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416 004, MAHARASHTRA
PHONE : EPABX – 2609000, BOS Section – 0231-2609094, 2609487
Web : www.unishivaji.ac.in Email: bos@unishivaji.ac.in
शिवाजी विद्यापीठ, कोल्हापूर, ४१६ ००४, महाराष्ट्र
दूरध्वनी - इपीबीएक्स - २०६०९०००, अभ्यासमंडळे विभाग : ०२३१- २६०९०९४. २६०९४८७
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संदर्भ / जा.क्र. / शिवाजी वि. / अ.मं. / 377 दि. १५ / ०९ / २०२६

प्रति,

अधिविभाग प्रमुख,
शिक्षणशास्त्र अधिविभाग.,
शिवाजी 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.
संदर्भ : या कार्यालयाचे पत्र क्र. 590 दि. 25 / 09 / 2025 रोजीचे पत्र.
संदर्भ : या कार्यालयाचे पत्र क्र. 132 दि. 04 / 05 / 2026 रोजीचे पत्र.

महोदय,

उपरोक्त संदर्भिय 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 खालीलप्रमाणे **किरकोळ दुरूस्ती** करण्यात आलेली आहेत.

Old Paper	New Paper
B. Sc. B.Ed. Part II (Sem- IV)	
Stage Speeific Content Cum Pedagogy Courses –II (Physical Sciences)	SSCCI- Content Cum Pedagogy of Mathematics at Sceondary Stage Courses-II

सोबत दुरूस्तीसह अभ्यासक्रमाची प्रत जोडली आहे. तसेच विद्यापीठाच्या www.unishivaji.ac.in.(NEP 2020@suk/Online Syllabus) या संकेतस्थळावर ठेवण्यात आली आहे.

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

कळावे,

आपला विश्वासू ,

उपकुलसचिव
अभ्यास मंडळे विभाग

सोबत : अभ्यासक्रमाची प्रत.

प्रत. माहितीसाठी व पुढील योग्य त्या 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 मुल्यमापन 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		

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संदर्भ / जा.क्र. / शिवाजी वि. / अ.मं. / १३२

दि. ०४ / ०५ / २०२६

प्रति,
अधिविभाग प्रमुख,
शिक्षणशास्त्र अधिविभाग.,
शिवाजी विद्यापीठ, कोल्हापूर.

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

संदर्भ : या कार्यालयाचे पत्र क्र. 590 दि. 25 / 09 / 2025 रोजीचे पत्र.

महोदय,

उपरोक्त संदर्भिय 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 दुरूस्ती** करण्यात आलेली आहेत.

सोबत सदर अभ्यासक्रमाची प्रत जोडली आहे. तसेच विद्यापीठाच्या www.unishivaji.ac.in.(NEP 2020@suk/Online Syllabus) या संकेतस्थळावर ठेवण्यात आला आहे.

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

कळावे,

आपला विश्वासू ,

उपकुलसचिव
अभ्यास मंडळे विभाग

सोबत : अभ्यासक्रमाची प्रत.

प्रत. माहितीसाठी व पुढील योग्य त्या कार्यवाहीसाठी.

1	अधिष्ठाता, आंतर विद्याशाखीय अभ्यास विद्याशाखा	7	संलग्नता टी. 1 व टी. 2 विभागास
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4	इतर परीक्षा 02, विभागास	10	पी. जी. सेमिनार विभागास
5	पात्रता विभागास	11	नॅक विभागास
6	आय. टी. सेल विभागास		

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संदर्भ/जा.क./शिवाजी वि./अ.मं./५९०

दि. २५/०९/२०२५

प्रति,
मा. अधिविभाग प्रमुख,
शिक्षणशास्त्र अधिविभाग.,
शिवाजी 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 संदर्भिय 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 दुरूस्ती करण्यात आलेली आहेत.

सोबत सदर अभ्यासक्रमाची प्रत जोडली आहे. तसेच विद्यापीठाच्या www.unishivaji.ac.in.(NEP 2020@suk/Online Syllabus) या संकेतस्थळावर ठेवण्यात आला आहे.

सदर अभ्यासक्रम सर्व संबधित 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
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6	आय. टी. सेल विभागास		

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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		



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SHIVAJI UNIVERSITY, KOLHAPUR

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

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

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

Secondary Stage Specialization

(9^{th} to 12^{th} 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)

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SHIVAJI UNIVERSITY, KOLHAPUR

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

Executive Summary of the Programme

National Council for Teacher Education (NCTE) has launched Integrated Teacher Education Programme (ITEP), which its flagship programme of NCTE under NEP-2020.

As per the NEP 2020 there are four stages in new school structure i.e. Foundational Preparatory, Middle and Secondary (5+3+3+4). Therefore B.Sc. B.Ed. is a Four-year dual-major holistic undergraduate degree programme is introduced for the students who choose teaching as a profession after Secondary school level, by choice. This integrated course will be benefit students since they will save one year by completing the course in 4 year rather than the customary 5 years required by the present B.Ed. programme.

This course will not only impart cutting – edge pedagogy but will also establish, a foundation in Early Childhood Care and Education (ECCE), Foundational literacy and Numeracy (FLN), Inclusive education and an understanding of India and its values /ethos/art/tradition among others. The course contributes substantially to the whole Teacher education sector. The irrespective teachers passing out of this course through a multi-disciplinary environment, grounded Indian values and traditions will be instilled with the needs at 21st century global standards hence, will be harbingers in shaping the future of new India. This programme will be four academic years with 8 semesters and students have to complete the programme with all 8 semesters. However as per the ITEP Multiple entry and Exit points and reentry options with appropriate certifications are available for this programme. As shown in Table No.1. as per NCTE and Government of Maharashtra's Notification:

Table No. 1. As per NCTE B.Sc. B.Ed. (ITEP) Multiple Entry and Exit Points:

Sr. No.	Duration	Description	Certification received by Students
1	After completion of 1 year (2 semesters)	Award of UG certificate with 60 credits	**Under Graduate Certificate in** Science
2	After completion of 2 years (4 semesters)	Award of UG diploma with 104 credits	**Under Graduate Diploma in** Physics/Chemistry/Mathematics
3	After completion of 3 years (6 semesters)	Award of UG Bachelor Degree in Major with 162 credits	**B.Sc. Degree** (Physics/Chemistry/Mathematics)
4	After completion of 4 years (8 semesters)	Dual-major Bachelor's Degree with 204 credits	**B.Sc.-B.Ed. Dual Major Holistic Bachelor Degree in Education and Science** (Physics/Chemistry/Mathematics)

Programme Need:

This is flagship programme under the NEP 2020 and according to its recommendations all Teacher Education programs will be covered into Integrated Teacher programmers by 2030.

Student Demand for Programme:

In present situation the students spend 5 years to complete B.Ed. programme after completing under-graduations. So if they enroll for this B.Sc. B.Ed. programme after 12th Standard they will save one year and get dual Major Holistic Bachelor's Degree in Education & Science.

Institutional Capacity: 50 students

Eligibility/Entry Requirements:

1. Successful completion of Science Grade 12 (or equivalent stage of education such as Pre- University, Intermediate etc.) with a minimum of 50% marks in aggregate or an equivalent grade from a recognized Board / University.
2. Students also have to appear and able to eligible in National Level Entrance Test, which is conducted by National Testing Agency (NTA).

Programme Characteristics:

B.Sc. B.Ed. Integrated Four Years Programme aims at integrating general studies comprising Science subject, professional studies, foundations of education, pedagogy of school subject and practicum related to the task and functions of school teacher. It maintains a balance between theory and practice and coherence and integration among the components of the programme, representing a wide knowledge base of a Secondary school teacher. The programme aim at preparing teachers for secondary stages of education. On successful completion of the four-year integrated B.Sc. B.Ed. programme, student teachers will be able to develop:

1. Teaching Competency: Know, select and use of learner centered teaching methods, understanding of paradigm shift in conceptualizing disciplinary knowledge in school curriculum, necessary competencies for organizing learning experiences.

2. Pedagogical Skills: Applying teaching skills and dealing with classroom select and use of appropriate assessment strategies for facilitating learning problems.

3. Teaching through Nonconventional Modes: Evolving a system of education which enhances the potential of every learner to acquire, retain and transform knowledge leading to wisdom society through creative, experiential and joyful modes of learning.

4. Integration of Artificial Intelligence in Education: Transform the educational landscape by providing open access to quality, value based and socially relevant education to all by harnessing the disruptive potential of Artificial Intelligence.

5. Critical Thinking: Analysis of Curriculum, selecting appropriate teaching strategies according to needs of students and enhancing their critical thinking.

6. Effective Communication: Presenting seminar before peer students and teachers and practicing communication skills through various linguistic activities and applying it for better classroom communication.

7. Sensitivity Towards Inclusion: Identifying the diversities and dealing it in inclusive classrooms environment, guidance and counseling programmes for disabled students.

8. Content Analysis: Analyze the text-books and syllabus.

9. Effective Citizen Ethics: Understand different values, morality, and social service and accept responsibility for the society.

10. Self-directed Learning: Preparing scripts for seminars, lesson plans and with the help of synchronous and asynchronous learning.

11. Social Resilience: Understand about social entities and enable to tolerate absorb, cope up with adverse conditions of life.

12. Physical Development: Practice yoga, self-defense, sports and scouting-guiding.

13. Team Work: Enable to work as a member or leader in diverse teams and in multi-disciplinary settings by following the principles of collaborative learning, cooperative learning and team teaching.

Program Goals and Assessment:

The four year integrated Teacher Education Programme (ITEP) is offered after Secondary level and aims at preparing committed, responsible and professional teachers through Continuous and Comprehensive evaluations.

Vision Statement

To develop professionally competent, ethically grounded, and technologically skilled science educators committed to fostering inclusive and sustainable education for all learners.

Mission Statement

- To provide comprehensive knowledge of learner development, pedagogy, and curriculum practices.
- To prepare teachers with strong scientific understanding and pedagogical skills.
- To equip student-teachers with modern ICT tools and inclusive teaching strategies.
- To instill professional ethics, social responsibility, and environmental consciousness.
- To empower educators to contribute meaningfully to national educational goals and global citizenship.

Programme Educational Objectives (PEOs)

PEO1: Holistic Understanding of Education Systems

Graduates will demonstrate a comprehensive understanding of physical, cognitive, social, and emotional development of learners, and apply this understanding to address contemporary educational issues, analyze educational policies, implement effective teaching-learning strategies, and uphold professional ethics through active school internships and field engagement.

PEO2: Catering to Individual Differences and Educational Assessment

Graduates will be equipped to recognize and address individual differences among students by effectively utilizing psychological tools, ICT-based resources, and evaluative techniques to enhance learning, support guidance services, and plan inclusive and effective lessons.

PEO3: Real-World Teaching Proficiency and ICT Integration

Graduates will acquire practical experience in both traditional and online teaching environments, especially focusing on remote and underserved areas, by employing modern ICT tools and software, thereby ensuring effective and innovative pedagogy in diverse educational contexts.

