DEPARTMENT OF INTEGRATED TEACHER EDUCATION PROGRAMME (ITEP)

SYLLABI Integrated B.Sc.-B.Ed. Degree Course (Semester 1st & 2nd)

(Foundation of Education/ Ability Enhancement and Value added Courses)



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Course Curriculum Structure of the Four-Year Integrated Teacher Education Programme (ITEP)

Sr.	Curriculum	Course Title	Course Code	Hours		Credits	
No.	Component			/week			
				L	Τ	P	
Two	week Inductior	n Program					
1.	Foundation of	Evolution of Indian	HMMJ0101**	3	1	0	4
	Education	Education**					
2.	Disciplinary	Physical Chemistry-I*	CYMJ0101*	3	0	0	3
	Courses	Inorganic Chemistry-I*	CYMJ0102*	3	0	0	3
		Physical Chemistry Lab-I*	CYMJ0131*	0	0	2	1
		Mathematical Physics-I *	PHMJ0101*	3	0	0	3
		Mechanics*	PHMJ0102*	3	0	0	3
		Physics Lab-1*	PHMJ0131*	0	0	2	1
		Calculus*	MAMJ0101*	3	1	0	4
		Algebra*	MAMJ0102*	3	0	0	3
		Fundamentals of	ITCC0131**	0	0	2	1
		Information Technology					
		-1**					
3.	Ability	Punjabi Language**	HMMJ0102**	3	1	0	4
	Enhancement	Art (Performing and	HMMJ0103**	2	0	0	2
	and Value	Visual) & Creative					
	added	Expressions**					
	Courses	Understanding India (Indian	HMMJ0104**	2	0	0	2
		Ethos and Knowledge					
		Systems)**					
Total: 20							

1st Semester

Note: * Students can choose two major courses from Chemistry or Physics or Mathematics. **Common courses for all students.

2nd Semester

Sr.	Curriculum	Course Title	Course Code	H	Iour	•S	Credits
No.	Component			/week			
				L	Τ	P	
1.	Disciplinary	Inorganic Chemistry-II*	CYMJ0201*	3	0	0	3
	Courses	Organic Chemistry-I*	CYMJ0202*	3	0	0	3
		Organic Chemistry Lab-I*	CYMJ0231*	0	0	2	1
		Mathematical Physics-II*	PHMJ0201*	3	0	0	3
		Electromagnetism*	PHMJ0202*	3	0	0	3
		Physics Lab-2*	PHMJ0231*	0	0	2	1
		Differential Equations*	MAMJ0201*	3	1	0	4
		Real Analysis*	MAMJ0202*	3	0	0	3
		Elementary Mathematics- I***	MAMI0203***	3	0	0	3
		Physical Chemistry M-1***	CYMI0203***	2	0	0	2
		Electricity and	PHMI0203***	2	0	0	2
		Magnetism***					
		Physical Chemistry Lab	CYMI0232***	0	0	2	1
		M-1***					
		Physics Minor Lab-1***	PHMI0232***	0	0	2	1
		Fundamentals of	ITCC0231**	0	0	2	1
		Information Technology- II**					
		Fundamentals of Electronics**	ECCC0231**	0	0	2	1
2.	Ability	English Language**	HMMJ0201**	3	1	0	4
	Enhancement	Understanding India (Indian	HMMJ0202**	2	0	0	2
	and Value	Ethos and Knowledge					
	added	Systems)**					
	Courses	Teacher and Society**	HMMJ0203**	2	0	0	2
Total: 20							

Note: *** Students will continue with the major courses chosen in the 1st semester and can opt for one minor course out of Chemistry or Physics or Mathematics but not from the subject already taken as major.

**Common courses for all students.

Abbreviations: Institute's Codes pattern (ABCD-YLXX) is followed and is as under:

HM: Humanities and Management; **CY**: Chemistry; **PH**: Physics; **MA**: Mathematics; **IT**: Information Technology; **EC**: Electronics and Communication; **CC**: Common Course; **MJ**: Major; **MI**: Minor



ode: HMMJ0101 LT PC 3104

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2.0 FOUNDATIONS OF EDUCATION

2.1 Evolution of Indian Education

Credits: 4 Semester: S-1

2.1.1 About the Course

The course seeks to develop an understanding among student teachers of the evolution of education in India that would allow student teachers to locate themselves within the larger system of education. The course aims at orienting student teachers to the historical perspective of Indian education including the development and features of education in ancient India such as the Gurukuls, post-Vedic period, during Mauryan and Gupta empires, during colonial era and post-independence period, and future perspectives about education development in India, and progression from Education 1.0 to Education 4.0 etc. This course also provides an overview of the contribution of Indian thinkers to evolve Indian Education system – Savitribai and Jyotiba Phule, Rabindranath Tagore, Swami Vivekananda, Mahatma Gandhi, Sri Aurobindo, Gijubhai Badheka, Pt. Madanmohan Malaviya, Jiddu Krishnamurti, Dr. Bhima Rao Ambedkar and others.

2.1.2 Learning Outcomes

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

- discuss genesis, vision, and evolution of education in ancient India to the contemporary India,
- enable themselves to shape their educational perspective to act as an effective teacher.

UNIT - I

Ancient Indian Education: Vedic Period

- A. Vision, objectives and salient features of Vedic Education System.
- B. Teaching and Learning Process.
- C. Development of educational institutions: Finances and Management.
- D. Famous Educational institutions and Guru-Shishya.
- E. Education at the time of Epics: Ramayana and Mahabharata.

UNIT - II

Ancient Indian Education: Buddhist and Jain Period

A. Vision, objectives and salient features of Buddhist and Jain Education System.

- B. Teaching and Learning Process.
- C. Finance and Management of Educational Institutions.
- D. Educational Institutions: Nalanda, Taxila, Vikramshila, Vallabhi, Nadia.
- E. Famous Guru-Shishya.

UNIT - III

Post-Gupta Period to Colonial Period

- A. Vision, objectives, brief historical development perspective as well as salient features of Education in India.
- B. Teaching and Learning Process.
- C. Finance and Management of educational institutions.

UNIT - IV

Modern Indian Education

- A. Colonial Education in India
 - Woods Despatch, Macaulay Minutes and Westernization of Indian Education
- B. Shiksha ka Bhartiyakaran (Indigenous Interventions in Education)

(Bird's eye view of their contribution)

- Swadeshi and Nationalist attempts of educational reforms with special reference to general contribution of Indian thinkers
 - Savitribai and Jyotiba Phule, Rabindranath Tagore, Swami Vivekananda, Mahatma Gandhi, Sri Aurobindo, Gijubhai Badheka, Pt. Madanmohan Malaviya, Jiddu Krishnamurti and Dr. Bhima Rao Ambedkar others to the education systems of India.

