Modern Physics- Arthur Beiser.
3. Atomic and Nuclear Physics by Gupta and Gosh, 2nd Edition.
4. Quantum Mechanics by Sing, Bagade, Kamal Sing, Chand & Comp.
5. Introduction to Atomic and Nuclear Physics by H. Semat and Albright.
6. Atomic Physics by J.B. Rajam.
7. "Modern Physics" by Kenneth S. Krane
8. Concepts of Modern Physics by S.L. Gupta and S. Gupta, Dhanpatrai and Sons

B.Sc. B.Ed. (Integrated) Four Years Programme**Semester-IV****Paper Code: D-IV****PHYSICS Major Paper-VIII****Title of the Paper: Analog & Digital Electronics**

Marks	50	Credits	2
Total Hours	30	Hours Per Week	2
Internal Exam Marks	20	External Exam Marks	30
		Duration of External Examination	1.5 Hours

- **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 and various applications of CRO and illustrate it with suitable examples.
2. Student will be able to discuss single stage common emitter amplifier with ac and dc load line.
3. Student will be able to design different types of oscillator circuits of desired frequency.
4. Student will be able to list basic logic gates and derived logic gate.
5. Student will be able to understand basics of Python programming language.

Unit No.	Topics	Total Lectures
Unit I	Cathode Ray Oscilloscope 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)	05
Unit II	Transistor Amplifier and Oscillators 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).	10
Unit III	Digital Electronics Review of basic logic gates, Derived logic Gates (NOR, NAND, XOR and	07

	XNOR gates), De Morgan's theorems, NAND and NOR as universal gates, R-S flip-Flop, J-K Flip-flop, half Adder, full adder and parallel binary adder.	
Unit IV	Python Programming Language 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 and Identity Operator. Expression, Statement Conditional Statement: If else, if-elif-else statement Loop: for, while	08

Reference Books:

1. Digital Principles & Applications, A.P. Malvino, D.P. Leach & Saha, 7th Ed. 2011, Tata McGraw Hill.
2. Microelectronic circuits, A.S. Sedra, K.C. Smith, A.N. Chandorkar, 2014, 6th Edn., Oxford University Press.
3. Modern Electronic Instrumentation & Measurement Tech., Helfrick & Cooper, 1990, PHI Learning.
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, Yashavant Kanetkar, Aditya Kanetkar
8. Website Reference: <https://www.geeksforgeeks.org/python-programming-language-tutorial/>

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

Semester- IV

Paper Code: D-IV, PHYSICS Major Practical IV

Title of the Paper : PHYSICS Major Practical IV :

Modern Physics and Analog & Digital Electronics

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

1. Able to perform experiments in Modern Physics and Electronics.
2. Develop practical skill, instruments handling skills, observational skills and problem solving skills.
3. Able to solve problems in Python programming language.

Group: I - Modern Physics

1. Determination of Boltzmann constant using semiconductor diode.
2. Determination of Plank's constant using photodiode or LED.
3. To verify Stefan's fourth power law.
4. To determine Stefan's constant by using black body radiation.
5. To determine Rydberg's constant using hydrogen source and plane diffraction grating
6. To study photoelectric current with intensity of light using photoelectric cell/ To determine stopping potential by using photoelectric cell.
7. Simulation of Lorenz Transformation.

Group: II - Analog & Digital Electronics

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 De- morgan's theorems by using IC - 74 series.
6. Python program to find the maximum of two numbers by using if – else statement.
7. Python program to find factorial of number using for loop.

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

Semester-IV

Paper Code: D-IV

PHYSICS Minor Paper-VII

Title of the Paper: Semiconductor Physics

Marks	50	Credits	2
Total Hours	30	Hours Per Week	2
Internal Exam Marks	20	External Exam Marks	30
		Duration of External Examination	1.5 Hours

- **Learning Outcomes:**

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

1. Explain the fundamental properties of semiconductors, distinguish between intrinsic and extrinsic semiconductors, and describe the behaviour of majority and minority carriers in a p-n junction.
2. Analyse the properties of a p-n junction under forward and reverse bias and interpret the V-I characteristics of the junction.
3. Demonstrate the ability to design and analyse rectifier circuits (half-wave, full-wave, and bridge), calculate ripple factors, and understand the role of filter circuits in reducing ripples. They will also evaluate the operation of a Zener diode as a voltage stabilizer.
4. Students will understand the working principles of NPN and PNP transistors, explain the transistor configurations (CE, CB) and evaluate the characteristics of transistors in these configurations.

Unit No.	Topics	Total Lectures
Unit I	SEMICONDUCTORS Semiconductors, Types of semiconductors-intrinsic and extrinsic, majority and minority carriers, p-n junction, properties of p-n junction, forward bias and reverse bias of p-n junction, V-I characteristics of p-n junction.	06
Unit II	SEMICONDUCTOR DIODE p-n junction diode, diode as a rectifier- half wave, full wave, bridge; ripple factor, filter circuits, types of filter circuits, Zener diode, Zener diode as a voltage stabilizer.	09
Unit III	TRANSISTOR Types of transistors, symbol, working of npn and pnp transistors, common emitter, common base, common collector configurations, transistor characteristics in CE and CB mode.	09

UNIT IV	TRANSISTOR AMPLIFIER: Single Stage CE transistor amplifier, D.C. and A.C. equivalent circuit, load line analysis.	06
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Reference Books:

1. Electronic Devices and Circuits: Allen Mottershead, Prentice-Hall of India Pvt.Ltd.
2. Electricity and electronics: G. K. Mithal, Khanna Publishers
3. Principles of electronics: V. K. Mehta, S Chand & Company, New Delhi (11th Edition)
4. Electronic Principles: Elbert Malvino, David Bates, Patrick Hoppe (9th edition)

B.Sc. B.Ed. (Integrated) Four Years Programme**Semester-IV****Paper Code: D-IV****PHYSICS Minor Paper-VIII****Title of the Paper: Astronomy & Astrophysics**

Marks	50	Credits	2
Total Hours	30	Hours Per Week	2
Internal Exam Marks	20	External Exam Marks	30
		Duration of External Examination	1.5 Hours

- Learning Outcomes:

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

1. Understand the fundamentals laws and theories of Astronomy.
2. Discuss the star evolution and related basic concepts.
3. Compare the characteristics of the Galaxy
4. Explain various activities of the Sun.