PEO4: Inclusive and Value-Based Education

Graduates will develop the competencies needed to manage diverse and inclusive classrooms, promote education for human rights, environmental sustainability, and women empowerment, and design meaningful online learning content to meet the needs of all learners.

PEO5: Mastery in Subject-Specific Pedagogy (Science Education) Graduates will deepen their subject-specific knowledge, particularly in science education, and apply discipline-based pedagogical skills to effectively teach and assess secondary school learners in alignment with contemporary curriculum standards and scientific inquiry.

Programme Specific Outcomes:

PSO1: Enable to comprehend the development in physical, cognitive, social and emotional areas, contemporary issues and educational policies of education system in India, teaching-learning methods, strategies, epistemological basis of education, school management, professional ethics and observation of school activities by school internship.

PSO2: Understand the individual differences among students, measuring the programmes and administering Psychological tools, ICT based communication attainment, evaluating progress, and assessing learning abilities, guidance and teaching and lesson planning.

PSO3: Practice teaching in Schools, inculcate the real experiences of classroom teaching and online teaching for remote areas students by using ICT and its different tools and software.

PSO4: Understand the classroom diversities and enable them to deal with diverse learners in inclusive classroom setup, education for human rights and women empowerment, environmental education and developing online content.

PSO5: Enhance discipline specific knowledge of students specifically required for science teachers while teaching at secondary school stages.

Student Preparation:

Student teachers will learn key concepts and principles of education related to different aspects of pedagogical knowledge of secondary school teachers which are necessary for effective teaching and reflective practices in schools.

Semester System: The Stage-Specific ITEP will be organised on the semester pattern with two semesters in an academic year. Each semester will consist of 15 -16 weeks of teaching learning activities, excluding end-semester examinations. A semester will consist of a minimum 96 working days, excluding end-semester examination days. Each working week will have a minimum of 40 hours of instructional/contact time.

Regulations:

R.1 Admission

R.1.1 Admission to B.Sc. B.Ed. (Integrated) four year's programs at Shivaji University, Kolhapur, based on guidelines periodically provided by the Government of India's Ministry of Education (MoE). According to guidelines from the MoE, GoI, the number of seats in each Major Subject for the B.Sc.B.Ed program will be determined. Seats for different categories will be reserved in accordance with MoE, GoI guidelines as they become available.

R.1.2 The requirements set forth by the admission authority, which is periodically assigned by the MoE, GoI, must be met in order to be eligible for admission.

R.1.3 The chosen applicants cannot be admitted to the B.Sc. B.Ed. program unless they have fulfilled all entrance requirements set forth by Shivaji University, Kolhapur, and have paid the necessary fees.

R.1.4 In all cases pertaining to admission to the B.Sc.B.Ed. Program, the University will make the final decision as per the MoE and GOI rules.

R.1.5 Even after a candidate has been admitted, the Head of the Department of Education at Shivaji

University may cancel the candidate's admission and report the incident to the appropriate authorities if it is discovered that the candidate has not met any of the requirements set forth by the University or any other body or organization that the MoE/the Institute has entrusted with the admission process.

R.1.6 Shivaji University sets its own fees based on periodic orders from the Ministry of Education, Government of India.

R.1.7 At the time of admission, the student must select the Dual-Major subjects for the B.Sc. B.Ed. program from the available options in accordance with the eligibility requirements.

Registration and Enrollment

R.2.1 A student's selection of courses to be credited in the following semester in accordance with the applicable curriculum using the University's Admission Management System (AMS) within the time frame allotted by the Academic Section is referred to as registration. The act of physically reporting pupils to the admission committee on the day designated by the academic section just before to the start of the semester is known as enrollment.

R. 2.2 A B.Sc.B.Ed. student may register a maximum of the regular credits for that semester, as specified by the applicable curriculum, excluding the eighth semester. However, students may overload one subject in addition to the customary credit for the semester if they are repeating failed courses or crediting dropped courses together with regular courses.

R.2.3 According to R.10, a student who receives a W/F for a core course is required to retake it. According to R.10, a student who receives a W/F in an elective course may choose to retake the course or, with the HoD's recommendation, enroll in a different elective.

R.2.4 Subject to the maximum number of courses allowed in R.5.2, registration for higher-semester courses is only allowed after registering for all pending core courses from lower semesters that are being offered at the moment.

R.2.5 Registration for courses in a higher semester is only allowed until all outstanding core courses from lower semesters that are currently being offered have been completed, up to the maximum number of courses allowed under R.5.2.

R.2.6 A student shall be eligible for registration and enrolment only if the minimum requirement to continue the programme as per regulation R.3 is satisfied cleared all the dues in the department, hostel, and library up to the end of the previous semester not debarred from enrolment by disciplinary action of the University completed the course feedback on the courses registered in the previous semester, as notified by the Academic Section paid all the tuition fees and all other relevant fees, if any, prescribed by the University.

R.2.7 If it is discovered that any of the requirements in R.2.6 were broken at the time of registration, the Institute retains the right to cancel the student's registration for a semester that follows, barring the case where the initial registration was made with the express consent required by University regulations.

R. 3 Minimum Requirement to Continue the Programme

R.3.1 A student admitted to B.Sc.B.Ed. programme in the first semester can continue up to the 8th semester, in ascending order, subject to the following conditions:
Successfully maintained registration for all the semesters.

Registration to the fourth-level courses shall be permitted only after successfully completing all courses up to and including the second-level courses.

R.4 Maximum Duration for Completion of the Programme

The B.Sc.B.Ed. Curriculum typically lasts eight semesters, or four years. A student may, nonetheless, take longer to finish the program at a slower pace; however, this should not exceed sixteen semesters (eight years), without including withdrawn semesters (temporary discontinuance per R.5 for medical reasons). However, in order to avoid the processes associated with registration cancellation, students must satisfy R.3.

R.5 Temporary Discontinuation

5.1 On the permission of the HoD, a student may be allowed to temporarily withdraw from the program for a maximum of two semesters due to illness or other medical conditions. When a student takes a leave from school due to illness, they must provide the required medical records and certifications from the treating physician, along with a clear justification for the break's duration. The Institute's Medical Officer should properly endorse the medical certificate. A fitness certificate from the student's treating physician, endorsed by the Institute's Medical Officer, is required before the student can return. Only two of these brief stops will be permitted for the duration of the event.

5.2 When a student is permitted to resume the program after the period of discontinuation, they must register for the approved equivalent courses (meeting the credits) as per the curriculum/syllabi, following the HoD's advice in the event that the curriculum or syllabus changes during the period of discontinuation.

5.3 In order to keep their program registration active until they resume their regular academic activities, students who are requesting a temporary cessation must pay the appropriate fees. The costs for regular students must be paid after they re-enroll following a brief break.

R. 6 Attendance and Leave

R.6.1 It is expected of students to attend every session of the courses for which they have signed up. As per the usual policy of the Institute, students who have completed 90% of their practicum and at least 80% of their classes are qualified to write the end-semester examinations for any course. The HoD may, however, set the attendance requirement for their courses in a way that does not go above the 80% threshold for theory. Students will be informed of the course's attendance rules during the first class. It needs to be submitted later and approved at the initial meeting. If a student cannot attend classes due to medical issues or other compelling reasons, a leave application as detailed below, must be submitted to the HoD. Application for any leave shall be submitted within five instructional days after returning from leave or on or before the last instructional day of the semester, whichever is earlier. Application for leave on medical grounds must be supported with necessary treatment records for the period of leave applied for. The student is expected to inform the course faculty before proceeding on medical leave under normal circumstances.

R.6.2 A student is not entitled to appear for the end-semester test for a course in which their attendance for any registered course throughout a semester falls below 80% or the limit set by the HoD, unless the absence is excused in accordance with the regulations. With the exception of first

semester students, the percentage of attendance will be determined by counting the number of classes held starting on the day the semester officially began, in accordance with the academic calendar. For first-semester students, the count begins on the date of the student's admittance to the department or the first day of classes, whichever comes first.

R.6.3 On or before the last day of instruction, students whose attendance falls below 80% or the cap set by the course faculty for any course registered in a semester must notify their instructor of the attendance shortfall.

R.6.4 Students who register for any course in a semester and have attendance below 80% or the cap set by the course faculty may be eligible to have their lack of attendance excused and therefore take the course exam at the end of the semester, provided they meet the requirements below. The attendance in that semester for the course concerned, without applying any condonation, is not less than 50% of the total classes handled for that course.
Attendance after applying for a medical exemption, which is greater than 80% of the cap set by the relevant authorities, and for co-curricular and extracurricular activities, which is based on permission from the appropriate authorities (maximum limit: 10% of classes taught by the course faculty).

R.6.5 Should a course have a set attendance requirement, all requests for the HoD to be consulted regarding the excused absences must be made. Before the date of the course's end-of-semester exam, the HoD will review these requests and any accompanying documentation and determine whether or not the absence is excused. Students may file an application with the university's Grievance Committee if they have a grievance against a decision.

R.6.6 Duty leave for on-the-job training placement activities is available to students who have enrolled in the University's Center for Career Development (CCD) for internship or placement-related activities, subject to the actual absence from class for these activities, for a maximum of ten days per semester. To validate the claims made by the pupils, CCD will furnish the relevant departments and schools with the attendance statistics on a day-by-day and company-by-company basis.