C. Education in Independent India

- Overview of Constitutional values and educational provisions.
- Citizenship Education:
 - Qualities of a good citizen.
 - Education for fundamental rights and duties.
- Overview of 20th Century Committees, Commissions and Policies.
- UEE, RMSA, RTE Act 2009: Overview and impact.
- NEP 2020: vision and implementation for a vibrant India.

2.1.3 Suggestive Practicum

- 1. Prepare a report highlighting educational reforms with special reference to school education in the light of NEP 2020.
- 2. Critically analyze the concept of good citizen from the perspective of education for democratic citizenship.
- 3. Compare vision, objectives, and salient features of education during different periods.
- 4. Working out a plan to develop awareness, attitude and practices related to Fundamental Rights or fundamental duties or democratic citizenship qualities, execute it in the class and write the details in form of a report.
- 5. Sharing of student experiences (in groups) related to Indian constitutional values, 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.
- 6. Analyses of current educational strengths and weaknesses of one's own locality and work out a critical report.
- 7. Visit to places of educational significance and value centers and develop a project report.
- 8. Observation of unity and diversity in a social locality and matching it with unity and diversity in the class and work out a plan for awareness for national-emotional integration for class to develop awareness, attitudes, skills, and participatory values, execute it in the class and report the details.

2.1.4 Suggestive Mode of Transaction

The course content transaction will include the following:

- Planned lectures infused with multimedia /power-point presentations.
- Small group discussion, panel interactions, small theme-based seminars, group discussions, cooperative teaching and team teaching, selections from theoretical readings, case studies, analyses of educational statistics and personal field

engagement with educationally marginalized communities and groups, through focus group discussion, surveys, short term project work etc.

Hands on experience of engaging with diverse communities, children, and schools. .

2.1.5 Suggestive Mode of Assessment

The assessment will be based on the tests and assignments.

2.1.6 Suggestive Reading Materials

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

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5.1 Language 1 (As per the 8th Schedule of the Constitution of India)

Credits: 4 Semester: S-1

5.1.1 About the Course

Language has undeniable links with all kinds of learning. Language enables an individual to understand new concepts, exchange ideas and communicate thoughts with fellow beings. To appreciate fully the role of language in education, one must begin to develop a holistic perspective on language. Language needs to be examined in a multi-dimensional space, giving due importance to its structural, literary, sociological, cultural, psychological, and aesthetic aspects. The National Education Policy 2020 envisages imparting language skills as part of holistic education. It lays thrust on the need to enhance linguistic skills for better cognitive development and the development of a rounded personality of the learners. This course aims at enabling student teachers to enhance their ability to listen, speak, read, write and demonstrate linguistic skills in an effective manner. Linguistic skills - listening, speaking, reading, writing, speaking effectively - are fundamental to constructing knowledge in all academic disciplines, and, participating effectively in the world of work and creating sense in the everyday life. Through this course, the students will be able to enhance proficiency in reading with comprehension, understanding, thinking, and conceptualizing. The course seeks to enhance critical thinking abilities and effective communication skills of student teachers. The course involves hands-on activities and practical sessions that help student teachers develop and use linguistic skills in a variety of situations.

5.1.2 Learning Outcomes

After completing the course, the student teachers will be able to:

- Demonstrate knowledge and capacity for effective listening, speaking, reading, writing and critical thinking.
- recognize the link between language and cognition and using linguistic knowledge and skills for effective communication of ideas and thoughts.
- build inter-personal relationships and enhance social skills.

UNIT - I

Understanding Language, Communication and Cognition

- A. Language, communication, and cognition; Definitions and functions of language. Types of communication, Language, culture and society, Bi-/Multilingualism in India, Language learning, translation, formal and informal communication, verbal and non-verbal communication, gestures language skills (listening, speaking, reading, & writing) and the new-age technologies. Language as a means of communication and language as a medium of cognition.
- B. Nature and process of communication: principles, Definition, and types; Language: Definition, characteristics, functions; Language and society: language variation, language and dialect, language policy and language planning, language standardization; Multilingualism in Indian context, Language as a means of communication and language as a medium of cognition.
- C. The process of communication, barriers to communication, written and oral

Code: HMMJ0/02

LTPC

communication, the story of human communication from early times to new age; Language variation, Multilingualism.

D. Context of communication, the role of decoder, face to face interaction, turn taking, conversation, politeness principles, opening and closing, regional variation, social variation, the standard language.

UNIT - II

Understanding Grammar

- A. Classification of speech sounds and letters, stress, pitch, tone, intonation and juncture, parts of speech, identification of morphemes, word formation processes, sentences-simple, complex, and compound, semantics and pragmatics, lexical semantics, speech acts.
- B. Production of speech sounds in languages; Suprasegmentals: stress, pitch, tone, intonation; Word formation processes; Sentence formation, semantics, and pragmatics.
- C. Identification of morphemes, word formation processes; Sentence formation, vocabulary formation; Pragmatics and speech acts.
- D. Sound production in the language; Coining new words, Speech acts.

UNIT - III

Reading Skills

- A. Reading comprehension, types of reading, text, meaning and context, reading as an interactive process; strategies for making students active readers and developing critical reading skills; Understanding denotative and connotative aspects of a text, Vocabulary development through reading.
- B. Features that make texts complex, reading as an interactive process; Strategies for making students active readers and developing critical reading skills; Understanding denotative and connotative aspects of a text, Vocabulary development through reading.
- C. Reading discipline-based texts; vocabulary development

UNIT - IV

Writing Skills

- A. Speech versus writing; Types of writing; writing for specific purposes (essays, letters, and reports).
- B. Language and style of Writing; Dealing with New Words (Academic Vocabulary Building)
- C. Summarizing and Paraphrasing techniques.

UNIT - V

Speaking skills

- A. Speaking to learn and learning to speak; situational conversations and role plays; tasks/activities for developing speaking (speech, elocution, discussion, debate, storytelling, illustrations).
- B. Activities for developing speaking, role play; The impact of culture on speaking.
- C. Presentation and speaking skills; Practicing narrative skills; Body language, voice, and
- pronunciation; Creating interest and establishing a relationship with the audience.

UNIT - VI

Listening Skills

- A. Why listening is important; kinds of listening; Listening strategies.
- B. Need for modelling good listening behaviour; Listening across the curriculum, note taking.
- C. Listening Comprehensions and Recorded speeches/texts; Understanding of various accents.

UNIT - VII

Academic writing

- A. Academic writing components; development of academic language; Activities to develop academic writing skills.
- B. Developing Critical, analytical, and interpretive thinking skills.
- C. Learning to analyze.