Unit No.	Topics	Total Lectures
Unit I	Origin of Modern Astronomy Introduction, Geocentric theory, heliocentric theory, Tectonic system, Kepler's laws of planetary motion, Galileo's astronomical contribution, Newton's laws of motion, Newton's law of gravitation.	07
Unit II	Stellar Evolution Formation of the Stars (protostar), Sources of Stellar Energy, H-R Diagram (only diagram), Main Sequence stars, Evolution from the Main Sequence to Red Giants, Chandrasekhar Limit and White Dwarfs, Neutron Stars (only concept), Black Holes (only concept).	08
Unit III	The Sun Internal structure of Sun, Photosphere, Chromospheres and Corona, Sunspots, Solar cycle, Solar Flares, Coronal Mass Ejections, Solar wind, solar radio bursts, Space Weather (only concept).	07
UNIT IV	The Milky Way Galaxy Origin of the Milky Way galaxy, Spiral Structure of the galaxy, Galactic Coordinates, The Mass of the Galaxy, Self-Sustaining Star Formation, The galactic centre, Stellar Populations in the Galaxy.	08

Reference Books:

1. Foundations of Astronomy, Eleventh Edition, Michael A. Seeds, Dana E. Backman, 2011, Brooks/Cole, Cengage Learning.
2. Astronomy: Fundamentals and Frontiers – Jastrow& Thomson, third edition, John Wiley & Sons, 1979
3. Astronomy: A Physical Perspective - Marc L. Kutner, Cambridge University Press, 2003
4. Source book on space science by S. Glasstone, Van Nostrand Company Incorporated, 1965
5. Structure and Evolution of the Stars by Martin Schwarzschild, Princeton University Press, 2016.
6. Structure of the Universe by J.V. Narlikar, Oxford University Press, 1977
7. Astrophysics of the Sun, by H. Zirin, Cambridge University Press, 1989

Classroom Activities:

1. Hands-On: Telescope operation and celestial observations.
2. Interactive Sessions: Exploring constellations using star charts.
3. Debates: The role of space exploration in societal progress.

Recommended Resources:

Simulations and Apps:

1. Stellarium (Planetarium Software)
2. SkySafari (Astronomy App)

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

Semester- IV
Paper Code:_____

PHYSICS Minor Practical IV

Title of the Paper :

**PHYSICS Minor Practical IV : Semiconductor Physics and Astronomy &
Astrophysics**

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

1. Handle and operate various instruments in Physics laboratory.
2. Develop practical skill, instruments handling skills, observational skills.

Group: I - Semiconductor Physics

1. To study of I-V Characteristics of a p-n Junction Diode (Forward and Reverse Bias).
2. To study the half-wave rectifier.
3. To study the full-wave rectifier.
4. To study the output of the bridge rectifier with and without a filter circuit.
5. Study of Zener Diode as a Voltage Regulator.
6. To study the output characteristics of a Transistor in CE Configuration.
7. Single-Stage CE Transistor Amplifier.

Group: II - Astronomy & Astrophysics

1. Verification of inverse square law of intensity using solar cell.
2. Study of Solar Spectrum.
3. Sunspot activity analysis.
4. Constellation map drawings – a) Orion b) Ursa Major (Big Dipper) c) Auriga d) Taurus.
5. To use idea of parallax to determine large distance.
6. Spherical Aberration (Caustic Curve)
7. Study of polar graph.

B.Sc. B.Ed. (Integrated) Four Years Program
Chemistry (Major)
Semester- IV
Paper Code: Paper VII
Title of the Paper: Inorganic Chemistry

Marks	50	Credits	2
Total Hours	30	Hours Per Week	2
Internal Exam Marks	20	External Exam Marks	30
		Duration of External Examination	1.5 Hours

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 $\text{BF}_3\text{-NH}_3$, $[\text{NH}_4]^+$ and H_2O , 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. $\text{CoCl}_3.6\text{NH}_3$, $\text{CoCl}_3.5\text{NH}_3$, $\text{CoCl}_3.4\text{NH}_3$, $\text{CoCl}_3.3\text{NH}_3$. 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. Valence bond theory of transition metal complexes concerning, C.N. = 4, complexes of $[\text{CuCl}_4]^{2-}$ and $[\text{Cu}(\text{CN})_4]^{2-}$ and C.N. = 6 complexes of $[\text{FeF}_6]^{3-}$ and $[\text{Fe}(\text{CN})_6]^{3-}$. 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, 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 (7 hours)

- a. Chemical Bonding and Molecular Structure: 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 .

UNIT III: Inorganic Semi-micro–Qualitative Analysis (7 hours)

- a.** 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.
- b.** 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 et.al.
- 2) Inorganic Chemistry by Shriver and Atkins 5th edition.
- 3) Vogels Textbook of Qualitative Inorganic Analysis by A. I. Vogel. 3rd and 6th edition.
- 4) Advanced Inorganic Chemistry by Agrawal Keemtilal (Pragati Prakashan).
- 5) Theoretical Inorganic Chemistry by C. Day & J. Selbin IInd 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. Wilkison & 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
Chemistry (Major)
Semester- IV
Paper Code: Paper VIII
Title of the Paper: Organic Chemistry

Marks	50	Credits	2
Total Hours	30	Hours Per Week	2
Internal Exam Marks	20	External Exam Marks	30
		Duration of External Examination	1.5 Hours

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. Understanding the classification, configuration and structure of carbohydrates.
- d. Student will be capable of understanding the nomenclature and reactivity of aldehydes and ketones.
- e. Student will learn the basic knowledge of conformational Stereochemistry analysis of some organic compounds.