7. Examination

Semester Examination has following nature of Question paper and Practicum

<table>
<tr><th>Exam</th><th>Nature</th><th>Marks</th></tr>
<tr><td rowspan="2">Theory Exam</td><td>Theory Exam 50 Marks Course</td><td>(40+10 (Internal) = 50 Marks)</td></tr>
<tr><td>Theory Exam 100 Marks Course</td><td>(80+20 (Internal) = 100 Marks)</td></tr>
<tr><td rowspan="6">Practical Exam</td><td rowspan="2">I Year : Practical Exam
(Three Practical= 03+03+03 hrs = 09hrs)</td><td>Sem-I (50+50+50 = 150 Marks)</td></tr>
<tr><td>Sem-II (50+50 +50= 150 Marks)</td></tr>
<tr><td rowspan="2">II Year : Practical Exam
(Three Practical = 03+03+03 hrs = 09 hrs)</td><td>Sem-III (50+50+50) = 150 Marks)</td></tr>
<tr><td>Sem-IV (50+50+50) = 150 Marks)</td></tr>
<tr><td rowspan="2">III Year : Practical Exam
(Two Practical=06+03 hrs = 09hrs)</td><td>Sem-V (100+50 = 150 Marks)</td></tr>
<tr><td>Sem-VI (100+50 = 150 Marks)</td></tr>
</table>

Nature of Question Paper
Education (Major Subject)
For External Theory (40 Marks) Examination

Theory	**40**
Internal Exam/ Assignment	**10**
Total	**50**

Q.1) Fill in the blanks by selecting correct alternative - (Multiple Choice) (4 Marks)

1)

2)

3)

4)

Q.2) Short Question (4 Marks)

1) (2 Marks)

2) (2 Marks)

Q.3) Attempt two out of three (8 Marks)

1) (4 Marks)

2) (4 Marks)

3) (4 Marks)

Q.4) Attempt three out of four (24 Marks)

1. (8 Marks)

2. (8 Marks)

3. (8 Marks)

4. (8 Marks)

Nature of Question Paper
Education (Major Subject)
For External Theory (80 Marks) Examination

Theory	**80**
Internal Exam/ Assignment	**20**
Total	**100**

Q.1 Fill in the blanks by selecting correct alternative - (Multiple Choice) (8 Marks)

1)

2)

3)

4)

5)

6)

7)

8)

Q.2 Short Question (8 Marks)

1) (2 Marks)

2) (2 Marks)

3) (2 Marks)

4) (2 Marks)

Q.3 Attempt two out of three (16 Marks)

1) (8 Marks)

2) (8 Marks)

3) (8 Marks)

Q. 4 Attempt three out of four (48 Marks)

1) (16 Marks)

2) (16 Marks)

3) (16 Marks)

4) (16 Marks)

Nature of Science
Question Paper
For External Theory (40 Marks) Examination

Theory	**40**
Internal Exam/ Assignment	**10**
Total	**50**

Q.1) Fill in the blanks by selecting correct alternative - (Multiple Choice) (4 Marks)

1)

2)

3)

4)

Q.2) Short Question (4 Marks)

1) (2 Marks)

2) (2 Marks)

Q.3) Attempt two out of three (8 Marks)

1) (4 Marks)

2) (4 Marks)

3) (4 Marks)

Q.4) Attempt three out of four (24 Marks)

1) (8 Marks)

2) (8 Marks)

3) (8 Marks)

4) (8 Marks)

Nature of Practical Examination Total Marks: 50 Scheme of Practical Examination for B. Sc. B.Ed. (ITEP)
Part –I 1. Practical examination will be conducted semester wise.
2. Practical examination will be conducted for one day per batch.
3. The examination will be conducted in two sessions per day and each session will be of three hours duration.
4. Every candidate should perform one experiment each from Group I and Group II.
5. In only critical medical conditions eighty percent practical should be completed by the student.
6. **The marks distribution for practical is as below**

Practical groups	**Marks**
Group- I	20
Group- II	20
Certified laboratory journal-	10
Total Marks-	**50**

For the Self-Study (SS) courses are given only grades and not marks. The marks of these courses are converted as follows:

Marks	Grade
46-50	O (Outstanding)
41-45	A+ (Excellent)
37-40	A (Very Good)
33-36	B+ (Good)
29-32	B (Above average)
25-28	C (Average)
21-24	P (Pass)

Method of Grading

8.1 Based on the each semester performance, every student will be awarded a final letter grade for each course, where the letter grades will correspond to the grade points as shown below.

Aggregate of Total marks	Letter Grade	Grade points
75-100	O (Outstanding)	10
60-74	A + (Excellent)	9
55-59	A (Very Good)	8
50-54	B+ (Good)	7
44-49	B (Above Average)	6
40-44	C (Average)	5
35-40	P (Pass)	4
below of 80% in Theory 90% Practicum	W (Insufficient attendance)	0
Not Submitted Practicum or Give Theory Paper	I (Incomplete assessment)	0

A student is said to have credited a course or earned credits in respect of a course when a grade other than F, W, or I is secured for that course.

R. 9 Grade Point Average

R. 9.1 The performance of a student in a semester is indicated by the Semester Grade Point Average (SGPA), which is given as

$$SGPA = \frac{\Sigma(C*GP)}{\Sigma C}$$

where C is the number of credits for a course, GP is the grade point scored by the student for that course, and the summation is for all courses registered by the student in the relevant semester.

R.9.2 The performance of a student up to and including a particular semester is indicated by the Cumulative Grade Point Average (CGPA), which is given as

$$CGPA = \frac{\Sigma(C*GP)}{\Sigma C}$$

where C is the number of credits for a course, GP is the grade point scored by the student for that course, and the summation is for all courses registered by the student up to and including the relevant semester.

R.9.3 The CGPA is not convertible to a percentage. However, notionally, the CGPA may be multiplied by a factor of 10 to obtain a numerical percentage.

R. 10 Class/Division

R.10.1 At the end of the programme, the Class/ Division awarded by the Institute shall be based on CGPA as follows.

First Class with Distinction: CGPA≥7.5
First Class: 7.5> CGPA ≥ 6 and
Second Class: 6 > CGPA ≥ 5

R. 11 Transfer of Credits

R.11.1 Within the broad framework of these regulations, university authorities may permit students to earn part of the credit requirements in other approved institutes of repute and status in the country or abroad. The appropriate credit mapping in the above cases will be done based on the recommendations from authorities.

R. 12 Eligibility for the Award of B.Sc./B.Sc. B.Ed. Degree

A student becomes eligible for the award of the B.Sc./B.Sc. B.Ed. Degree when

(i) credited all the courses in the respective levels as per the curriculum within the stipulated time
(ii) acquired the Major-wise minimum credits in the relevant B.Sc. B.Ed. curriculum
(iii) no dues to any Departments/Sections of the University, including hostels
(iv) no disciplinary action is pending

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Structure of Semester-III							
Component	**Code**	**Title**		**Marks**	**Credits**	**Total Hours**	**Hours Per Week**
Foundations of Education	F-II	**Child Development & Educational Psychology**		100 (T80 + P20)	04	60	06
Disciplinary / Inter-disciplinary Courses	D-III	Major (Physics)	DSC III (2): Physics -V: Thermal Physics	50 (T40 + I 10)	02	30	02
			DSC III (2): Physics -VI: Waves and Optics	50 (T40 + I 10)	02	30	02
			DSC P III (2): Physics Practical-III	50	02	60	04
		Minor (Physics)	DSC III (2): Physics -V: Thermodynamics	50 (T40 + I 10)	02	30	02
			DSC III (2): Physics -VI: Applications of Physics	50 (T40 + I 10)	02	30	02
			DSC P III (2): Physics Practical-III	50	02	60	04
		Major (Chemistry)	DSC III (2): Chemistry -V: Physical Chemistry	50 (T40 + I 10)	02	30	02
			DSC III (2): Chemistry -VI: Analytical Chemistry	50 (T40 + I 10)	02	30	02
			DSC P III (2): Chemistry Practical-III	50	02	60	04
		Minor (Chemistry)	DSC III (2): Chemistry -V: Applied Physical Chemistry	50 (T40 + I 10)	02	30	02
			DSC III (2): Chemistry -VI: Applied Analytical Chemistry	50 (T40 + I 10)	02	30	02
			DSC P III (2): Chemistry Practical-III	50	02	60	04
		Major (Mathematics)	DSC III (2): Mathematics -V: Differential Equations-II	50 (T40 + I 10)	02	30	02
			DSC III (2): Mathematics -VI: Numerical Methods	50 (T40 + I 10)	02	30	02
			DSC P III (2): Mathematics Practical-III	50	02	60	04
		Minor (Mathematics)	DSC III (2): Mathematics -V: Computational Mathematics for Sciences-I	50 (T40 + I 10)	02	30	02
			DSC III (2): Mathematics -VI: Improper Integrals and Special Functions	50 (T40 + I 10)	02	30	02
			DSC P III (2): Mathematics Practical-III	50	02	60	04
Skill Enhancement Courses (SEC)	**(Major) SEC-I**	(Major) SEC-I P-I (2): Physics -I : Physics Laboratory Techniques-I		50	02	60	04
		(Major) SEC-I P-I (2): Chemistry -I: Chemistry Laboratory Techniques-I		50	02	60	04
		(Major) SEC-I P-I (2): Mathematics -I: Mathematics Typesetting using LaTeX - I		50	02	60	04
Stage-Specific Content-cum-Pedagogy	**SSCCP-I**	**Stage-Specific Content- cum- Pedagogy Courses-I : Basics of Pedagogy at Secondary stage**		100 (T 80 + P 20)	04	60	06
Self-Study	SS-III	Environmental Studies-I		Student required to qualify the internal exam.			
Total =				550	22	420	32

■ University may decide to offer maximum of three subjects (Courses) in the first year. The student may select one subject out of combination of three subjects (Courses), (which a student has chosen in the first year) as a **MAJOR** subject (Course) and one subject (Course) as **MINOR** Subject in the second year. Thereby it is inferred that the remaining third subject (Course) shall stand discontinued.

Structure of Semester-IV							
Component	**Code**	**Title**		**Marks**	**Credits**	**Total Hours**	**Hours Per Week**
Foundations of Education	F-III	**Philosophical & Sociological Perspectives of Education-I**		100 (T 80 + P 20)	04	60	06
Disciplinary / Inter-disciplinary Courses	D-IV	Major (Physics)	DSC IV (2) : Physics -VII: Modern Physics	50 (T40 + I 10)	02	30	02
			DSC IV (2) : Physics -VIII: Analog & Digital Electronics	50 (T40 + I 10)	02	30	02
			DSC P IV (2): Physics Practical-IV	50	02	60	04
		Minor (Physics)	DSC IV (2) : Physics -VII: Semiconductor Physics	50 (T40 + I 10)	02	30	02
			DSC IV (2) : Physics -VIII: Astronomy & Astrophysics	50 (T40 + I 10)	02	30	02
			DSC P IV (2): Physics Practical-IV	50	02	60	04
		Major (Chemistry)	DSC IV (2) : Chemistry -VII: Inorganic Chemistry	50 (T40 + I 10)	02	30	02
			DSC IV (2) : Chemistry -VIII: Organic Chemistry	50 (T40 + I 10)	02	30	02
			DSC P IV (2): Chemistry Practical-IV	50	02	60	04
		Minor (Chemistry)	DSC IV (2) : Chemistry -VII: Fundamentals of Inorganic Chemistry	50 (T40 + I 10)	02	30	02
			DSC IV (2) : Chemistry -VIII: Applied Organic Chemistry	50 (T40 + I 10)	02	30	02
			DSC P IV (2): Chemistry Practical-IV	50	02	60	04
		Major (Mathematics)	DSC IV (2) : Mathematics -VII: Differential Calculus	50 (T40 + I 10)	02	30	02
			DSC IV (2) : Mathematics -VIII: Integral Calculus	50 (T40 + I 10)	02	30	02
			DSC P IV (2): Mathematics Practical-IV	50	02	60	04
		Minor (Mathematics)	DSC IV (2) : Mathematics -VII: Computational Mathematics for Sciences-II	50 (T40 + I 10)	02	30	02
			DSC IV (2) : Mathematics -VIII: Laplace Transform	50 (T40 + I 10)	02	30	02
			DSC P IV (2): Mathematics Practical-IV	50	02	60	04
Skill Enhancement Courses (SEC)	**(Major) SEC-II**	(Major) SEC-II : Physics : Community Engagement Programme CEP (2)		50	02	60	04
		(Major) SEC-II : Chemistry : Community Engagement Programme CEP (2)		50	02	60	04
		(Major) SEC-II : Mathematics : Community Engagement Programme CEP (2)		50	02	60	04
Stage Specific Content- cum-Pedagogy	**SSCCP-II**	**Stage-Specific Content- cum- Pedagogy Courses-II : Content cum Pedagogy of Mathematics at Secondary Stage**		100 (T 80 + P 20)	04	60	06
Self-Study	SS-IV	Environmental Studies-II		Student required to qualify the internal exam.			
Total =				550	22	420	32