UNIT - VIII

Critical thinking

- A. Enhancing Critical thinking abilities; Critical Interpretation, Questioning and Challenging your Beliefs and Values; developing ideas and evaluating an argument.
- B. Observing a problem, describing the problem, framing the problem, comparing, and evaluating a problem.

5.1.3 Suggestive Practicum

- 1. How do you interpret every day and reflect what you read? Prepare a report.
- 2. Analyze a recorded video from the perspective of voice and pronunciation and write a report.
- 3. Observing, describing and frame a problem and evaluating it.

5.1.4 Suggestive Mode of Transaction

Teaching this course will involve a mix of interactive lectures, tutorials, and practical involves such as discussion, role plays, projects, simulations, workshops, and language-awareness activities. The teaching intends deeper approaches to learning involving in- class room discussion, developing the critical thinking/ problem solving abilities among the students and will also focus on situations where in our daily lives the one would be performing tasks that involve a natural integration of language skills. The students are expected to read assigned chapters/ articles before the session and the course requires active participation from the students.

5.1.5 Suggestive Mode of Assessment

The assessment of the learner will be primarily based on the assessment of both linguistic and communicative skills using a battery of tests and test types, group work and projects.

5.1.6 Suggestive Reading Materials

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

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Code: HMMJ0103 LTPC 2002

5.3 Art Education (Performing and Visual) and Creative Expressions Exemplar 1 - Puppetry

Credits 2 Semester S-1 and S-7

5.3.1 About the Course

Engagement with various forms of art as self-expression and need to develop sensibility to appreciate them has been an important concern in educational theory and practice. This concern is premised on the claim that forms of self-expression contribute immensely to the development of cognitive, affective, and psycho-motor dimensions among children, as well as that through one or another art form, children come to explore ways of expressing themselves. Further, it is also the case that critical appreciation of art enables children to form judgments of a very special kind, namely, aesthetic judgment. This enables students as they grow into adults to have focused attention on making sense of and appreciating cultural productions.

Children enjoy artwork a lot. They explore and find meaning in artwork. Their psycho-motor skills get developed through art. The huge element of socialization is acquired through different forms of art. They get to know each other and understand each other and make friends through art. They develop their peer group through getting involved in art forms. Learning to work with others is also achieved through art. It gives them space to think independently, create and reflect. It is one space where all the three are involved- hand, head, and heart.

Therefore, educational practitioners that the students of MA Education aim to be, will need to bring an element of art in practices that they engage in. To be able to do this, they need an appreciation of art in general, familiarity with one art form, and basic skills and capabilities to be creative and artful. Additionally, they should be familiar with some critical debates in art education, even if their work is in other subject areas.

To this end in the first semester students will do one course that aims to help them recognize and appreciate the importance of aesthetic judgment, develop familiarity with an art form and basic skills to be creative and artful in their expressions. Skills develop from practice, therefore hands-on training in doing art will be emphasized in this course. This course aims to help students develop a habit of performing skillful activities that are essentially aesthetic and artful which is expected to contribute to other educational practices that they develop in other courses in the programme. Therefore, this course will explicitly relate this skill to activities that practitioners of education engage in, like teaching, development of teaching-learning material, and content of other subject areas wherever possible.

Puppetry

Puppetry is an integrated art form, which takes into its fold everything from fine arts to performance. Puppetry is one of the oldest forms of performing art. Puppetry has evolved over the years into a sophisticated form of art. The journey was very interesting with a lot of ups and downs. There are thousands of forms of puppetry from simple finger puppets to highly complex puppets played by more than 3 people. Each country has a puppet form, why country, each area in a country has a puppet form. Hence, in India you will find many, many forms of puppetry. In puppetry there are two main aspects. One the designing and creating of puppets and the other playing or performing puppetry. These two skills are different. Designing will need a lot of thinking, visualization, and technical skills while performance will need high level

communication skills. Hence, together they make a consolidated a high range of skills. In this course, students are exposed to different forms of puppets and puppetry. There will be a discussion around the forms and the aesthetic sense of puppetry. Later the students are encouraged to prepare, design and create puppets. They then prepare script and play the puppets. This creation of the puppets together in small groups with a lot of discussions and give and take helps the students develop working together skills and conceptual understanding.

Learning Outcomes

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

- articulate the importance of aesthetics and art in elementary education,
- demonstrate their familiarity with and appreciation of puppetry,
- design puppets,
- practice and create a short puppetry show.

UNIT - I

Importance of Aesthetics and Art education (2 Sessions)

In this unit the basic idea of aesthetics and art, and ways in which the aesthetic dimension manifests itself in human life will be discussed. Using various examples of art, students will engage in identifying aesthetic aspects of daily life, develop aesthetic judgment, and gain familiarity with the role of art in education. Students will also be introduced to three aspects of art in education: The value of art itself and its use as an instrument in education; moral dimensions of works of art and the controversial distinction between the value of Popular art and High art.

UNIT - II

Designing Puppets (6 Sessions)

In this unit, students will learn about puppetry, its history and specifically about how puppets work. This unit will also discuss the imagination required to design puppets, visualize how puppets will be used and the technicalities of designing puppets. These will be learnt by designing puppets. Students will start with constructing finger puppets and move towards small shapes through papers, like Fish, birds, rat - then they will design masks, flat masks, and masks with dimensions. At the end they will design puppets with old newspaper. The puppets are designed with old newspapers and colour papers. They decorate it and design it in such a way that it can be played, performed. They prepare costumes and all other accessories.

UNIT - III

Performing the puppets (4 Sessions)

This unit will engage in performance of puppetry and the level of communication skills required to create a good engaging story and perform it with the help of puppets they have created. The performance will be expected to relate to some activity in the educational context. Students will perform the puppets they have designed. Initially each member will play their own puppets. Later they will play in pairs, later they will be formed into a small group and asked to prepare their own skits with the puppets. They conclude by performing in small groups. Their learning is consolidated and reflected.

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Discussion is held on how different aspects of puppet making can be incorporated in class room processes of young children. Adapting the individual and group exercises done during the puppetry course will be discussed to be used in the classroom situation.

The Pedagogy is basically hand-on training. More emphasis is given to experiential learning. They do things and through doing learn about art and its connection to education. The process takes you through different forms of art- fine arts, playing with colours, costume designing, facial make -up, script writing, music, and performance.