UNIT I: Carboxylic Acids and Their Derivatives, Amines and Diazonium Salts (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 Diazonium Salts: Amines i) Introduction, Classification and Nomenclature ii) Methods of preparation: a) From alkyl halide by amination b) By reduction of nitriles or cyanides c) From unsubstituted amides (Hoffmann degradation), d) By Gabriel synthesis (From Phthalamide). 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 -Sandmeyer's reaction. b) Coupling reactions: Synthesis of Congo red.

UNIT II: Carbohydrates, Carbonyl Compounds- Aldehydes and Ketones (13 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.

UNIT III: Stereochemistry (6 hours)

- a. 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, Arun Bahl. S. Chand & Company, Ltd.
9. Chemistry by R. L. Madan, S. Chand and Company Ltd.

B.Sc. B.Ed. (Integrated) Four Years Program
Chemistry (Major)
Semester- IV

Title of the Paper: Chemistry Practical IV

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

A) Inorganic Chemistry:

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 $\text{NiSO}_4 \cdot 7\text{H}_2\text{O}$ 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^- , NO_3^- , CO_3^{2-} , SO_4^{2-} , S^{2-} , (insoluble CO_3^{2-} may be given)

- v) Following cations are to be given:

Cu^{2+} , Cd^{2+} , Al^{3+} , Fe^{3+} , Cr^{3+} , Zn^{2+} , Mn^{2+} , Ni^{2+} , Co^{2+} , Ca^{2+} , Ba^{2+} , Mg^{2+} , NH_4^+ , K^+

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

B) Organic Chemistry:

- 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 group.

3) Organic Preparations (Any two)

- i) Preparation of p-nitro acetanilide from Acetanilide.
- ii) Preparation of Acetanilide from Aniline using anhydrous ZnCl_2 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 Textbook of Qualitative Inorganic Analysis by A. I. Vogel .3rd and 6th edition.
- 3) Vogel's Textbook 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) Handbook of Organic Qualitative Analysis by H.T. Clarke.
- 8) A Laboratory HandBook of Organic Qualitative Analysis and Separation by V. S. Kulkarni. Dastane Ramchandra & 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, Pragati Prakashan.

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

Chemistry

Semester- IV

Paper Code: Paper VII

Title of the Paper: Fundamentals of Inorganic Chemistry

Marks	50	Credits	2
Total Hours	30	Hours Per Week	2
Internal Exam Marks	20	External Exam Marks	30
		Duration of External Examination	1.5 Hours

Learning Outcomes

- Learning and understanding unique properties such as electronic configuration, stability of Oxidation states, color, and separation of lanthanides and its applications.
- Knowledge about Crystal structure and defects in Ionic solids will be gained by the students.
- Learning and understanding classification and physical properties of non-aqueous solvents.
- Learning and understanding classification and physical properties of catalysis and its industrial applications.

UNIT I: Chemistry of Lanthanide Elements (10 hours)

- Introduction, Occurrence of lanthanides, Properties of lanthanides with respect to (i) Electronic configuration. (ii) Oxidation states. (iii) Color and spectra. (iv) Lanthanide contraction. Separation of Lanthanides by Ion Exchange method. Applications of Lanthanides.

UNIT II: Crystal Structure and Defects in Solids, Chemistry of Non-Aqueous Solvents (14 Hours)

- Crystal Structure and Defects in Solids: Introduction to ionic solids, Crystal structures – Radius ratio, radius ratio effect on geometry and calculation of r^+/r^- for octahedral geometry, NaCl crystal structure, CsCl crystal structure, ZnS, crystal structure, Defects in solids- Introduction, Types of defects in Solids, Stoichiometric defects – Schottky defects and Frenkel defects. Non- stoichiometric defects- (a) Metal excess defects, (i) Due to anion vacancies and (ii) Due to interstitial cations (b) Metal deficiency defects, (i) Due to cation vacancies and (ii) Due to interstitial anions, Consequences of defects in solids.

- Chemistry of Non-Aqueous Solvents: Introduction, Definition and Characteristics of Solvents, Classification of Solvents (i) Liquid, Solid and Gaseous Solvents, (ii) Protic and Aprotic Solvents, (iii) Ionizing and Non-ionizing Solvents, (iv) Aqueous and Non-aqueous Solvents. Physical properties and acid-base reactions in liquid NH_3 and liquid SO_2 .

UNIT III: Catalysis (6 Hours)

- Introduction, Classification of catalytic reactions- 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 (Use of Catalysis in Industrial Processes)

References:

- Inorganic Chemistry, Principles of structure and reactivity J. E. Huheey & etal.
- Inorganic Chemistry-Shriver and Atkins, 5th Edition
- Principles of Inorganic Chemistry by Puri, Sharma, Kalia
- Advance Inorganic Chemistry by Agrawal, Keemtilal (Pragati Edition)
- Theoretical Inorganic Chemistry 2nd Edition by C. Day and J. Selbin
- Principles of Inorganic Chemistry by Puri, Sharma, Jauhar
- Chemistry in Non – Aqueous Solvents by H. H. Sisler (Chapman and Hall Ltd.)
- Modern Inorganic Chemistry by R. D. Madan (S. Chand)
- Inorganic Chemistry by J. D. Lee
- Basic Inorganic Chemistry by F. A. Cotton, G. Wilkinson and B. L. Gaus Wiley.
- Concept and Models of Inorganic Chemistry by B. Douglas. D. Mc. Daniel and J. Alexander, John Wiley.
- Coordination Chemistry by R. Basolo and Pearson.

B.Sc. B.Ed. (Integrated) Four Years Program
Chemistry
Semester- IV

Paper Code: Paper VIII

Title of the Paper: Applied Organic Chemistry

Marks	50	Credits	2
Total Hours	30	Hours Per Week	2
Internal Exam Marks	20	External Exam Marks	30
		Duration of External Examination	1.5 Hours

Learning Outcomes

- a. Understanding the sources, classification, structure and functions of major biomolecules: Amino Acids, Peptides, and Proteins. Students should also be able to understand biological processes like metabolism, energy transformation, and the functions of enzymes.
- b. Learning and understanding of classification, Configuration, and structures of carbohydrates.
- c. Students will get knowledge about classification, preparation, structure, and applications of synthetic dyes.
- d. Understanding the chemistry of fertilizers and pesticides for sustainable agriculture.
- e. Students get knowledge about chemical structures and the mechanism of action of various fertilizers and pesticides, with their environmental impact.