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

Note:

- University may decide to offer maximum of three subjects (Courses) in the first year. The student may select one subject out of combination of three subjects (Courses), (which a student has chosen in the first year) as a **MAJOR** subject (Course) and one subject (Course) as **MINOR** Subject in the second year. Thereby it is inferred that the remaining third subject (Course) shall stand discontinued.
- DSC: Discipline Specific Course
- MAJOR: Mandatory/Elective
- MINOR: Course may be from different disciplines of same faculty of DSC Major
- OE(Open Elective): Elective courses/Open Elective to be chosen compulsorily from faculty other than that of the Major.
- VSC/SEC: Vocational Skill Courses (MAJOR related)/Skill Enhancement Courses
- AEC/ VEC / IKS: Ability Enhancement Courses (English, Modern Indian Language)/Value Education Courses/ Indian Knowledge System (Generic & Specific))
- OJT/FP/RP/CEP/CC: On-Job Training (Internship/Apprenticeship) / Field Project (Major related)/ Research Projects (Major related) Community Engagement (Major related)/ Co-Curricular courses(CC) such as Health& Wellness, Yoga Education, Sport, and Fitness, Cultural activities, NSS/NCC and Fine /applied/visual/performing Arts / Vivek Vahini etc

Structure of Semester-III							
Component	**Code**	**Title**		**Marks**	**Credits**	**Total Hours**	**Hours Per Week**
Foundations of Education	F-II	**Child Development & Educational Psychology**		100 (T80 + P20)	04	60	06
Disciplinary / Inter-disciplinary Courses	D-III	Major (Physics)	DSC III (2): Physics -V: Thermal Physics	50 (T40 + I 10)	02	30	02
			DSC III (2): Physics -VI: Waves and Optics	50 (T40 + I 10)	02	30	02
			DSC P III (2): Physics Practical-III	50	02	60	04
		Minor (Physics)	DSC III (2): Physics -V: Thermodynamics	50 (T40 + I 10)	02	30	02
			DSC III (2): Physics -VI: Applications of Physics	50 (T40 + I 10)	02	30	02
			DSC P III (2): Physics Practical-III	50	02	60	04
		Major (Chemistry)	DSC III (2): Chemistry -V: Physical Chemistry	50 (T40 + I 10)	02	30	02
			DSC III (2): Chemistry -VI: Analytical Chemistry	50 (T40 + I 10)	02	30	02
			DSC P III (2): Chemistry Practical-III	50	02	60	04
		Minor (Chemistry)	DSC III (2): Chemistry -V: Applied Physical Chemistry	50 (T40 + I 10)	02	30	02
			DSC III (2): Chemistry -VI: Applied Analytical Chemistry	50 (T40 + I 10)	02	30	02
			DSC P III (2): Chemistry Practical-III	50	02	60	04
		Major (Mathematics)	DSC III (2): Mathematics -V: Differential Equations-II	50 (T40 + I 10)	02	30	02
			DSC III (2): Mathematics -VI: Numerical Methods	50 (T40 + I 10)	02	30	02
			DSC P III (2): Mathematics Practical-III	50	02	60	04
		Minor (Mathematics)	DSC III (2): Mathematics -V: Computational Mathematics for Sciences-I	50 (T40 + I 10)	02	30	02
			DSC III (2): Mathematics -VI: Improper Integrals and Special Functions	50 (T40 + I 10)	02	30	02
			DSC P III (2): Mathematics Practical-III	50	02	60	04
Skill Enhancement Courses (SEC)	**(Major) SEC-I**	(Major) SEC-I P-I (2): Physics -I : Physics Laboratory Techniques-I		50	02	60	04
		(Major) SEC-I P-I (2): Chemistry -I: Chemistry Laboratory Techniques-I		50	02	60	04
		(Major) SEC-I P-I (2): Mathematics -I: Mathematics Typesetting using LaTeX - I		50	02	60	04
Stage-Specific Content-cum-Pedagogy	**SSCCP-I**	**Stage-Specific Content- cum- Pedagogy Courses-I : Basics of Pedagogy at Secondary stage**		100 (T 80 + P 20)	04	60	06
Self-Study	SS-III	Environmental Studies-I		Student required to qualify the internal exam.			
Total =				550	22	420	32

University may decide to offer maximum of three subjects (Courses) in the first year. The student may select one subject out of combination of three subjects (Courses), (which a student has chosen in the first year) as a **MAJOR** subject (Course) and one subject (Course) as **MINOR** Subject in the second year. Thereby it is inferred that the remaining third subject (Course) shall stand discontinued.

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

Paper Code: F-II,

Title of the Paper -Child Development and Educational Psychology

Marks	**100**	**Credits**	**04**
Total Hours	**60**	**Hours Per Week**	**06**
Internal Exam Marks	**20**	**External Exam Marks**	**80**
		Duration of External Examination	**03 Hours**

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

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

UNIT - I Child Development

a. Meaning and Concept of Child Development

b. Understanding the process of Child Development -Biological, cognitive, socio-emotional, and moral.

c. Developmental characteristics of a child during:

- Infancy stage • Early Childhood stage • Middle to Late Childhood stage • Adolescence stage

c. The Indian concept of self: Mind, Intellect, Memory. Panch-koshya Vikas.

d. 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 on 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. Meaninig 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

Paper Code: D-III

(Major) Physics Paper-V

Title of the Paper: Thermal Physics

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

- **Learning Outcomes:**

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

1. Student 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 $\mathbf{C_P - C_V}$ and $\mathbf{C_P / C_V}$ 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, (8^{th} Edn) McGraw Hill.
2. Thermal Physics – S Garg, R.Bansal and Ghosh, 2^{nd} 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

Paper Code: D-III

(Major) Physics Paper-VI

Title of the Paper: Waves and Optics

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

- **Learning Outcomes:**

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

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. Subrahnmanyam, 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

Paper Code: D-III
(Major) Physics Practical-III

Title of the Paper: PHYSICS 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**

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

Paper Code: D-III

(Minor) Physics Paper-V

Title of the Paper: Thermodynamics

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

- **Learning Outcomes:**

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

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), Seeback 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**

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
Paper Code: D-III
(Minor) Physics Paper-VI
Title of the Paper: Applications of Physics

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

- **Learning Outcomes:**

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

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

Paper Code: D-III
(Minor) Physics Practical-III

Physics Minor 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**

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 Programme

Semester-III

Paper Code: D-III
(Major) Chemistry Paper-V
Title of the Paper: Physical Chemistry

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

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 Programme Semester-III

Paper Code: D-III
(Major) Chemistry Paper-VI
Title of the Paper: Analytical Chemistry

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

Learning Outcomes

a. Learning and understanding of basic concepts in gravimetric analysis
b. Understanding, working and applications of optical methods as an analytical tool.
c. 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 Deriphat, 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 Programme Semester- III

Paper Code: D-III

(Major) Chemistry Practical-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 coductometrically.
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. 3^{rd} and 6^{th} 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 Programme Semester-III

Paper Code: D-III

(Minor) Chemistry Paper-V

Title of the Paper: Applied Physical Chemistry

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

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 Programme Semester-III

Paper Code: D-III

(Minor) Chemistry Paper-VI

Title of the Paper: Applied Analytical Chemistry

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

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 & amp; 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 Programme Semester- III

Paper Code: D-III

(Minor) Chemistry Practical-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 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 coductometrically.
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) 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 $KMnO_4$ 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 Programme Semester-III

Paper Code: D-III

(Major) Mathematics Paper-V

Title of the Paper: Differential Equations-II

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

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

CO1: 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: Equations of the first order but not of the first degree and Cauchy-Euler equations (15 Hrs.)

1. Introduction
2. Method I: Equations solvable for p
3. Method II: Equations solvable for x
4. Method III: Equations solvable for y
5. Method IV: Equations in Clairaut's form
6. Method V: Equations reducible to Clairaut's form
7. Examples based on 1.1.2 to 1.1.6

1.1 Homogeneous linear equations or Cauchy-Euler equations

1. Homogeneous linear equation (Cauchy-Euler equation)
2. Method of solution of homogeneous linear differential equations
3. Working rule for solving linear homogeneous differential equations
4. Equations reducible to homogeneous linear form (Legendre's linear equations)
5. Working rule for solving Legendre's linear equations

6. Examples based on 1 to 5.

Unit 2: Linear differential equations of second order (09 Hrs)

1. The general (standard) form of the linear differential equation of the second order.
2. Complete solution of $y'' + Py' + Qy = R$ in terms of one known integral belonging to the complementary function (C.F.).
3. Rules for getting an integral belonging to C.F. of $y'' + Py' + Qy = R$.
4. Working rule for finding complete primitive (solution) when an integral of C.F. is known or can be obtained.
5. Removal of first derivative (Reduction to normal form or changing the dependent variable).
6. Working rule for solving problems by changing the dependent variable.
7. Transformation of the equation by changing the independent variable.
8. Working rule for solving equations by changing the independent variable.
9. Examples based on 1 to 8.

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

1. Introduction
2. The nature of solution of $(dx)/P = (dy)/Q = (dz)/R$
3. Geometrical interpretation of $(dx)/P = (dy)/Q = (dz)/R$
4. Rule I for solving $(dx)/P = (dy)/Q = (dz)/R$
5. Rule II for solving $(dx)/P = (dy)/Q = (dz)/R$
6. Rule III for solving $(dx)/P = (dy)/Q = (dz)/R$
7. Rule IV for solving $(dx)/P = (dy)/Q = (dz)/R$
8. Examples based on 1 to 7.

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. (Integrated) Four Years Programme Semester-III

Paper Code: D-III

(Major) Mathematics Paper-VI

Title of the Paper: Numerical Methods

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

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

CO1: find numerical solutions of algebraic, transcendental 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 Solutions of Algebraic and Transcendental Equations (15 Hrs.)

1. Introduction
2. Mathematical
3. Preliminaries
4. Bisection Method
5. Method of False position
6. Newton- Raphson method
7. Examples

1.1 Interpolation

1. Introduction
2. Finite differences
3. Forward differences
4. Backward differences
5. Symbolic relations and Separation of symbols
6. Newton's formulae for Interpolation
   6.1 Newton's forward difference interpolation formula
   6.2 Newton's backward difference interpolation formula
7. Interpolation with Unevenly Spaced Points
   7.1 Lagrange's Interpolation Formula
   7.2 Examples

Unit- 2 Numerical Integration & Solutions of Linear system of equations (9 Hrs.)