5.3.4 Suggestive Mode of Assessment

Details to be determined by the faculty member as per applicable UGC norms

Week wise break up of sessions		Session flow		Remarks
Sl. no	Topics	Dead	their	
1	Aesthetics and art, art in everyday life.	experience	then	
2	Importance of art. Appreciation of art.	Discussion		
3	Art for art sake. Art with social responsibility, art for social change	Debate		
4	The world of puppetry. Different forms	Presentations		*
5	History of puppetry	Lecture	•	
6	Preparation- finger puppets	Hands on		
7	Preparation of masks	Hands on		
0	Prenaring nunnets	Hands on		
0	Performing individually	Practice		
9	Derforming in pairs	Practice		
10	Performing in groups - 3, 4, 5.	Practice		
11	Assignments	Written.		

5.3.5 Suggestive Reading Materials

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

5.3 Arts (Performing and Visual) and Creative Expressions **Exemplar 2 - Theatre**

Credits 2 S-1 and S-7 Semester

5.3.1 About the Course

The engagement with various forms of art as self-expression and the need to develop a sensibility to appreciate them has been an important concern in educational theory and practice. This concern is premised on the claim that forms of self-expression contribute immensely to the development of cognitive, affective, and psycho-motor dimensions among children, as well as that through one or another art form that children come to explore ways of expressing themselves. Further, it is also the case that critical appreciation of art enables children to form judgments of a very special kind, namely, an aesthetic judgment. This enables students as they grow into adults to have focused attention on making meaning of what surrounds them and in appreciating cultural productions.

Children are naturally tuned to appreciate art, as it activates their senses. Further, their psychomotor skills get developed through art. It gives them space to think independently, create and reflect, while working with others. It is a unique space where all the three are involved- hand, head and heart.

Therefore, students who aim to be educational practitioners, will need to bring an element of art in educational practices that they engage in. To be able to do this, they need an appreciation of art in general, familiarity with one art form, and basic skills and capabilities to be creative and artful.

To this end in the first semester students will attend one course that aims to help them recognize and appreciate the importance of aesthetic judgment, develop familiarity with an art form and basic skills to be creative in their expressions. Skills develop from practice, therefore hands on training in doing art will be emphasised in this course. This course aims to help students develop a habit of improvising on theatrical performances that include following aesthetic judgement at all stages, which will contribute to other educational practices that they develop in the larger programme. Therefore, this course will explicitly relate this skill to activities that practitioners of education engage in, like teaching, development of teaching-learning material, and also producing content of other subject areas wherever possible.

Theatre

Theatre is a collaborative art form, and it is inherently interdisciplinary in its nature. It comprises many facets and skills like acting, directing, writing, designing the sets and costumes, make-up, production, lights, sounds and music. All these elements and skill sets come together and are stitched in the form of a 'play' which is performed live, in front of an audience. In the Indian context, theatre has a deep-rooted history with its classical, folk, and other cultural forms until other contemporary forms of theatre evolved in recent times.

Theatre education for children can play a vital role in their individual, social, and emotional development. It teaches them the values of trust and interdependence, makes them confident to express themselves and helps them learn to work in a collaborative environment. It develops their ability to contextualise, critique and discuss certain questions and thoughts they encounter in everyday life. It further helps them imagine, explore, and create their own narratives.

In this course, we will briefly talk about the aesthetics of theatre and how theatre exists in different forms. The students will learn some basic theatre tools that will help them create and perform a narrative they collaboratively arrive at.

In simple terms one can say theatre has two major aspects i.e., creating the script and then performing it. Body is the primary instrument in any theatrical performance accompanied by text, material, visual and sound. This course will introduce students to these aspects of any theatre performance, in the form of direct experience by doing this themselves.

5.3.2 Learning Outcomes

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

- articulate the importance of aesthetics and art in elementary education,
- demonstrate their familiarity with and appreciation of theatre,
- learn basic theatre tools of improvisation, ideation, and creation of a script,
- create a short performance with educational possibilities.

UNIT - I

Importance of Aesthetics and Art education (2 Sessions)

In this unit the basic idea of aesthetics and art, and ways in which the aesthetic dimension manifests itself in human life will be discussed. Using various examples of art, students will engage in identifying aesthetic aspects of daily life, develop aesthetic judgment, and gain familiarity with the role of art in education. Students will also be introduced to three aspects of art in education: The value of art itself and its use as an instrument in education; moral dimensions of works of art and the controversial distinction between the value of Popular art and High art.

UNIT - II

Introduction to Theatre, and Beginning with the body (3 Sessions)

We will discuss some core essentials in the aesthetics of theatre like the performance, the makers, the audience, and the context and how we relate this to the world around us, in everyday lives. In this unit, we will discuss examples of how theatre was used in social movements that have contributed to educating the larger population about important social issues. Additionally, we will also learn from practices and approaches of theatre groups like Budhan Theatre who work with denotified tribes, and Manalmagudi who work closely with physical nonverbal theatre. Exposing students to these approaches will lead to rich discussions on the role of theatre in pedagogy and practice.

In this unit, students will learn certain principles and awareness on how to use their body and voice in a given space and time, with respect to other bodies. There will be several games, exercises that will familiarise them with certain basics of movement, voice, acting and thereby create improvisations and images in a given context. The activities and tasks will be both in individuals and groups.

UNIT - III Arriving at a script (3 Sessions)

We will engage in some theatre making processes to arrive at a script by the end of this unit. How to adapt or devise a script with actors? How can we borrow from everyday experiences of memory, sound and visuals, without a written text or spoken word? Plays, stories, poems, newspapers articles, will be shared to read, reflect, analyse, and re-create like "Why, why Girl" by Mahashweta Devi, "Ratna Pakshi" by K Ramaiah, "Beyond the land of Hattamala and Scandal in Fairyland" by Baadal Sircar, and songs of Kabir etc. The texts chosen will have a direct relation with topics from social studies, moral and political education.

Students will use their skills of improvisation they learned in Unit 2 to explore, ideate, create, and finally arrive at a script. What kind of stories, narratives, and characters they choose to perform will lead back to the discussion of aesthetics. Students will mostly work in groups to choose or create a text, concept, or an idea which they want to perform. Students will be encouraged to use their perspectives on the education system, in converting the text into a script.

UNIT - IV Performing the script

This unit will engage in the actual making of the final piece they choose to make. Students will have to visualise the final text on stage and start rehearsing in their groups. Apart from using their bodies to play characters, the students will also have to think about design and other aesthetic elements like sets, props, costumes, lights, music and sounds they want to use in the performance.

Students will have to practice beyond the six classes as the class time will be utilised to discuss and provide feedback as the work progresses. The last two classes in this unit will be utilised for the final rehearsals and assessments. The final performance will take place in front of a small audience followed by a brief post-performance discussion. Students will engage in discussing and reflecting on the views, questions and comments shared by the audience.