UNIT I: Biomolecules and Chemistry of Carbohydrates (15 Hours)

a. Introduction, nomenclature & sources of Amino acids. Classification of Amino Acids: Based on polarity, charge. Acid-Base Properties and Zwitterion Concept 1,4 Isoelectric Point (pI) and Electrophoresis Ninhydrin test, and Biurate test, Biological Functions and Importance of Amino Acids, Synthesis of Amino Acids (Alanine & Phenylalanine), Introduction, nomenclature & sources of Peptides, Structure and Properties of Simple Peptides. Biological Functions and Importance of Peptides, Introduction, nomenclature & sources of Proteins, Biological Functions and Importance of Proteins.

b. Chemistry of Carbohydrates: Introduction to Carbohydrates: Definition and general formula ($C_nH_{2n}O_n$), Sources, importance, and biological role of carbohydrates. Classification: Monosaccharides, Disaccharides, Oligosaccharides, Polysaccharides, Monosaccharides: Structure and nomenclature (aldoses & ketoses), Open and cyclic structure of Glucose, Fructose: D- and L-configuration. Mutarotation of glucose. Disaccharides: Properties and Haworth structures of Sucrose, Lactose, and Maltose. Polysaccharides: Properties and Structures of Starch, Cellulose

UNIT II: Synthetic Dyes (7 Hours)

a. Introduction to Dyes, Classification of dyes (based on application), Terms used in dyes (Chromophores and auxochromes with examples). Witt's theory of dye. Diazotization of benzene. Synthesis and applications of Methyl Orange and Indigo dye. Dyeing of cotton, silk, wool.

Unit III: Organic Chemistry in Agriculture (8 Hours)

a. Agrochemicals: Introduction, Definition, and Importance. Types of agrochemicals (fertilizers, pesticides, herbicides, insecticides, fungicides, plant growth regulators). Synthesis and applications of Carbaryl and Indol-3-Acetic Acid (IAA). Biopesticides: Preparation of neem-based pesticides. Mechanism of action of Fertilizers & Pesticides. Advantages of Agrochemicals, Limitations of Agrochemicals.

Reference Books:

1. Lehninger Principles of Biochemistry, 6th edition by David L. Nelson, Michael M. Cox.
2. Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd.
3. Finar, I. L. Organic Chemistry (Volume 2), Dorling Kindersley (India) Pvt. Ltd.
4. Organic Chemistry. Volume I, II, III by S.M. Mukharjee, S.P. Singh, and R.P. Kapoor. Wiley Eastern Limited (New Age International)
5. Advanced Organic Chemistry by B.S. Bahl, Arun Bahl. S. Chand & Company, Ltd.
6. Chemistry by R. L. Madan, S. Chand and Company Ltd.
7. Indian Council of Agricultural Research (ICAR) Reports (2022).
8. Agricultural Chemistry by Dr. L. Rakesh Sharma.

B.Sc. B.Ed. (Integrated) Four Years Program
Chemistry
Semester- IV

Title of the Paper: Chemistry Practical IV

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

A) Fundamentals of Inorganic Chemistry:

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 $\text{Ni}(\text{DMG})_2$ from a solution containing $\text{NiSO}_4 \cdot 7\text{H}_2\text{O}$ 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^- , NO_3^- , CO_3^{2-} , SO_4^{2-} , S^{2-} , (insoluble CO_3^{2-} may be given) v)

Following cations are to be given:

Cu^{2+} , Cd^{2+} , Al^{3+} , Fe^{3+} , Cr^{3+} , Zn^{2+} , Mn^{2+} , Ni^{2+} ,

Co^{2+} , Ca^{2+} , Ba^{2+} , Mg^{2+} , NH_4^+ , K^+

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

B) Applied Organic Chemistry:

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 group.

3) Organic Preparations (Any two)

- i) Preparation of p-nitro acetanilide from Acetanilide.
 - ii) Preparation of Acetanilide from Aniline using anhydrous ZnCl_2 and Zn dust.
 - iii) Preparation of Phthalimide from Phthalic anhydride.
 - iv) Preparation of Benzoic acid from Benzamide.
- 4) To determine the total sugar content in honey by Fehling's solution.
- 5) Synthesis of para red from m-nitro aniline and 2-naphthol by diazotization reaction.
- 6) Ninhydrin test and Biuret test for the detection of maltose.

Reference Books:

- 1) Vogel's Quantitative Chemical Analysis, Pearson 2009.
- 2) Vogel's Textbook of Qualitative Inorganic Analysis by A. I. Vogel .3rd and 6th edition.
- 3) Vogel's Textbook 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) Handbook of Organic Qualitative Analysis by H.T. Clarke.
- 8) A Laboratory HandBook of Organic Qualitative Analysis and Separation by V. S. Kulkarni. Dastane Ramchandra & 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, Pragati Prakashan.

B.Sc. B.Ed. Mathematics (Integrated) Four Years Programme Semester-IV

Title of the Paper: (D-IV: MATHEMATICS (Major), PAPER-VII) Differential Calculus

Total Marks	50	Credits	02
Total Hours	30	Hours Per Week	04
Internal Exam Marks	20	External Exam Marks	30
		Duration of External Examination	1.5 Hours

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

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

CO1: evaluate the limit and examine the continuity of a function at a point.

CO2: understand conceptual variations while advancing from one variable to several variables in differential calculus.

CO3: set and solve optimization problems involving several variables.

CO4: learn the concept of Jacobian of a transformation.