2.1 Numerical Integration

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

2.2 Solutions of Linear system of equations

2.2.1 Solutions of linear system - Direct method

2.2.1.1 Gauss Elimination Method

2.2.2 Solutions of linear system - Iterative method

2.2.2.1 Gauss-Seidel Method

2.2.3 Examples based on art. 2.2.1 to 2.2.2.

Unit- 3 Numerical Solutions of ODE (6 Hrs.)

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. (Integrated) Four Years Programme Semester- III

Paper Code: D-III

(Major) Mathematics Practical-III

Title of the Paper: Mathematics 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	1
12.	Evaluation of Numerical integration by using Simpson's 1/3rd rule	1
13	Evaluation of Numerical integration by using Simpson's 3/8th rule	1
14	Numerical solutions of ordinary differential equations by Euler's method.	1
15	Numerical solutions of ordinary differential equations by Runge-Kutta method of second order	1
	Total Practicals	**15**

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

Paper Code: D-III

(Minor) Mathematics Paper-V

Title of the Paper: Computational Mathematics for Sciences-I

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

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

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. $x(\partial z/\partial x) + y(\partial z/\partial y) = nz$.
      b. $x^2 (d^2z/dx^2) + 2xy (d^2z/dxdy) + y^2 (d^2z/dy^2) = n(n-1) z$
   2. If z is a homogeneous function of degree n in x and y and $z = f(u)$, then
      a. $x(\partial u/\partial x) + y(\partial u/\partial y) = n \{f(u)/f'(u)\}$
      b. $x^2 (d^2u/dx^2) + 2xy (d^2u/dxdy) + y^2 (d^2u/dy^2) = g(u)\{g'(u) - 1\}$, where $g(u) = n \{f(u)/f'(u)\}$
   5. Examples based on 1 to 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, w with respect to x, y, z and J ' is Jacobian of x, y, z with respect to u, v, w then JJ'=1.

2.2.3 If p, q are functions of u, v & u, v are functions of x, y then prove that

$\partial(p, q)/\partial(u, v) = \{\partial(p, q)/\partial(x, y)\}\{\partial(x, y)/\partial(u, v)\}$.

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

$\partial(p, q, r)/\partial(u, v, w) = \{\partial(p, q, r)/\partial(x, y, z)\}\{\partial(x, y, z)/\partial(u, v, w)\}$.

2.2.5 Jacobian of implicit functions (without proof)

2.2.6 Examples based on 2.2.1 to 2.2.5

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 grad $\emptyset$, where $\emptyset$ 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. $\text{grad}(\emptyset \pm \psi) = \text{grad}\,\emptyset \pm \text{grad}\,\psi$

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. $\text{grad}\,\emptyset\psi = \emptyset\,\text{grad}\,\psi + \psi\,\text{grad}\,\emptyset$

ii. $\text{div}\,\emptyset f = \emptyset\,\text{div}\,f + (\text{grad}\,\emptyset)\cdot f$

iii. $\text{div}f \times g = g\cdot\,\text{curl}\,f - f\cdot\text{curl}\,g$

iv. $\text{curl}\emptyset f = \text{grad}\,\emptyset \times f + \emptyset\,\text{curl}\,f$

3.2.3 Second order differential operators

i. $\text{div grad}\,\emptyset = \nabla\cdot\nabla\emptyset = \partial^2\emptyset/\partial x^2 + \partial^2\emptyset/\partial y^2 + \partial^2\emptyset/\partial z^2$

ii. $\text{curl grad}\,\emptyset = \nabla\times\nabla\emptyset = 0$

iii. $\text{div curl}\,f = \nabla\cdot\nabla\times f = 0$

3.3.4 The Laplacian Operators ∇^2

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. (Integrated) Four Years Programme Semester-III

Paper Code: D-III

(Minor) Mathematics Paper-VI

Title of the Paper: Improper Integrals and Special Functions

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

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

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

Unit 1. Improper Integrals (Gamma Function) (06 Hrs.)

1.1 Introduction
1.2 Improper Integrals of the First Kind (Range of Integration is Infinite) (Definition)
1.3 Improper Integral of the Second Kind (Definition)
1.4 **Gamma Function**
1.5 Some Identities of Gamma Function
1.3.1 1. $\Gamma(1) = 1$
1.5.2. $\Gamma(n+1) = n\,\Gamma(n)$
1.5.3. $\Gamma(n+1) = n!$, for any positive integer n.
1.5.4. $\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$
1.5.5. $\Gamma(n) = 2\int_0^\infty e^{-x^2} x^{2n-1} dx, n > 0$
1.5.6. $\Gamma(n) = k^n \int_0^\infty e^{kx} x^{n-1} dx, n, k > 0$

Unit 2. Improper Integrals (Beta Function) (09 Hrs.)

1. Beta Function
2. Some Identities of Beta function
1.6.1 $\beta(m,n) = \beta(n,m)$
1.6.1 $\beta(m,n) = 2\int_0^{\frac{\pi}{2}} sin^{2m-1}\theta\ cos^{2n-1}\theta\ d\theta$
1.6.1 $\beta(m,n) = 2\int_0^\infty \frac{x^{m-1}}{(1+x)^{m+n}}\ dx$
1.6.1 $\beta(m,n) = \frac{\Gamma(m)\,\Gamma(n)}{\Gamma(m+n)}$
1.6.1 $\beta(m,n) = \beta(m+1,n) + \beta(m,n+1)$
1.6.1 Duplication formula of Gamma function (only statement)
1.6.1 Examples based on 2.1 to 2.6

Unit 3. Improper integrals involving a parameter and the Error functions (15 Hrs.)

3.1. Definition of improper integral involving a parameter
3.2. Integral with its limits as constants (Statement only)
3.3. Integral with limits as functions of the parameter (Leibnitz's Rule) (Statement only)
3.4. Examples based on 2.2 and 2.3
3.5. Error Function Integral $\mathrm{erf}(\ )$
3.6. Complementary Error Function Integral $\mathrm{erf_c}(\ )$
3.7. Expression for $\mathrm{erf}(\ )$ in series
3.8. Properties of error-integral functions

i) $\mathrm{erf}(-\ ) = -\mathrm{erf}(\ )$

ii) $\mathrm{erf}(-\ ) = 1 + \mathrm{erf}(\ ) = 2 - \mathrm{erf_c}(\ )$

iii) Derivative of error function: $\frac{\mathrm{d}}{\mathrm{dx}}[\mathrm{erf}(ax)] = \frac{2\mathrm{a}}{\sqrt{\pi}} e^{-a^2x^2}$

iv) Integral of error function:

$$\int_0^u \mathrm{erf}(ax)\,dx = u\,\mathrm{erf}(au) + \frac{1}{a\sqrt{\pi}} e^{-a^2x^2} - \frac{1}{a\sqrt{\pi}}$$

3.9. Examples based on 3.5 to 3.7

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 VidhyarthiGrihaPrakashan, Pune. Vol.I, 2011.

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

Reference Books:-

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

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

Paper Code: D-III

(Minor) Mathematics Practical-III

Title of the Paper: Mathematics 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
	TOTAL	**15**

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

Paper Code: D-III

(Major) Physics SEC Practical –I

Title of the Paper: Physics Laboratory Techniques-I

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**

Group I (Skills in General Physics)

1. To determine radius of curvature of convex and concave surfaces using Spherometer.
2. To measure the radius of the capillary tube using Travelling Microscope.
3. To Measure unknown resistance using P. O. Box.
4. To find unknown resistance using meter bridge.
5. Use of telescope and stop watch.
6. To measure the radius of capillary using mercury thread.
7. To find the time period of simple pendulum for small amplitudes and draw the graph of length of pendulum against square of time period
8. To establish graphically relation between tension and length of the string of the sonometer resonating with given tuning fork

Group II (Skills in Optics)

1. Polar graph using photocell/photovoltic cell
2. Schuster method and optical levelling of spectrometer
3. To find angle of prism using spectrometer
4. Mounting of grating with its plane vertical and set it for normal Incidence
5. Obtaining Biprism fringes without lateral shift
6. To varify inverse square law of radiation using photoelectric cell
7. To measure divergence of LASER source
8. To show that the distance between the object and screen must be four times the focal length to obtain real magnified and diminished images of an object using convex lens

References

1. Practical electronics : Ralph, Morrison
2. An advance course in practical Physics : D. Chattopadhyay
3. B. Sc. Practical Physics : C. L. Arora
4. B. Sc. Practical Physics : Harnam Singh
5. Practical Physics : K. K. Dey, B. N. Dutta
6. Advance practical Physics : Worshnop Flint

Course Outcomes

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

1. Able to handle and operate various instruments in Physics laboratory.
2. Able to perform experiments in General Physics and Optics.
3. Develop practical skill, instruments handling skills, observational skills and problem solving skills
4. Able to record experimental observations scientifically.

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

Paper Code: D-III

(Major) Chemistry SEC Practical –I

Title of the Paper: Chemistry Laboratory Techniques-I

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**

Course Outcomes:

After completion of the course, the students will be able to:

CO1 Understand the concepts, principles, theories and practical applications of Chemistry

CO2 Understand the simple techniques of synthesis and analysis

CO3 Gain basic knowledge of instruments to be used for analysis.

CO4 Develop analytical skills

Practicals:

Note: An explanation and understanding of theoretical concepts, mechanisms, reactions, and instrumentation are expected.

1) Preparation of Orange II Azo dye from Sulphanilic acid.
2) Determine the amount glycine from given solution.
3) Determination of viscosity coefficient of unknown solvents using Ostwalds Viscometer.
4) Determination of surface tension of soap solution using a stalagmometer,
5) Analysis of vinegar sample using conductivity measurements.
6) Preparation of standard sodium carbonate solution, standardization of HCl solution and determination of sodium carbonate and sodium bicarbonate in the given solution.
7) Determination of C.O.D. in polluted water.
8) Determination of pH of the following biological Juices. (i) Milk (ii) Orange Juice (iii) Lime water (iv) Lemon Juice
9) Identification of aldehydes and ketones using i) Brady's Test ii) Tollen's Test iii) Schiff Test iv) Iodoform Test
10) Preparation of tetrammine copper (II) sulphate.
11) Gravimetric estimation of aluminium as Aluminium oxinate from a solution containing aluminium sulphate or potash alum and free sulphuric acid.

12) To determine the λ_{max} of $KMnO_4$ solution using a Colorimeter.
13) Determination of sulphate from drinking water using Conductivity measurements.
14) Determination of alkali contents from antacid tablet using Conductivity measurements.
15) Determine the density and Refractive index of given unknown liquids.
16) Separation of liquid + liquid binary mixture by using distillation method.
17) Identify and differentiate the amines using functional group tests.
18) Determination of reducing sugars and non-reducing sugars.