5.3.3 Pedagogy

The pedagogy is basically hands-on training. More emphasis is given to experiential learning. They do things and through doing, they learn about art and its connection to education. The process takes you through different forms of art- fine arts, playing with colours, costume designing, facial make -up, script writing, music, and performance.

5.3.4 Suggestive Mode of Assessment Details to be determined by the faculty member as per applicable UGC norms.

Week wise break up of sessions				
Week	Topics	Session flow		
1	UNIT - I: Aesthetics and art, art in everyday life. Importance of art. Appreciation of art	Based on their experience		
2	Art for art's sake. Art with social responsibility. Art for social change	Discussion		
3	UNIT 2: Aesthetics of Theatre	Discussion .		
4	Body work - Individual and group	Hands on		
5	Body work – Improvisation	Hands on		
6	UNIT - III: Adaptation of texts. Aesthetic choices.	Hands on, discussion		
7	Story making and devising	Hands on		
8	Arriving at a text	Hands on		
9.	UNIT - IV: Visualising the final piece. Thinking about design and aesthetic elements.	Hands on, Discussion		
10.	Rehearsals and feedback	Hands on		
11.	Rehearsals and feedback	Hands on		
12.	Final rehearsals and assessment			
13.	Finals rehearsals and assessment			
14.	Performance and audience discussion			

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

5.3 Arts (Performing and Visual) and Creative Expressions Exemplar 3 - Collage-Making

Credits 2 Semester S-1 and S-7

5.3.1 About the Course

Engagement with various forms of art as self-expression and the need to develop sensibility to appreciate them has been an important concern in educational theory and practice. This concern is premised on the claim that forms of self-expression contribute immensely to the development of cognitive, affective and psycho-motor dimensions among children, as well as that through one or another art form, children come to explore ways of expressing themselves. Further, it is also the case that critical appreciation of art enables children to form judgments of a very special kind, namely, aesthetic judgment. This enables students as they grow into adults to have focused attention on making sense of and appreciating cultural productions.

Children enjoy artwork a lot. They explore and find meaning in artwork. Their psycho-motor skills get developed through art. The huge element of socialization is acquired through different forms of art. They get to know each other and understand each other and make friends through art. They develop their peer group through getting involved in art forms. Learning to work with others is also achieved through art. It gives them space to think independently, create and reflect. It is one space where all the three are involved- hand, head, and heart.

Therefore, educational practitioners that the students aim to be, will need to bring an element of art in practices that they engage in. To be able to do this, they need an appreciation of art in general, familiarity with one art form, and basic skills and capabilities to be creative and artful. Additionally, they should be familiar with some critical debates in art education, even if their work is in other subject areas.

To this end, students will do one course that aims to help them recognize and appreciate the *importance of aesthetic judgment, develop familiarity with an art form* and basic skills to be *creative and artful in their expressions*. Skills develop from practice, therefore hands-on training in doing art will be emphasized in this course. This course aims to help students develop a habit of performing skillful activities that are essentially aesthetic and artful which is expected to contribute to other educational practices that they develop in other courses in the programme.

Therefore, this course will explicitly relate this skill to activities that practitioners of education engage in, like teaching, development of teaching-learning material, and content of other subject areas wherever possible.

Collage as visual art medium

A major aspect of college, and one that is sometimes overlooked, is the incredibly diverse array of materials and objects that can be used. Collecting interesting materials is an ongoing activity for artists and for those who teach college. But it is just as important for young people to hunt for and make decisions about materials they would like to incorporate into their work. All materials, and the alterations that artists make to them, are suggestive of ideas and concepts based on their surfaces, forms, textures, degree of transparency and opacity, color, and other visual characteristics. Materials also connect us, through association and reference, to social and cultural worlds and places. What ideas might a scrap of newspaper, as a collage material, express? How might these meanings differ from those of, say, feathers? Or twigs? Or a thin piece of plastic cut out from a plastic bag?

Working with and creating artwork in Collage involves various aspects: selecting materials, manipulating materials, investigating materiality, closely observing materials, discovering possibilities, composing, designing the artwork, planning, finding solutions, applying solutions, thinking flexibility, decision-making, research, using imagination, expressing, taking creative risks, develop perseverance, and much more. Students will also be introduced to various aspects of art in education: The value of art and artmaking by itself, art's use as an instrument in education, social and moral dimensions of art, and the controversial perceptions around good art and bad art.

This course aims for students to understand the importance of aesthetics and art in education, the role art can play in education, and mainly to appreciate, understand and gain skills with the medium of collage and its techniques.

5.3.2 Learning Outcomes

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

- articulate the importance and the role of aesthetics and art in education.
- understand the medium of collage and its versatility.
- design, plan, and create an expressive self-portrait collage by applying a variety of collage techniques.
- design and set up an interactive visual art exhibition to display their artworks.
- understand and appreciate art-based learning experiences.
- develop the ability to reflect and challenge their assumptions and beliefs around art and develop new understandings.

UNIT - I

Understand the importance of Aesthetics and Art in Education (2 Sessions)

Students will be introduced to Aesthetics and Arts by engaging in experiences, discussions, and dialogues. Students will experience a session of 'Visual thinking strategy' (VTS) activity in which students will collectively view and engage in a series of artworks closely, share their observations, critically analyze their observations, listen to multiple perspectives from peers, suspend judgements, and draw their own understanding of the artwork. Students will recognize aesthetic and un-aesthetic experiences through compare and contrast. Through this activity and unpacking of the experience, students will start making connections and develop understandings around what aesthetics mean, aesthetic aspects of daily life, develop aesthetic judgment, and how arts evoke emotion and awaken.

UNIT - II

Exploring paper collage and its techniques (4 Sessions)

Students will be introduced to the medium of collage and open their minds to the possibilities within this medium. Students will view and discuss examples of collage artworks, artist process and artist interview videos. Students will get a chance to compare and contrast various ways collage as a medium is used. Students will reflect upon their own past art educational experiences and observations and engage in dialogue and discussions. Students will analyze effective and ineffective ways of using the medium of collage in educational and other settings.

Through inquiry-based participatory demonstrations, students will investigate and discover a variety of ways to manipulate paper and create individual and unique two-dimensional compositions in the medium of paper Collage. They will understand and learn the techniques, artistic terminologies of the collage medium. Students will reflect on their experience and engage in facilitated discussions to deepen their understanding on the role of art medium exploration and how it can foster various learning skills.

Students then use their knowledge and experience from the previous sessions and explore collage as a medium further. Students will investigate, discover, and learn to create visual textures, physical textures, and create their own unique patterns. They will understand the difference between textures and patterns. Students will use a variety of techniques to create unique textures and patterns, analyze their findings, give each other feedback, work in groups to problem solve, etc. They will understand how art medium explorations can be used as a pedagogical tool in learning environments.