Unit – 1: Limit, Continuity and Differentiability **hrs.)**

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1. Left hand and Right hand limits (do not use $\sum$ -TM definition).
2. Properties of limits:
Theorem (without proof): If f and g are two functions defined on some neighborhood of c such that $\lim_{x \rightarrow c} f(x) = l$, $\lim_{x \rightarrow c} g(x) = m$ then
 - i $\lim_{x \rightarrow c} (f+g)(x) = l+m$
 - ii $\lim_{x \rightarrow c} (f-g)(x) = l-m$
 - iii $\lim_{x \rightarrow c} f(x)g(x) = lm$
 - iv $\lim_{x \rightarrow c} f(x)/g(x) = l/m$ if $m \neq 0$
3. Evaluation of limit: Examples (using techniques like factorization, rationalization, Left hand and Right hand limits).
4. Continuous functions: definition of Continuity at a point, definition of continuity in an interval.
5. Properties of continuous functions:
 1. Theorem: Let f and g be two functions continuous at a point c , then the functions $f+g$, $f-g$, fg are also continuous at c and if $g(c) \neq 0$, then f/g is also continuous at c . Functions continuous on closed intervals:
 2. Definition of bounded function
 3. Theorem (Statement only): If a function f is continuous in a closed interval, then it is bounded therein.
 4. Theorem: If a function f is continuous on a closed interval $[a, b]$, then it attains its bounds at least once in $[a, b]$.
 5. Theorem (Statement only): If a function f is continuous at an interior point c of an interval $[a, b]$ and $f(c) \neq 0$, then $\exists$ a $\delta > 0$ such that $f(x)$ has the same sign as $f(c)$, for every $x \in (c-\delta, c+\delta)$.
 6. Corollary (Statement only): If f is continuous at the end point b of $[a, b]$ and $f(b) \neq 0$, then there exists an interval $(b-\delta, b]$ such that $f(x)$ has the sign of $f(b)$ for all x in $(b-\delta, b]$.

7. Corollary (Statement only): If f is continuous at the end point a of a, b and $f a \neq 0$, then there exists an interval $[a, a+\delta)$ such that $f x$ has the sign of $f a$ for all x in $[a, a+\delta)$.
8. Theorem (Statement only): If a function f is continuous on a closed interval a, b and $f a$ and $f b$ are of opposite signs ($f a \cdot f b < 0$), then there exists at least one point $\alpha \in a, b$ such that $f = 0$.
9. Intermediate Value Theorem.
10. Corollary (Statement only): A function f , which is continuous on a closed interval a, b , assumes every value between its bounds.
6. Discontinuous functions: Definition, Types of discontinuities – (i) removable discontinuity (ii) discontinuity of first kind (iii) discontinuity of second kind.
7. Examples on 1.4 and 1.6
8. Differentiability at a point and Differentiability in an interval: definitions.
9. Examples on 1.8.
10. (Differentiability and continuity) Theorem: A function which is derivable at a point is necessarily continuous at that point.

Unit – 2: Partial derivatives and Jacobian **hrs.)**

(12

1. Partial derivatives:
 1. Total Differentials.
 2. Differentiation of composite functions.
 3. Homogeneous functions: definition.
 4. Euler's theorems on homogeneous functions (Case of two and three variables)
 5. Examples on 2.1.2, 2.1.3, 2.1.4.
2. Jacobian
 1. Definition of Jacobian and examples.
 2. Jacobian of function of functions (proof of the corollary $J.J' = 1$ is expected).
 3. Jacobian of implicit functions (without proof)
 4. Examples on 2.2.2 and 2.2.3.

Unit – 3: Extreme values

(06 hrs.)

- 3.1 Maxima and minima of functions of **two** variables: Sign of quadratic expression, Lagrange's condition for stationary value.
- 3.2 Lagrange's method of undetermined multipliers for three variables.
- 5.4 Examples on 3.1 and 3.2.

Recommended Books:

1. **Mathematical Analysis**, S. C. Malik and Savita Arora, New Age International Publishers, 4th Edition (2012) – For Unit 1 of the syllabus.
[Scope: Chapter 5 – section 1.1, 1.2, section 2.1, 2.2, 2.3, 2.4, section 3, Chapter 6 – section 1, 1.1, 1.2, section 2 (Theorem 1), 2.1].
2. **Differential Calculus**, Shanti Narayan and P.K. Mittal, S. Chand publishing, 15th edition (2016) – For Unit 2 & 3 of the syllabus.
[Scope: Chapter 11 – 11.8, 11.8.1, 11.9.1, 11.9.2, 11.9.3,
Chapter 12 – 12.1, 12.2, 12.3
Chapter 9 – 9.6, 9.6.1, 9.6.2, 9.6.3, 9.6.4, 9.7]

Reference Books:

1. **Differential Calculus**, Gorakh Prasad, Pothishala Pvt. Ltd., 19th edition (2016).
2. **Aspects of Calculus**, Gabriel Klambauer, Springer-Verlag.(1986)
3. **Basic Multivariable Calculus**, J. E. Marsden, A. J Tromba & A. Weinstein; Springer Verlag, New New York, 1993.

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

Semester-IV

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

Integral Calculus

Total Marks	50	Credits	02
Total Hours	30	Hours Per Week	04
Internal Exam Marks	20	External Exam Marks	30
		Duration of External Examination	1.5 Hours

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 $1=1$

1.1.2.2 $n+1=n!$ in general.

1.1.2.3 $n+1=n!$ if n is positive integer.