References:

1. Fundamentals of Analytical Chemistry; Skoog, West. Holler and Crouch 9th edition; Mary Finch. (2014).
2. Vogel's Textbook of Quantitative Chemical Analysis; 6^{th} edition, Pearson Education Limited, (2007).
3. Industrial Chemistry by B. K. Sharma.
4. Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co: New Delhi (2011).
5. Findlay's Practical Physical Chemistry (Longman) 2015.
6. Practical Physical Chemistry: Gurtu (S Chand) 2014.
7. Systematic Experimental Physical Chemistry: Rajbhoj, Chandekar (Anjali Publication) 2016.
8. Advanced Practical Physical Chemistry: J.B. Yadav (Goel Publishing House) 2015.
9. Vogel's Textbook of Quantitative Inorganic Chemistry by A. I. Vogel.
10. Physical Chemistry of Inorganic Qualitative Analysis by Kuricose & Rajaram.
11. Advanced Practical Organic Chemistry by N.K. Vishnoi. Vikas Publishing House Private Limited.

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

Paper Code: D-III

(Major) Mathematics SEC Practical –I

Title of the Paper: Mathematics Typesetting using LaTeX - I

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	Introduction to LaTeX	01
2	Styling pages	01
3	Formatting: bold, italic, underlining, and comments	01
4	Subscript and superscript	01
5	Adding math to LaTeX	01
6	Fractions and binomials	01
7	Integral and limits	01
8	Equations and its alignment	01
9	Math Accents	01
10	Delimeters	01
11	Matrix	01
12	Creating list	01
13	Math Functions	01
14	Creating and Using Theorems	01
15	Drawing Diagrams	01
	T O T A L	**15**

Reference books: -

1. "LaTeX Tutorials - A Primer" by Indian TeX Users Group, Trivandrum, India 2003 September.
   Link: https://www.tug.org/twg/mactex/tutorials/ltxprimer-1.0.pdf
2. The Not So Short Introduction to LATEX, Tobias Oetiker, Marcin Serwin Hubert Partl, Irene Hyna and Elisabeth Schlegl.

   Link https://tobi.oetiker.ch/lshort/lshort.pdf
3. LaTeX Wikibook Link: https://upload.wikimedia.org/wikipedia/commons/2/2d/LaTeX.pdf

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

Paper Code: SSCP-I

Title of the Paper: Basics of Pedagogy at Secondary stage

Marks	**50**	**Credits**	**04**
Total Hours	**60**	**Hours Per Week**	**06**
Internal Exam Marks	**20**	**External Exam Marks**	**80**
		Duration of External Examination	**03 hrs.**

Learning Outcomes

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

- build comprehensive understanding of secondary stage learners,
- assess the physical, mental, social, and emotional growth of secondary stage learners,
- develop skills to observe and recognize the unique capabilities and strengths of secondary stage learner,
- discuss the necessary knowledge and skills to implement effective teaching and learning strategies,
- create enriching and inclusive learning environments to foster values- based education,
- develop a deeper understanding of various pedagogical approaches and their impact on learners,
- determine the knowledge to make informed decisions about instructional practices,
- explain the crucial role of pedagogy in facilitating effective learning experiences for students,
- outline knowledge and skills necessary for continuous professional development.

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

a) Understanding the physical, mental, social, and emotional growth and characteristics of learners

b) Observing the unique capabilities of learner & Understanding the Thought processes and cognitive skills of learners

c) Understanding the Psychological and social orientations of learners

d) Understanding the Social and academic lives of learners

e) Understanding the Conflicts and challenges of secondary learners

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

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

UNIT – III: Pedagogical Approaches (15 hrs.)

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

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

a) Meaning and need of Continuous Professional Development of Teacher
b) Meaning of professional and ethical competencies
c) Need for updating content and pedagogical competencies to develop their professional competencies.
d) Professional development activities: seminars, conferences, orientation programmes, workshops, online and offline courses, competitions, publications,
e) D. development of teaching portfolio, capacity building programmes, and teacher exchange programmes.

Unit-V: Development of professional competencies

a) Development of professional competencies to deal with gender issues, equity and inclusion,
b) Development of professional competencies to deal with ethical issues, environmental issues,
c) Development of professional competencies to deal with human health and well-being,
d) Development of professional competencies to deal with the population, human rights

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

TRANSACTIONAL MODE:

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

ESSENTIAL READINGS:

- National Council of Educational Research and Training. (April 2022). Mandate documents Guidelines for the development of National Curriculum Frameworks.
- National Education Policy 2020, MoE, Government of India (English and Hindi)
- National Steering Committee for National Curriculum Frameworks, (2023). Draft National Curriculum Framework for School Education.
- National Policy on Education 1968, 1986 and 2020.

REFERENCES:

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

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

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

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

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

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

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

Paper Code: SS-III

Title of the Paper: Environmental Studies-I

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 it's impacts.

SESSIONAL WORK:
Assignments, Participation in Nature Club activities/Plantation/Collection of seeds/Conservation
TRANSACTIONAL MODE: Lectures, Field visits and project

ESSENTIAL READINGS:

Environmental studies, Shivaji University, Kolhapur Gharpure T.N. (2000) 'Paryavaranshastra' Paryavaran Shastra – Gharapure
Agarwal, K.C.2001, Environmental Biology, Nidi Pubi. Ltd., Bikaner. Bharucha Erach, The Biodiversity of India, Mapin Publishing pvt.
Ltd., Ahmedabad 380013, India, Email:mapin@icenet.net (R) Cunningham, W.P. Cooper, T.H.Gorhani, E. & Hepworth, M.T.2001, Environmental Encyclopedia, Jaico Publ. Hpise, Mumbai, 1196p Down to Earth, Cebtre fir Scuebce and Environment (R)
Gleick, H.,1993, Water in crisis, Pacific Institute for studies in
Dev., Environment & Security. Stockholm Env. Institute. Oxford Univ. Press 473p
Hawkins R.e., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R)
Heywood, V.H.& Watson, R.T.1995, Global Biodiversity Assessment, Cambridge Univ. Press 1140p.
Mickinney, M.L.& School. R.M.1196, Environmental Science Systems & Solutions, Web enhanced edition, 639p.
Miller T.G.Jr., Environmental Science. Wadsworth Publications Co. (TB) Odum, E.P.1971, Fundamentals of Ecology, W.B.Saunders Co. USA, 574p. Survey of the Environment, The Hindu (M)
Townsend C., Harper, J. and Michael Begon, Essentials of Ecology, Blackwell Science (TB)
Trivedi R.K. Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, vol. I 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-III	**Philosophical & Sociological Perspectives of Education-I**		100 (T 80 + P 20)	04	60	06
Disciplinary / Inter-disciplinary Courses	D-IV	Major (Physics)	DSC IV (2) : Physics -VII: Modern Physics	50 (T40 + I 10)	02	30	02
			DSC IV (2) : Physics -VIII: Analog & Digital Electronics	50 (T40 + I 10)	02	30	02
			DSC P IV (2): Physics Practical-IV	50	02	60	04
		Minor (Physics)	DSC IV (2) : Physics -VII: Semiconductor Physics	50 (T40 + I 10)	02	30	02
			DSC IV (2) : Physics -VIII: Astronomy & Astrophysics	50 (T40 + I 10)	02	30	02
			DSC P IV (2): Physics Practical-IV	50	02	60	04
		Major (Chemistry)	DSC IV (2) : Chemistry -VII: Inorganic Chemistry	50 (T40 + I 10)	02	30	02
			DSC IV (2) : Chemistry -VIII: Organic Chemistry	50 (T40 + I 10)	02	30	02
			DSC P IV (2): Chemistry Practical-IV	50	02	60	04
		Minor (Chemistry)	DSC IV (2) : Chemistry -VII: Fundamentals of Inorganic Chemistry	50 (T40 + I 10)	02	30	02
			DSC IV (2) : Chemistry -VIII: Applied Organic Chemistry	50 (T40 + I 10)	02	30	02
			DSC P IV (2): Chemistry Practical-IV	50	02	60	04
		Major (Mathematics)	DSC IV (2) : Mathematics -VII: Differential Calculus	50 (T40 + I 10)	02	30	02
			DSC IV (2) : Mathematics -VIII: Integral Calculus	50 (T40 + I 10)	02	30	02
			DSC P IV (2): Mathematics Practical-IV	50	02	60	04
		Minor (Mathematics)	DSC IV (2) : Mathematics -VII: Computational Mathematics for Sciences-II	50 (T40 + I 10)	02	30	02
			DSC IV (2) : Mathematics -VIII: Laplace Transform	50 (T40 + I 10)	02	30	02
			DSC P IV (2): Mathematics Practical-IV	50	02	60	04
Skill Enhancement Courses (SEC)	**(Major) SEC-II**	(Major) SEC-II : Physics : Community Engagement Programme CEP (2)		50	02	60	04
		(Major) SEC-II : Chemistry : Community Engagement Programme CEP (2)		50	02	60	04
		(Major) SEC-II : Mathematics : Community Engagement Programme CEP (2)		50	02	60	04
Stage Specific Content- cum-Pedagogy	**SSCCP-II**	**Stage-Specific Content- cum- Pedagogy Courses-II : Content cum Pedagogy of Mathematics at Secondary Stage**		100 (T 80 + P 20)	04	60	06
Self-Study	SS-IV	Environmental Studies-II		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 Semester-IV

Paper Code: F-III

Foundations of Education

Title of the paper: Philosophical & Sociological Perspectives of Education -I

Marks	**100**	**Credits**	**04**
Total Hours (in One Semester)	**60**	**Hours Per Week**	**06**
Internal Exam Marks	**20**	**Theory Exam Marks**	**80**
		Duration of Theory Exam	**03 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 (तत्व ज्ञानमीमांसा) 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 Apara 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 Developmenta

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
(Major) Physics Paper-VII

Title of the Paper: Modern Physics

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

- **Learning Outcomes:** After successfully completing this course, the student will be able to:

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-Hunt law, Characteristic X -ray spectrum, Compton Effect, Expression for Compton wavelength, Experimental verification of Compton Effect.	**08**

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 H2 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
(Major) Physics Paper-VIII

Title of the Paper: Analog & Digital Electronics

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

- **Learning Outcomes:** After successfully completing this course, the student will be able to do the following:
  1. Student will be able to discuss the construction and working of CRO 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

(Major) Physics Practical IV

Title of the Paper: 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
(Minor) Physics Paper-VII

Title of the Paper: Semiconductor Physics

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

- **Learning Outcomes:**

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

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**

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 (11^{th} Edition)
4. Electronic Principles: Elbert Malvino, David Bates, Patrick Hoppe (9^{th} edition)

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

Paper Code: D-IV
(Minor) Physics Paper-VIII

Title of the Paper: Astronomy & Astrophysics

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

- **Learning Outcomes:**

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

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, Tychonic 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 gala ctic 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: D-IV

(Minor) Physics Practical-IV

Title of the Paper: Physics 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**

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: D-IV
(Major) Chemistry Paper-VII

Title of the Paper: Inorganic Chemistry

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

Learning Outcomes

a. Learning and understanding basic concepts about coordination complexes.
b. Student will be capable of understanding the properties of 3d series elements.
c. Students will understand the formation of molecules on the basis of concept of hybridization and molecular orbital theory.
d. Students will learn the basic knowledge about the qualitative analysis of inorganic compounds.