Students will bring in various materials found around them like different kinds of paper, paperbased materials, natural materials, fabric, and explore these materials and use them as materials to create collage compositions. Students will explore a wide range of techniques and discover their own ways to manipulate these found materials to create interesting textures and patterns. Students will work in groups, problem solve, investigate, develop solutions on their own, and share their findings with each other. Through discussions, students will reflect upon this exploration experience and understand how art making processes can develop skills and abilities in a learner.

Resource Videos

- 1. Works of Deborah Roberts, William Kentridge, Wangechi Mutu, etc
- 2. Marc, Cut paper collage artist <u>https://www.youtube.com/watch?v=WgRZlWl-Oh0</u>
- 3. G. Subramanian: Collage art https://www.youtube.com/watch?y=ioRRi9R46a0
- 4. Amber Fletschock, Collage artist https://www.youtube.com/watch?v=aa7p1vYqUc4
- 5. Arturo Herrera, artist https://www.youtube.com/watch?v=Oagx3 NZ5HU

UNIT - III

Ideating for an Expressive Self-Portrait (2 Sessions)

In this session students will further explore and discover possibilities in Collage as a medium. Students will learn a variety of ways to make paper stands and create interesting paper sculpture compositions using 3D techniques. Students will draw from their previous experiences of using paper for 2D explorations and add more interest to their unique 3D explorations. Students will share their findings with peers and widen their understanding about the possibilities. Students will reflect on all the material exploration sessions thus far and participate in a facilitated dialogue around art making and education.

Students will engage in a close observation sketching and drawing activity. Through a guided process, students will create a well observed self-portrait drawing. Students will engage in discussions and dialogue to unpack the self-portrait drawing experience, the learnings, discoveries, challenges and more. Through this activity students will also be able to challenge assumptions around talent and art-making.

Resources: Handouts out on Collage techniques and artist examples Resources: JR's Face to face project (videos and red https://www.youtube.com/watch?v=4u G0G6Jog4

readings)

UNIT - IV

Creation of an Expressive Self-Portrait Collage (3 Sessions)

Students will engage in a step-by-step process involving sketching, ideating, planning, applying their discoveries of using paper as a collage material, and finally create a large expressive self-portrait using the medium of paper collage. Throughout the process students will problem-solve, critically think, push their imagination, find multiple solutions, make independent decisions, receive and give peer feedback, use resources effectively, draw from their own experiences, apply their learnings into creating this unique and expressive self-portrait piece.

UNIT - V

Designing and setting up an Exhibition (2 Sessions and Exhibition Day)

Students will collectively start designing and planning for the exhibition to put up their artworks for a general audience to view and engage with. Students will be planning the various aspects of a visual art exhibition: ways to display artworks, designing the layout of the exhibition space and how the audience will move within the space, design invitations, ways that the audience can engage with the artworks, various ways the artists can talk about their art-making, and more. Students will divide the tasks among themselves, take on the various roles required, and set up the exhibition space.

Resources: Planning templates

5.3.3 Pedagogy

- Students will engage in hands-on art making activities.
- Students will engage in discussions and dialogues with peers.
- Students will engage in giving and receiving peer feedback.
- Students will continually reflect on their learning through journaling.
- Students will work independently and collaboratively throughout the course.
- Students will receive reference materials and resources to broaden and deepen their understanding.

5.3.4 Suggestive Assessment

Details to be determined by the faculty member as per applicable UGC norms.

5.3.5 Suggestive Reading Materials

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

Code: HMMJOloy LTPC 2002

5.4 Understanding India (Indian Ethos and Knowledge Systems)

Credits 2 Semester: S-1

5.4.1 About the Course

At a time when the world finds itself deep in dynamism, led by technological innovations and environmental changes, there is a need for an inward-looking approach to building the young minds of a country. By looking inwards, one not only finds a sociological belongingness but also a spiritual and intellectual rooting in these changing times. The course provides an overview of India's heritage and knowledge traditions across key themes of economy, society, polity, law, environment, culture, ethics, science & technology, and philosophy. It places special emphasis on the application of these knowledge traditions, helping students to noy only know and appreciate India's heritage and knowledge traditions but also to independently evaluate them through a multidisciplinary lens. This evaluation would produce valuable lessons for obtaining transferable and 21st-century skills. The course requires no pre-requisite knowledge or understanding. Spread over two years, the course will establish foundational knowledge and build upon it. It will allow students to have a basic understanding of the traditions of India and how it has evolved over the years. The course is designed to enable student teachers to outline and interpret the processes and events of the formation & evolution of knowledge of India through a multidisciplinary lens; to evaluate the diverse traditions of India to distinguish its achievements and limitations, and to develop and articulate an ethics-based education rooted in Indian thought to their students in the classroom context.

5.4.1 Learning Outcomes

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

- recognize the vast corpus of knowledge traditions of India, while developing an appreciation for it,
- apply their acquired research and critical thinking skills in multidisciplinary themes,
- summarize and pass on their learnings to their students of different Indian traditions in an easily digestible manner.

UNIT - I

Introduction to the Knowledge of India

A. Definition & scope; Relevance of this knowledge.

B. Need to revisit our ancient knowledge, traditions, and culture.

UNIT - II

Culture - Art and Literature

- A. Fine arts (traditional art forms, contemporary arts, arts & spirituality, arts and Identity, and art and globalization);
- B. Performing Arts (Indian dance systems, traditional Indian pieces of music, visual arts, folk arts, etc.,).
- C. Literature (Sanskrit literature, religious literature, Indian poetry, folk literature, Indian fiction, Sangam literature, Kannada, Malayalam literature, Bengali literature, etc.

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UNIT - III

Polity and Law

- A. Kingship & types of government (oligarchies, republics); Local administration (village administration);
- B. Basis of Law: Dharma & its sources; Criminal Justice: police, jails, and punishments; Lessons from Chanakyaniti; Lessons for modern-day India: Towards a tradition-driven equitable and just polity and law system.

UNIT - IV

Economy

- A. Overview of the Indian Economy from the Stone Age to the Guptas: The new culture of Urbanization (including castes, guilds, and other economic institutions; Harappan civilization economy; growth of agriculture and proliferation of new occupations; growth of writing);
- B. Internal & external trade and commerce, including trade routes, Indo-roman contacts, and maritime trade of South India; Temple economy.
- C. Land ownership land grants & property rights, land revenue systems.
- D. Understanding Arthashastra: Ideas & Criticism; Locating relevance of ancient Indian economic thought in modern-day Indian Economy.