1.1.2.4 $0=\infty, \infty=\infty$

1.1.2.5 $n=20e^{-x}x^{2n-1}dx, n>0$

1.1.2.6 $n=kn^0e^{-kx}x^{n-1}dx, n,k>0$

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 $m,n=\beta n,m;m,n\geq 0$

1.2.2.2 $m,n=2\sin^{2m-1}\theta\cos^{2n-1}\theta d\theta;m,n\geq 0$

1.2.2.3 $2\sin^p\theta\cos^q\theta d\theta=2^{p+1}2^{q+1}p,q>-1$

1.2.2.4 $2\sin^n\theta d\theta=2^{n+1}2^{12}$

i) If n is an even positive integer, then $2\sin^n\theta d\theta=2^{n-1}n-3n-2n-5n-4\ldots 34122$

ii) If n is an odd positive integer, then $2\sin^n\theta d\theta=2^{n-1}n-3n-2n-5n-4\ldots 4523\cdot 1$

1.2.2.5 $2\cos^n\theta d\theta=2^{n+1}2^{12}$

i) If n is an even positive integer, then $2\cos^n\theta d\theta=2^{n-1}n-3n-2n-5n-4\ldots 34122$

ii) If n is an odd positive integer, then $2\cos^n\theta d\theta=2^{n-1}n-3n-2n-5n-4\ldots 4523\cdot 1$

1.2.2.6 $2\sin^m\theta\cos^n\theta d\theta=2^{m+1}2^{n+1}2$

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

$$2\sin^m\theta\cos^n\theta d\theta=m-1m-3\ldots 2 \text{ or } 1[n-1n-3\ldots 2 \text{ or } 1]m+n-2\ldots 3\cdot 2\cdot 12$$

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

$$2\sin^m\theta\cos^n\theta d\theta=m-1m-3\ldots 2 \text{ or } 1[n-1n-3\ldots 2 \text{ or } 1]m+n-2\ldots 3\cdot 2\cdot 1\cdot 1$$

1.2.2.7 Relation between Beta and Gamma function

$$m, n = m(n) m + n; m, n > 0$$

1.2.2.8 $12 =$

1.2.2.9 $m, n = 0 x m^{-1} + x m + n dx$

1.2.2. $\beta m, n = a n b m 0 x m^{-1} + x m + n dx$

1.2.2.11 $m, n = 0 1 x m^{-1} + x n^{-1} + x m + n dx$

1.2.2.12 Duplication formula of Gamma function.

1.2.2.13 Examples based on 1.2.2

Unit 2. Differentiation under integral sign
(Hrs.)

(05

2.1 Leibnitz first rule of differentiation under integral sign.

2.2 Leibnitz second rule of differentiation under integral sign.

2.3 Examples based on articles 2.1 and 2.2.

Unit 3. Multiple Integrals
(Hrs.)

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3.1 Double Integral: Evaluation of double integrals.

3.2 Evaluation of double integrals in Cartesian form.

3.3 Evaluation of double integrals in Polar form.

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

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

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

3.7 Triple integrals: Evaluation of triple integrals.

3.8 Proof of $m, n = m(n) m + n; m, n > 0$

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 & 3: P. N. Wartikar and J. N. Wartikar, A text book of Applied Mathematics, Pune Vidhyarthi Griha Prakashan, 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 Griha Prakashan, 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. Mathematics (Integrated) Four Years Programme
Semester-IV
(D-IV: Practicum MATHEMATICS (Major))
Lab work-IV

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

Sr. No	Title of the Practical	No. of Practical(s)
1	Examples on evaluation of Limit	01
2	Examples on Continuity	01
3	Examples on Euler's theorems on homogeneous functions	01
4	Examples on Jacobian	02
5	Extreme values of functions of two variables	01
6	Lagrange's method of undetermined multipliers	01
7	Gamma function	02
8	Beta function	02
9	Differentiation under integral sign	02
10	Evaluation of double integrals in Cartesian form over the given region.	01
11	Evaluation of triple integrals	01
	T O T A L	15

B.Sc. B.Ed. Mathematics (Integrated) Four Years Programme Semester-IV

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

Computational Mathematics for Sciences-II

Total Marks	50	Credits	02
Total Hours	30	Hours Per Week	04
Internal Exam Marks	20	External Exam Marks	30
		Duration of External Examination	1.5 Hours

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

1. apply various interpolation methods.
2. approximate polynomials for the real-life data.
3. construct and interpret finite difference tables for data analysis.
4. apply interpolation techniques in solving problems related to computer science, such as curve fitting and numerical estimation.

Unit 1. Interpolation on Evenly Spaced Points (15 Hrs.)

- 1.1 Introduction: Interpolation, Extrapolation, Interpolating polynomial.
- 1.2 Finite Differences: Forward Differences (), Backward Differences (), Central Differences ().
- 1.3 Shift Operator (E) and means operator ().
- 1.4 Symbolic Relations and Separation of Symbols.
 1. Show that $\Delta = E - 1$, $\nabla = 1 - E$, $\delta = E^{1/2} - E^{-1/2}$, $\mu = \frac{1}{2}(E^{1/2} + E^{-1/2})$, $\nabla^2 = 1 - 2E + E^2$, $\Delta^2 = E^2 - 2E + 1$.
 2. Show that $E^h D = D E^h$, where $D \equiv \frac{d}{dx}$.
 3. Show that $\Delta^n u_x = u_x - n u_{x-1} + \frac{n(n-1)}{2} u_{x-2} - \dots + (-1)^{n-1} n u_{x-n+1}$.
 4. Show that $\nabla^n u_0 = u_0 - n u_1 + \frac{n(n-1)}{2} u_2 - \dots + (-1)^{n-1} n u_{n-1}$.
- 1.5 Forward and Backward Differences of a polynomial.
- 1.6 Newton's Forward and backward Formulae for Interpolation.
- 1.7 Examples based on 1.1 to 1.6

Unit 2. Interpolation on Unevenly Spaced Points (08 Hrs.)

- 2.1 Lagrange's Interpolation Formula.
- 2.2 Divided Difference and Their Properties.

Unit 3: Newtons Interpolation formula (07 Hrs.)

- 3.1 Newton's General Interpolation Formula.
- 3.2 Method of successive approximations

Recommended Book:

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

Scope: Chapter 3 Section 3.1, 3.3, 3.5, 3.6 and 3.7.1, Chapter 3 Section 3.9 to 3.11

Reference Books:

1. B. S. Grewal - Numerical Methods in Engineering And Science: C, C++, and MatLab, Mercury Learning and Information, New Delhi (2012).
2. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age International Publisher, Mumbai (2012).