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

a. Coordination Chemistry: Introduction, Definition and formation of co-ordinate covalent bond in BF_3–NH_3, $[NH_4]^+$ 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. $CoCl_3.6NH_3$, $CoCl_3.5NH_3$, $CoCl_3.4NH_3$, $CoCl_3.3NH_3$. 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. Valance bond theory of transition metal complexes concerning, C.N. = 4, complexes of $[CuCl_4]^{2-}$ and $[Cu(CN)_4]^{2-}$ and C.N. = 6 complexes of $[FeF_6]^{3-}$ and $[Fe(CN)_6]^{3-}$. Chelation. Definition and explanation of terms chelation, chelating agent, metal chelate and chelate effect. Difference between metal chelate and metal complex. Classification of chelating agents (with specific illustration of bidentate chelating agent).

c. Chemistry of Elements of 3d Series Elements: Position of elements in the periodic table, 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 5^{th} edition.

3) Vogels Textbook of Qualitative Inorganic Analysis by A. I. Vogel. 3^{rd} and 6^{th} edition.

4) Advanced Inorganic Chemistry by Agrawal Keemtilal (Pragati Prakashan).

5) Theoretical Inorganic Chemistry by C. Day & J. Selbin II^{nd} edition.

6) Principles of Inorganic Chemistry by Puri Sharma & Kalia.

7) Modern Inorganic Chemistry by R. D. Madan (S. Chand).

8) Inorganic Chemistry by J. D. Lee.

9) Basic Inorganic Chemistry by F. A. Cotton, G. Wilkilson & B. L. Gauswiley.

10) Chemistry for Degree Students by R. L. Madan (S. Chand Publication).

11) Concise Coordination Chemistry by Ramlingam, Ramgopalan.

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

Paper Code: D-IV
(Major) Chemistry Paper-VIII

Title of the Paper: Organic Chemistry

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

Learning Outcomes

a. To impart knowledge about the synthesis, reactivity and applications of carboxylic acids.
b. Knowledge about classification, preparation and applications of amines and diazonium salts.

c. 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 NH_3, 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 $NaHCO_3$, C_2H_5OH 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 PCl_3 and $SOCl_2$. 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 amonolysis b) By reduction of nitriles or cyanides c) From unsubstituted amides (Hoffmann degradation), d) By Gabrial 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 -Sandmeyers reaction. b) Coupling reactions: Synthesis of Congo red.

NIT 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 Programme Semester- IV

Paper Code: D-IV

(Major) Chemistry Practical-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 $NiSO_4.7H_2O$ and free sulphuric acid.

Inorganic Preparations (Any Two)

i) Preparations of sodium cuprous thiosulphate

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

iii) Preparation of hexamine nickel (II)chloride

Semi-micro Qualitative Analysis

Analysis of binary mixtures with non-interfering cations and anions (at least **4 mixtures** to be analyzed)

iv) Following anions are to be given:

Cl^-, Br^-, I^-, $NO3^-$, $CO3^{--}$, $SO4^{--}$, S^{--}, (insoluble $CO3^{2-}$ 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 Programme Semester-IV

Paper Code: D-IV
(Minor) Chemistry Paper-VII

Title of the Paper: Fundamentals of Inorganic Chemistry

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

Learning Outcomes

a. Learning and understanding unique properties such as electronic configuration, stability of Oxidation states, color, and separation of lanthanides and its applications.

b. Knowledge about Crystal structure and defects in Ionic solids will be gained by the students.

c. Learning and understanding classification and physical properties of non-aqueous solvents.

d. Learning and understanding classification and physical properties of catalysis and its industrial applications.

UNIT I: Chemistry of Lanthanide Elements (10 hours)

a. 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)

a. 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.

b. 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)

a. 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:

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

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

Paper Code: D-IV
(Minor) Chemistry Paper-VIII

Title of the Paper: Applied Organic Chemistry

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

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 Programme Semester- IV

Paper Code: D-IV

(Minor) Chemistry Practical-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 $Ni(DMG)_2$ from a solution containing $NiSO_4.7H_2O$ and free sulphuric acid.

Inorganic Preparations (Any Two)

i) Preparations of sodium cuprous thiosulphate.

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

iii) Preparation of hexamine nickel (II) chloride

Semi-micro–Qualitative Analysis

Analysis of binary mixtures with non-interfering cations and anions (at least **4 mixtures** to be analyzed)

iv) Following anions are to be given:

Cl^-, Br^-, I^-, NO_3^-, CO_3^{--}, SO_4^{--}, S^{--}, (insoluble CO_3— 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-napthol 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. (Integrated) Four Years Programme Semester-IV

Paper Code: D-IV

(Major) Mathematics Paper -VII

Title of the Paper: Differential Calculus

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

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

CO1: 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 (12 hrs.)

1. Left hand and Right-hand limits (do not use $\varepsilon - \delta$ definition).
2. Properties of limits:
   Theorem (without proof): If f & g are two functions defined on some neighborhood of c such that $\lim_{x\to c} f(x) = l, \lim_{x\to c} g(x) = m$ then

i $\lim_{x\to c}(f+g)(x) = l + m$

ii $\lim_{x\to c}(f-g)(x) = l - m$

iii $\lim_{x\to c}(f\cdot g)(x) = l \cdot m$

iv $\lim_{x\to c}(f/g)(x) = l/m$, 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:

i. 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:

ii. Definition of bounded function

iii. Theorem (Statement only): If a function f is continuous in a closed interval, then it is bounded therein.

iv. Theorem: If a function f is continuous on a closed interval [a, b], then it attains its bounds at least once in [a, b].

v. Theorem (Statement only): If a function f is continuous at an interior point c of an interval [a, b] & $f(c) \neq 0$, then $\exists$ a $\delta > 0$ such that f(x) has the same sign as f(c), for every $x \in (c-\delta, c+\delta)$.

vi. 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 $(b-\delta, b]$.

vii. 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 $[a, a+\delta)$.

viii. 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 $f(\alpha) = 0$.

ix. Intermediate Value Theorem.

x. 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 4 and 6
8. Differentiability at a point and Differentiability in an interval: definitions.
9. Examples on 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 **(12*hrs.)***

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 1 to 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 and 3.

Unit – 3: Extreme values **(06 hrs.)**

1. Maxima and minima of functions of **two** variables: Sign of quadratic expression, Lagrange's condition for stationary value.
2. Lagrange's method of undetermined multipliers for three variables.
3. Examples on 1 and 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. (Integrated) Four Years Programme Semester-IV

Paper Code: D-IV

(Major) Mathematics Paper -VIII

Title of the Paper: Integral Calculus

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

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

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

Unit 1. Improper Integrals **(15 Hrs.)**

1.1 **Gamma Function**
1.2 Definition of Gamma Function and examples
1.3 Properties of Gamma Function
1.3.1 $\Gamma(1)=1$
1.3.2. $\Gamma(n+1)= n\,\Gamma(n)$ in general
1.3.3. $\Gamma(n+1)=n!$, for any positive integer n.
1.3.4. $\Gamma(0)=\infty, \Gamma(\infty)=\infty$
1.3.5. $\Gamma(n)=2\int_0^{\infty} e^{-x^2}x^{2n-1}dx, n>0$
1.3.6. $\Gamma(n)=k^n\int_0^{\infty} e^{-kx}x^{n-1}dx, n,k>0$
1.3.7 Examples based on article 1.3
1.4 **Beta Function**
1.5 Definition of Gamma Function and examples
1.6 Properties of Beta function
1.6.1 $\beta(m,n)=\beta(n,m)$ m, n ≥ 0
1.6.1 $\beta(m,n)=2\int_0^{\frac{\pi}{2}} sin^{2m-1}\theta\ cos^{2n-1}\theta\ d\theta$
1.6.1 $\int_0^{\frac{\pi}{2}} sin^{p}\theta\ cos^{q}\theta\ d\theta=\frac{1}{2}\beta\left(\frac{p+1}{2},\frac{q+1}{2}\right), p,q\ >-1$
1.6.1 Relation between Beta and Gamma Function $\beta(m,n)=\frac{\Gamma(m)\,\Gamma(n)}{\Gamma(m+n)}, m,n>0$
1.6.1 $\Gamma\left(\frac{1}{2}\right)=\sqrt{\pi}$
1.6.1 $\beta(m,n)=2\int_0^{\infty}\frac{x^{m-1}}{(1+x)^{m+n}}\ dx$
1.6.1 $\beta(m,n)=a^n b^m\int_0^{\infty}\frac{x^{m-1}}{(a+bx)^{m+n}}\ dx$
1.6.1 $\beta(m,n)=\int_0^{1}\frac{x^{m-1}+x^{n-1}}{(1+x)^{m+n}}\ dx$
1.6.1 Duplication formula of Gamma function
Examples based on 1.6

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

Recommended Book:-

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

Scope:- Chapter VII: 7.1 to 7.3,7.5

Unit. 2 & 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 GrihaPrakashan, Pune. Vol.I, 2011.
2. Shanti Narayan and Dr. P. K. Mittal, Integral Calculus, S. Chand and Company, New Delhi,2015.
3. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, Delhi, 2012.
4. Gorakh Prasad, Integral Calculus, Pothishala Pvt. Ltd., Allahabad
5. Dass H. K, Advanced Engineering Mathematics, 22e, S. Chand and Company, New Delhi, 2018.

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

Paper Code: D-IV

(Major) Mathematics Practical-IV

Title of the paper: 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. (Integrated) Four Years Programme Semester-IV

Paper Code: D-IV

(Minor) Mathematics Paper -VII

Title of the Paper: Computational Mathematics for Sciences-II

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

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

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 (Δ), Backward Differences (∇), Central Differences (δ).
1.3 Shift Operator (E) and means operator (μ).
1.4 Symbolic Relations and Separation of Symbols.