UNIT - V

Environment & Health

- A. Understanding Equilibrium between Society & Environment: Society's perceptions of natural resources like forests, land, water, and animals.
- B. Sustainable architecture & urban planning; Solving today's environmental challenges (best practices from indigenous knowledge, community-led efforts, etc.).
- C. India's Health Tradition: Ayurveda, Siddha, Ashtavaidya, Unani, and other schools of thought; Lessons from Sushruta Samhita and Charaka Samhita;
- D. Mental health in ancient India: towards time-tested concepts of mental wellness (concept of mind, dhyana, mind-body relationship, Ayurveda, yoga darshan, atman, etc.)

5.4.3 Suggestive Practicum

The modes of curriculum transaction will include lectures, Tutorials, and Practicum.

• Practicum will include organization of day trips that help student teachers watch events relating to visual and performing art; activities that enable student teachers to identify and record through photos, videos, etc. the elements of ancient architecture still existing in the city around them; organisation of Individual and group presentations based on themes such as Polity, Law and Economy etc., organisation of a 'Knowledge of India' day in the institution to celebrate the culture (food, clothes, etc.) that they would have been explored in lectures and tutorials; interactions with family members, elders, neighbors, and other members of society about the evolution of local systems and economy etc.

5.4.4 Suggestive Mode of Transaction

• Lectures will include learner-driven participatory sessions, and Guest lectures through experts and practitioners, such as fine arts and performing arts practitioners along with contemporary poets & writers of Indian literature.

• Tutorials will include Screening of documentaries and films followed by a discussion; Learner-driven discussions in the form of focus group discussions (FGDs), Socratic Discussions, etc.; Debate/discussion can be organized to explain India's Vaad tradition; discuss on how some of the ancient methods of teaching are relevant in today's time; discussions that help Identify ethical dilemmas in daily lives and understanding the importance of ancient ethics and values to resolve them.

5.4.5 Suggestive Mode of Assessment

The approaches to learning assessment will include, for example:

- Supporting the curiosity and interest of student teachers in the selected themes through a multi-modal approach, including regular assessments and actionable feedback that enable learners to outline and interpret the processes and events of the formation & evolution of knowledge of India through a multidisciplinary lens.
- Enabling the student teachers to demonstrate critical analysis and independent thinking of the processes and events in the formulation & evolution of different traditions that help student teachers evaluate the diverse traditions of India to distinguish its achievements and limitations.
- Use of first-hand or second-hand experiences that enable student-teachers to develop and articulate an ethics-based education rooted in Indian thought to their students in the classroom context.

5.4.6 Suggestive Reading Materials

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



5.2 Language 2 (Other than L1)

Code: HMMJ0201 L.T. PC 3 104

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Credit	4		
Semester	S-2		

5.2.1 About the Course

The course aims to prepare the students to teach language at the school level. It focuses on training the students to the sounds systems of languages, word formation processes, sentence formation, semantic and pragmatic aspects of languages. The course intends to enable the learners to integrate all the four language skills using different genres. The major aim of this course is to empower the learners to contribute to the discourses on various issues and themes. The course also orients the students to the use of different technology and digital media for developing their own communicative skills as well as the school students they would teach in the future. The course helps improve basic communication skills such as listening, speaking, reading, and writing skills among L2 language learners. The course is designed to enhance knowledge of grammar of L2 and enable the students to formulate grammatically correct and contextually appropriate sentences and words and empower the students with summarizing skills, oral presentations skills effectively. The course also seeks to enhance students' critical thinking capacities and demonstrate effective communication skills and provide hands-on activities to student teachers to develop their linguistic skills through practical sessions.

5.2.2 Learning Outcomes

After completing the course, student teachers will be able to:

- demonstrate reading, writing, listening, speaking, and thinking abilities in L2,
- recognize the link between language and mental skills and demonstrate their knowledge and skills effectively for all purposes,
- build inter-personal relationships and enhance social skills.

UNIT - I

Language, Society, and learning

- A. Bi-/Multilingualism and scholastic achievements; need to promote multilingualism; Language variation and social variation; languages, dialects and varieties, cultural transmission of language, language, and gender; language and identity; language and power; constitutional provisions and National Education Policy 2020.
- B. Language acquisition and Language learning; language learning from mother tongues to other tongues; advantages of learning other languages; language and education; notion of first language, second language and others.

UNIT - II

Speech and Writing

- A. Writing Systems: Speech and writing; arbitrariness in language; types of writing systems.
- B. Classification sessions of speech sounds: vowels, consonants, and others; suprasegmental: stress, pitch, tone, intonation, and juncture; Acoustic phonetics.

UNIT - III

Understanding Grammar

- A. Word and meaning; parts of speech, grammatical categories; word formation: affixation, compounding, reduplication, vocabulary building.
- B. Sentence and its constituents: simple, complex, and compound sentences; Semantics and pragmatics: lexical meaning- synonymy, antonymy, meronymy, grammatical meaning, speech acts.

UNIT - IV

Basic Communication Skills in L2

- A. Pronunciation and listening comprehension skills.
- B. Reading and reading comprehension skills.
- C. Effective writing skills; effective presentation and speaking skills; summarizing and paraphrasing skills.

UNIT - V

Critical Reading and Thinking Skills

A. Components of critical thinking and reading; high order cognitive development; critical thinking and problem solving; rational inquiry.

5.2.3 Suggestive Practicum

- 1. Listen to a recorded speech and classify it based on sounds: vowels, consonants, and others; suprasegmental: stress, pitch, tone, intonation, and juncture; Acoustic phonetics.
- 2. Analyze sentences and their constituents as simple, complex, and compound sentences from written work.

5.2.4 Suggestive Mode of Transaction

Teaching this course will involve a mix of interactive lectures, tutorials, and practical involves such as discussion, role plays, projects, simulations, workshops and language-awareness activities. The teaching intends deeper approaches to learning involving in- class room discussion, developing the critical thinking/ problem solving abilities among the students and will also focus on situations where in our daily lives the one would be performing tasks that involve a natural integration of language skills. The students are expected to read assigned chapters/ articles before the session and the course requires active participation from the students.

5.2.5 Suggestive Mode of Assessment

The assessment of the learner will be primarily based on the assessment of both linguistic and communicative skills using a battery of tests and test types, group work and projects.