B.Sc. B.Ed. Mathematics (Integrated) Four Years Programme Semester-IV

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

Laplace Transform

Total Marks	50	Credits	02
Total Hours	30	Hours Per Week	04
Internal Exam Marks	20	External Exam Marks	30
		Duration of External Examination	1.5 Hours

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

1. understand definitions and existence conditions of the Laplace transform
2. apply key properties of the Laplace transform
3. understand inverse Laplace transform
4. apply Laplace transform to solve differential equations.

Unit 1. Laplace Transform (15 Hrs.)

- 1.1 Definitions: Piecewise or Sectional Continuity, Function of Exponential Order, Function of Class 'A'.
- 1.2 The Transform Concept, Definition of Laplace Transform, Notation.
- 1.3 Existence of Laplace Transform (Statement only).
- 1.4 Linear Property, First Shifting Theorem, Second Shifting Theorem and Change of Scale Property.
- 1.5. Some Standard Results
- 1.6 Laplace transform of derivatives, Laplace transform of integrals.
- 1.7 Multiplication by powers of 't', Division by 't'.
- 1.8 Periodic functions.
- 1.9 Examples based on 1.1 to 1.8

Unit 2. Inverse Laplace Transform (12 Hrs.)

- 2.1 Definitions of Inverse Laplace Transform and Null function. Uniqueness Theorem.
- 2.2 Linear property
- 2.3 First shifting theorem, second shifting theorem, Unit step function, change of scale property.
- 2.4 Inverse Laplace transform of derivatives, Division by 's'.
- 2.5 The Convolution theorem, Multiplication by 's'.
- 2.6 Inverse Laplace by partial fractions, Heavi-side's Expansion formula.

Unit 3: Applications of Laplace Transform (03 Hrs.)

- 2.7 Application to solve Ordinary Linear Differential Equations with constant and Variable Coefficients
- 2.8 Examples based on 2.1 to 2.7

Recommended Book:

1. J. K. Goyal, K. P. Gupta, Integral Transforms, A Pragati Prakashan, Meerut, 21st edition, 2021.

Scope:

Chapter 1 Part I: 1.0 to 1.6, Chapter 1 Part II: 1.0 to 1.3. Part III 1.0 to 1.1

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's outlines, 2018.

B.Sc. B.Ed. Mathematics (Integrated) Four Years Programme
Semester-IV
(D-IV: Practicum MATHEMATICS (Minor))
Lab work-IV

Sr. No	Title of the Practical	No. of Practical(s)
1	Properties of Finite Differences	01
2	Forward and Backward Differences of a polynomial	01
3	Examples on Newton's forward difference formula	01
4	Examples on Newton's backward difference formula	01
5	Examples on Lagrange's interpolation formula.	01
6	Examples on Newton's general interpolation formula	01
7	Examples on Method of successive approximations	01
8	Laplace transform of Derivative and Integrals	02
9	Multiplication by powers of 't', and division by 't'.	02
10	Laplace transform of Periodic Functions	01
11	Inverse Laplace by Convolution theorem	01
12	Inverse Laplace by partial fractions	01
13	Application to Linear differential equations	01
	TOTAL	15

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

Semester- IV Paper
Code:D-IV

PHYSICS Minor Practical IV

Title of the Paper :

PHYSICS Minor Practical IV : Semiconductor Physics and Astronomy & Astrophysics

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

1. Handle and operate various instruments in Physics laboratory.
2. Develop practical skill, instruments handling skills, observational skills.

Group: I - Semiconductor Physics

1. To study of I-V Characteristics of a p-n Junction Diode (Forward and Reverse Bias).
2. To study the half-wave rectifier.
3. To study the full-wave rectifier.
4. To study the output of the bridge rectifier with and without a filter circuit.
5. Study of Zener Diode as a Voltage Regulator.
6. To study the output characteristics of a Transistor in CE Configuration.
7. Single-Stage CE Transistor Amplifier.

Group: II - Astronomy & Astrophysics

1. Verification of inverse square law of intensity using solar cell.
2. Study of Solar Spectrum.
3. Sunspot activity analysis.
4. Constellation map drawings – a) Orion b) Ursa Major (Big Dipper) c) Auriga d) Taurus.
5. To use idea of parallax to determine large distance.
6. Spherical Aberration (Caustic Curve)
7. Study of polar graph.

B.Sc. B.Ed. (Integrated) Four Years Programme
Semester-IV

Paper Code: SSCCI-I, Content cum Pedagogy of Mathematics at Secondary Stage – Course

Marks	100	Credits	04
Total Hours	60	Hours Per Week	06
Internal Exam Marks	40	External Exam Marks	60
		Duration of External Examination	3 Hours

Learning outcomes after completion of this course, student teachers will be able to:

- appraise the contribution of Indian Knowledge Systems in development of Mathematics,
- explain the nature of Mathematics as an important subject for human development,
- interpret the recommendation of the various policy documents in reference to Mathematics education,
- classify the aims and objectives of teaching Mathematics,
- formulate objectives based on learning outcomes for Mathematics teaching,
- select and demonstrate various approaches and methods of teaching Mathematics,
- plan strategies to inculcate values through teaching Mathematics..

UNIT - I Nature, Scope and Historical Perspective of Mathematics

- a. Development of Mathematics from a historical perspective.
- b. Nature of Mathematical Knowledge – Axioms and Postulates, Conjectures, Proofs in Mathematics: inductive - deductive reasoning, theorems, mathematical modeling.
- c. Importance of Mathematics knowledge in everyday life.
- d. Recommendations of various committees to Mathematics education at Secondary stage
- e. Commissions and policies related and National Curriculum Frameworks) to Mathematics education at Secondary stage

UNIT - II Aims and Objectives of Teaching Mathematics

- a. Aims and objectives of teaching Mathematics at secondary stage.
- b. Learning outcomes of teaching Mathematics at secondary stage
- c. competencies for teaching Mathematics at secondary stage
- d. Linkages of Mathematics with other school subjects and place in school curriculum.
- e. Incultation of values through teaching of Mathematics.