1. Show that $\Delta = E - 1, \nabla = 1 - E^{-1}, \delta = E^{\frac{1}{2}} - E^{-\frac{1}{2}}, \mu = \left(\frac{1}{2}\right)\left(E^{\frac{1}{2}} - E^{-\frac{1}{2}}\right), \mu^2 = 1 + \left(\frac{1}{4}\right)\delta^2, \Delta = \nabla E = \delta E^{\frac{1}{2}}$.
2. Show that $E \equiv e^{hD}, where\ D \equiv \frac{d}{dx}$.
3. Show that $\Delta^n u_{x-n} = u_x - n u_{x-1} + \frac{n(n+1)}{2} u_{x-2} + \cdots + (-1)^n u_{x-n}$.
4. Show that $e^x\left(u_0 + x u_0 + \frac{x^2}{2!}\Delta^2 u_0 + \cdots\right) = u_0 + u_1 x + u_2 \frac{x^2}{2!} + \cdots$

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. (Integrated) Four Years Programme Semester-IV

Paper Code: D-IV

(Minor) Mathematics Paper -VIII

Title of the Paper: Laplace Transform

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

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

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.)**

3.1 Application to solve Ordinary Linear Differential Equations with constant and Variable Coefficients
3.2 Examples based on 3.1.

Recommended Book:

1. J. K. Goyal, K. P. Gupta, Integral Transforms, A Pragati Prakashan, Meerut, 21th 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. (Integrated) Four Years Programme Semester-IV

Paper Code: D-IV

(Minor) Mathematics Practical-IV

Title of the paper: 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	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: SEC-II

Physics/Chemistry/Mathematics Major SEC Practical –II

Title of the Paper: Community Engagement Programme (CEP)

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**

1. INTRODUCTION:

New generation of students are increasingly unaware of local rural and peri-urban realities surrounding their HEIs, as rapid urbanization has been occurring in India. A large percentage of Indian population continues to live and work in rural and peri-urban areas of the country. While various schemes and programs of community service have been undertaken by HEIs, there is no singular provision of a well-designed community engagement course that provides opportunities for immersion in rural realities. Such a course will enable students to learn about challenges faced by vulnerable households and develop an understanding of local wisdom and lifestyle in a respectful manner

2. OBJECTIVES:

- To promote a respect for rural culture, lifestyle, and wisdom among students.
- To learn about the present status of agricultural and development initiatives.
- Identify and address the root causes of distress and poverty among vulnerable households.
- Improve learning outcomes by applying classroom knowledge to real-world situations.

To achieve the objectives of the socio-economic development of New India, HEIs can play an important role through active community engagement. This approach will also contribute to improve the quality of both teaching and research in HEIs in India. India is a signatory to the global commitment for achieving Sustainable Development Goals (SDGs) by 2030. Achieving these 17 SDG goals requires generating locally appropriate solutions. Community engagement should not be limited to a few social science disciplines alone. It should be practiced across all disciplines and faculties of HEIs. These can take the forms of enumerations, surveys, awareness camps and campaigns, training, learning manuals/films, maps, study reports, public hearings, policy briefs, cleanliness and hygiene teachings,

legal aid clinics, etc. For example, students of chemistry can conduct water and soil testing in local areas and share the results with the local community. Students of science and engineering can undertake research in partnership with the community on solid and liquid waste disposal Therefore, students are being encouraged to foster social responsibility and community engagement in their teaching and research.

3. LEARNING OUTCOMES:

After completing this course, students will be able to

- Gain an understanding of rural life, Indian culture, and social realities.
- Develop empathy and bonds of mutuality with the local community.
- Appreciate the significant contributions of local communities to Indian society and economy.
- Learn to Value local knowledge and wisdom.
  Identify opportunities to contribute to the community's socioeconomic improvement.

4. Credits: Two credit Course; Students are expected to complete 60 hours of participation

5. COURSE STRUCTURE:

Sr.	Module Title	Module Content	Teaching/Learning/Methodolo
1	Appreciation of Rural Society	Rural lifestyle, rural society, joint family, caste and gender relations, rural values with respect to community, rural culture nature and public resources, ponds and fisheries, elaboration of soul of India lies in	Classroom discussions Field visit Individual /Group conference Report/journal submission &
2	Understanding rural and local economy and livelihood	Agriculture, farming, land ownership, water management, animal husbandry, non-farm livelihood and artisan's rural entrepreneurs, rural markets, migrant labour, social innovation projects	Classroom discussions Field visit Individual /Group conference Report/journal submission &
3	Rural and local Institution	Traditional rural and community organization, self-help groups, decentralized planning, panchayat raj institutions Gram panchayat, Nagarpalika and Municipalities, local Civil Society, Local administration, National rural, Livelihood	Classroom discussions Field visit Individual /Group conference Report/journal submission & VIVA
4	Rural and National development programmers	History of rural development and current National Programms in India: Sarva shiksha Abhiyan, Beti Bachao-Beti Padhao, Ayushman Bharat, eShram Swachh Bharat, PM Awas yojana, Skill India, Digital India, Start-Up India, Stand-Up India, Scheme of Fund for Regeneration of Traditional Industries (SFURTI), Jal	Classroom discussions Field visit Individual /Group conference Report/journal submission & VIVA

Note: Faculty can make addition in the list of activities as per domain content:

Recommended field-based activities (Tentative):

- Participate in Gram Sabha meetings, and study community participation;
- Visit to Swachh Bharat Mission project sites, conduct analysis and initiate problem-solving measures;
- Interaction with Self Help Groups (SHGs) women members, and study their functions and

challenges; planning for their skill-building and livelihood activities;

- Visit Mahatma Gandhi National. Rural Employment Guarantee Act 2005 (MGNREGS) project sites, interact with beneficiaries and interview functionaries at the work site;

- surveys on Mission Antyodaya to support under Gram Panchayat Development Plan

- Visit Rural Schools/mid-day meal centres, study academic and infrastructural resources, digital divide and gaps;

- Associate with Social audit exercises at the Gram Panchayat level, and interact with programme beneficiaries;

- Visit to local Nagarpalika office and review schemes for urban informal workers and migrants;

- Attend Parent Teacher Association meetings, and interview school drop outs;

- Visit local Anganwadi and observe the services being provided;

- Visit local NGOs, civil society organisations and interact with their staff and beneficiaries;

- Organize awareness programmes, health camps, Disability camps and cleanliness camps;

- Conduct soil health test, drinking water analysis, energy use and fuel efficiency surveys and building solar powered village;

- Understanding of people's impacts of climate change, building up community's disaster preparedness;
    - Organise orientation programmes for farmers regarding organic cultivation, rational use of irrigation and fertilizers, promotion of traditional species of crops and plants and awareness against stubble burning;
    - Formation of committees for common property resource management, village pond maintenance and fishing;

    - Identifying the small business ideas (handloom, handicaraft, khadi, food products, etc.) for rural areas to make the people self-reliant.

    - Interactive with local leaders, panchayat functionaries, grass-root officials and local institutions regarding village development plan preparation and resource mobilization; 4
    - Financial Literacy Awareness Programme
    - Digital Literacy Awareness Programme
    - Education Loan Awareness Programme
    - Entrepreneurship Awareness Programme
    - Awareness Programmes on Government Schemes
    - Products Market Awareness
    - Services Market Awareness
    - Consumer Awareness Programme
    - Accounting Awareness Programme for Farmers
    - Accounting Awareness Programme for Street Vendors etc.

6. IMPORTANT RULES AND REGULATIONS FOR CEP:

Concurrent Fieldwork:

Students must conduct comprehensive studies on various challenges that they face in their chosen field. Every work relevant to the subject matter should be compiled and documented.

Students should keep separate fieldwork diary or maintain journal in order to record their fieldwork experiences i.e. reading, e- contents, tasks, planning and work hours have to be recorded in the diary. Detailed work records report on students' fieldwork experiences and activities to be submitted and should be presented. The fieldwork conference is part of the timetable and is mandatory. Faculty should hold a fieldwork conference FOREIGHTNIGHTLY for all students.

In addition to the principal curriculum, the students engage in a variety of community development-related activities. They are encouraged to plan and carry out programs, processions, and events for social causes. These activities seek to enhance students' personal and professional skills as well as foster self- development. "Rural Camp" should be embedded in the curriculum for first-year students to be held in the backward and neglected areas of District's

Concurrent Fieldwork is the core curriculum activity in the CEP course. Hence, 100% attendance of the students is mandatory in case of absence on any student, supplementary fieldwork must be arranged and accomplished with the approval of the faculty supervisor.

7. EVALUATION/ASSESSMENT SCHEME:

Students should keep a Field Diary / journal to record, content, readings and field visit planning. The assessment pattern is internal and external i.e. 40+10.

Internal continuous Assessment: Participation in concurrent field visits 40%; individual/group field project
conference, report/journal submission 40%.

External Assessment: Presentation of field project findings (VIVA) should be assigned 20%.

B.Sc. B.Ed. (Integrated) Four Years Programme Semester -IV
Paper Code: SSCCI-I, Content cum Pedagogy of Mathematics at Secondary Stage Course-II

Marks	**100**	**Credits**	**04**
Total Hours	**60**	**Hours Per Week**	**06**
Internal Exam Marks	**20**	**External Exam Marks**	**80**
		Duration of External Examination	**03 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. 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,
f. 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

Paper Code: SS-IV.

Title of the Paper: Environmental Studies-II

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.

TRANSACTIONAL MODE: Lectures Field visits and project

ESSENTIAL READINGS:

Environmental studies, Shivaji University, Kolhapur Gharpure T.N. (2000) 'Paryavaranshastra'
Parya varan Sahastra – Gharapure
Bharucha Erach, The Biodiversity of India, Mapin Publishing pvt. Ltd., Ahmedabad 380013, India, Email: mapin@icenet.net (R)
Brunner R.C.,1989, Hazardous Waste Incineration, McGraw Hill Inc., 480p Clank R.S. Marine Pollution, Clanderson Press Oxford (TB)
Cunningham, W.P. Cooper, T.H. Gorhani, E. & Hepworth, M.T.2001, Environmental Encyclopedia, Jaico Publ. Hpise, Mumbai, 1196p
De A.K., Environmental Chemistry, Wiley Wastern Ltd.
Down to Earth, Cebtre fir Scuebce and Environment (R)
Gleick, H.,1993, Water in crisis, Pacific Institute for studies in Dev., Environment & Security. Stockholm Env. Institute. Oxford Univ. Press 473p
Hawkins R.e., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R)
Jadhav, H.& Bhosale, V.M.1995, Environmental Protection and Laws, Himalaya Pub. Hcuse, Delhi 284p.
Mickinney, M.L.& School. R.M.1196, Environmental Science Systems & Solutions, Web enhanced edition, 639p.
Mhaskar A.K., Mastter Hazardous, Techno-Science Publications (TB) Miller T.G.Jr., Environmental Science. Wadsworth Publications Co. (TB)
Rao M.N.& Datta, A.K.1987, Waste Water Treatment, Oxford & IBH Publ. Co.
Pvt. Ltd., 345p
Sharma B.K., 2001, Environmental Chemistry, Gokel Publ. Hkouse, Meerut Survey of the Environment, The Hindu (M)
Trivedi R.K. Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, vol. I anfd II, Environmental Media (R)
Trivedi R.K. and P.K. Gokel, Introduction to air pollution, Tecgbi-Science Publications (TB)
Wagner K.D., 1998, Environmental management, W.B. Saunders Co.Philadelphia, USA 499p.