UNIT - III Implication of various approaches of teaching Mathematics

- a. Analytical – inductive deductive, analytical and synthetical approach
- b. blended learning, approach
- c. Experiential learning, transdisciplinary, approach
- d. Interdisciplinary and multidisciplinary approach
- e. Constructivist

UNIT - IV Pedagogical concerns in teaching of Mathematics for higher order thinking skills

- a. Critical, creative, decision making, reflective, collaborative, and cooperative
- b. Learner-centric and participative methods of teaching of Mathematics: lecture cum demonstration, problem-solving, laboratory, project based.
- c. Techniques of teaching learning Mathematics: oral, written, drill work, homework, self study, group study, supervised study,
- d. Concept-mapping, learning,
- e. Art and sports integrated learning.

UNIT - V Learner-centric, participative and analytical pedagogical concerns of teaching of Mathematics

- a. Lecture cum demonstration, problem-solving,
- b. Laboratory, project based.
- c. Critical, creative,
- d. Decision making, reflective,
- e. Collaborative, and cooperative

Suggestive Practicum (Any Three)

1. Prepare a collage/ biographic sketch on the contribution of Indian mathematician.
2. Present a paper on comparison of nature of mathematical knowledge with other school subjects.
3. Formulate objectives based on learning outcomes and experiential learning for any one unit of secondary Mathematics.
4. Develop strategy to connect any three topics for value inculcation in teaching of Mathematics.
5. Analyze the content of one chapter of Mathematics textbook and develop concept maps at secondary stage.
6. Select and list approaches and methods for teaching various topics of secondary stage Mathematics.
7. Any other project assigned by HEI.

Suggestive Mode of Transaction Demonstration- field-based experience, library visits, classroom

discussions, self-study, field observations, assignment preparation, classroom presentations, discussion

forums, observation, research report, engaging in dialogue, flipped classroom.

Suggestive Mode of Assessment -Written test, classroom presentation, workshop, assignments, practicum, sessional and terminal semester examination (As per UGC norms).

Suggestive Reading Material

- MESE 001(2003) Teaching and Learning Mathematics. IGNOU series
- NCERT Publications: Pedagogy of Mathematics (Code-13074)

*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

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- c. Importance of Mathematics knowledge in everyday life.
- d. Recommendations of various committees to Mathematics education at Secondary stage
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UNIT - II Aims and Objectives of Teaching Mathematics

- a. Aims and objectives of teaching Mathematics at secondary stage.
- b. Learning outcomes of teaching Mathematics at secondary stage
- c. competencies for teaching Mathematics at secondary stage
- d. Linkages of Mathematics with other school subjects and place in school curriculum.
- e. Inculcation of values through teaching of Mathematics.

UNIT - III Implication of various approaches of teaching Mathematics

- a. Analytical – inductive deductive, analytical and synthetical approach
- b. blended learning, approach
- c. Experiential learning, transdisciplinary, approach
- d. Interdisciplinary and multidisciplinary approach
- e. Constructivist

UNIT - IV Pedagogical concerns in teaching of Mathematics for higher order thinking skills

- a. Critical, creative, decision making, reflective, collaborative, and cooperative
- b. Learner-centric and participative methods of teaching of Mathematics: lecture cum demonstration, problem-solving, laboratory, project based.
- c. Techniques of teaching learning Mathematics: oral, written, drill work, homework, self study, group study, supervised study,
- d. Concept-mapping, learning,
- e. Art and sports integrated learning.

UNIT - V Learner-centric, participative and analytical pedagogical concerns of teaching of Mathematics

- a.** Lecture cum demonstration, problem-solving,
- b.** Laboratory, project based.
- c.** Critical, creative,
- d.** Decision making, reflective,
- e.** Collaborative, and cooperative

Suggestive Practicum (Any Three)

- 1.** Prepare a collage/ biographic sketch on the contribution of Indian mathematician.
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- 3.** Formulate objectives based on learning outcomes and experiential learning for any one unit of secondary Mathematics.
- 4.** Develop strategy to connect any three topics for value inculcation in teaching of Mathematics.
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B.Sc. B.Ed. (Integrated) Four Years Programme
Semester-IV
Paper Code: AVEC VIII. Title of the Paper: Environmental Studies

Students required to do Self Study and at the end of semester there will be Internal Examination

Learning Outcomes

- a. To understand Importance of biodiversity and its conservation
- b. To study different types of pollutions, their effects and control measures.
- 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 Biodiversity and its conservation

- a. Introduction- Definition: genetic, species and ecosystem diversity
- b. Bio-geographical classification of India, India as a mega- diversity nation, Western Ghat as a biodiversity region, hot-spots of biodiversity
- c. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values
- d. Endangered and endemic species of India, Threats to biodiversity: habitat loss, poaching of wildlife, man- wildlife conflicts
- e. Conservation of biodiversity: In- situ and Ex- situ conservation of biodiversity, Convention on Biological Diversity
- f. Environmental Movements- Chipko movement, Appiko Movement, Silent valley, Save

UNIT: II Environmental Pollution

- a. Definition: Causes, effects and control measures of: Air pollution, Water pollution, Soil, 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. Disaster Management: Floods, earthquake, cyclone Tsunami and landslides. Wasteland reclamation
- e. Role of an individual in prevention of pollution.

UNIT: III Environment Protection -Policies and Practices

- 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
- h. Environment ethics: Role of Indian religious traditions and culture in conservation of environment

SESSIONAL WORK:

Field visits to local ecological sites and report writing and Submission of it. (25 Marks)

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 Western Ltd.

Down to Earth, Centre for Science 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. House, Delhi 284p.

Mickinney, M.L.& School. R.M. 1996, Environmental Science Systems & Solutions, Web enhanced edition, 639p.

Mhaskar A.K., Master 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. House, Meerut

Survey of the Environment, The Hindu (M)

Trivedi R.K. Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, vol. I and II, Environmental Media (R)

Trivedi R.K. and P.K. Gokel, Introduction to air pollution, Techno-Science Publications (TB)

Wagner K.D., 1998, Environmental management, W.B. Saunders Co. Philadelphia, USA 499p.