5.2.6 Suggestive Reading Materials

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

5.4 Understanding India (Indian Ethos and Knowledge Systems)

Credits 2 Semester: S-2

5.4.1 About the Course

At a time when the world finds itself deep in dynamism, led by technological innovations and environmental changes, there is a need for an inward-looking approach to building the young minds of a country. By looking inwards, one not only finds a sociological belongingness but also a spiritual and intellectual rooting in these changing times. The course provides an overview of India's heritage and knowledge traditions across key themes of economy, society, polity, law, environment, culture, ethics, science & technology, and philosophy. It places special emphasis on the application of these knowledge traditions, helping students to not only know and appreciate India's heritage and knowledge traditions but also to independently evaluate them through a multidisciplinary lens. This evaluation would produce valuable lessons for obtaining transferable and 21st-century skills. The course requires no pre-requisite knowledge or understanding. Spread across two years, the course will establish foundational knowledge and build upon it. It will allow students to have a basic understanding of the traditions of India and how it has evolved over the years. The course is designed to enable student teachers to outline and interpret the processes and events of the formation & evolution of knowledge of India through a multidisciplinary lens; to evaluate the diverse traditions of India to distinguish its achievements and limitations, and to develop and articulate an ethics-based education rooted in Indian thought to their students in the classroom context.

5.4.2 Learning Outcomes

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

- recognize the vast corpus of knowledge traditions of India, while developing an appreciation for it,
- apply their acquired research and critical thinking skills in multidisciplinary themes,
- summarize and pass on their learnings to their students of different Indian traditions in an easily digestible manner.

UNIT - I

Introduction of Knowledge of India

A. Recap of the previous semester's definition and introduction.

B. Recap of previous knowledge.

UNIT - II

Philosophy, Ethics & Values: Schools of Philosophy

- A. Vaishesika, Nyaya, Samkhya, Yoga, Purva Mimansa and Vedanta or Uttara Mimansa (theory and the major thinkers) and Jain, Buddhist, and Charvak traditions.
- B. Vedanta: philosophical systems (Advaita, Vishishtadvaita, Dvaita).
- C. Ethics, morality, and social dilemma (including self-leadership) and their relevance in today's time.
- D. How do Indians value spirituality? Spirituality and Social Responsibility; Importance of Spirituality in current times.

Code: HMMJ0202 L.T.P.C 2.002

- E. Using ethics in a technologically volatile world: leading an ethical and modern life.
- F. Practical Vedanta for well-being (mindfulness, inter-connectedness, society-self relationship, etc.).

UNIT - III

Culture-Lifestyle

- A. Food (regional cuisines, ayurvedic diet, food and festival, vegetarianism, Jainism in food, food and hospitality, and globalization).
- B. Clothes (traditional Indian clothing, textile arts, religious costumes, clothing status, clothing, gender, globalization in clothing).
- C. Sports (fraditional Indian sports, martial arts, sports, and gender, sports & globalization).

D. The lifestyle of Yoga; adapting ancient lifestyle - A path towards longevity.

UNIT - IV

Science & Technology

A. Arithmetic and logic.

B. Natural sciences: math, physics, metallurgy, and chemistry.

C. Astronomy: India's contributions to the world.

D. Indian notions of time and space.

E. Technology in the economy: agriculture, transportation, etc.

UNIT - V

Linguistic Traditions

- A. History of linguistics in India (conceptualizing ancient Indian linguistics, oral traditions, etc.).
- B. Language as Culture: Evolution of Languages over the years & language as building blocks to different cultures and society
- C. Language: Identity, culture, and History.

5.4.3 Suggestive Practicum

The modes of curriculum transaction will include lectures, Tutorials, and Practicum.

• Practicum will include organization of day trips that help student teachers watch events relating to visual and performing art; activities that enable student teachers to identify and record through photos, videos, etc. the elements of ancient architecture still existing in the city around them; organization of Individual and group presentations based on themes such as Polity, Law and Economy etc., organization of a 'Knowledge of India' day in the institution to celebrate the culture (food, clothes, etc.) that they would have been explored in lectures and tutorials; interactions with family members, elders, neighbors, and other members of society about the evolution of local systems and economy etc.

5.4.4 Suggestive Mode of Transaction

- Lectures will include learner-driven participatory sessions, and Guest lectures through experts and practitioners, such as fine arts and performing arts practitioners along with contemporary poets & writers of Indian literature.
- Tutorials will include Screening of documentaries and films followed by a discussion; Learner-driven discussions in the form of focus group discussions (FGDs), Socratic

Discussions, etc.; Debate/discussion can be organized to explain India's Vaad tradition; discuss on how some of the ancient methods of teaching are relevant in today's time; discussions that help Identify ethical dilemmas in daily lives and understanding the importance of ancient ethics and values to resolve them.

5.4.5 Suggestive Mode of Assessment

The approaches to learning assessment will include, for example:

- Supporting the curiosity and interest of student teachers in the selected themes through a multi-modal approach, including regular assessments and actionable feedback that enable learners to outline and interpret the processes and events of the formation & evolution of knowledge of India through a multidisciplinary lens.
- Enabling the student teachers to demonstrate critical analysis and independent thinking of the processes and events in the formulation & evolution of different traditions that help student teachers evaluate the diverse traditions of India to distinguish its achievements and limitations.
- Use of first-hand or second-hand experiences that enable student teachers to develop and articulate an ethics-based education rooted in Indian thought to their students in the classroom context.

5.4.6 Suggestive Reading Materials

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

5.5 Teacher and Society

Credit:	2
Semester	S-2

5.5.1 About the Course

Teachers unarguably have the key role in nurturing young lives and shaping positive and inspired future generations. Emphasizing on the crucial role of teachers NEP 2020 states "teachers truly shape the future of our children - and, therefore, the future of our nation.". "The high respect for teachers and the high status of the teaching profession must be restored to inspire the best to enter the teaching profession. The motivation and empowerment of teachers is required to ensure the best possible future for our children and our nation." (NEP Para 5.1). The NEP in its introductory section states, "the teacher must be at the centre of the fundamental reforms in the education system" and highlights the need to "help re-establish teachers, at all levels, as the most respected and essential members of our society, because they truly shape our next generation of citizens". (NEP 2020, Introduction). The policy also stresses the need to "do everything to empower teachers and help them to do their job as effectively as possible." It is recognized that teachers are second to mothers in having the opportunity to work with children during the most impressionable years in their life and shape opinions, form ideas about personal and social goals and about society and life, contributing so much to the development of both individuals and society.

The focus of the course on 'Teacher & Society' is on developing an understanding among student teachers of the roles of teachers in the emerging Indian society, including the changing roles of teachers in the context of the global flows of people, culture and resources that are shaping society, and the application of technologies that are constantly redefining not only the educational landscape but also the human relationships and social norms which are continuously undergoing change which entails a recalibration of the teacher roles aligned to the current and future realities and preparing teachers for the volatile, uncertain, complex and ambiguous world. The course enables the students to understand the roles and obligations of teachers as an architect of the society based upon the cultural ethos, traditions, and diversity. The student teachers shall be equipped with the knowledge, capacities and value system that enables them to act as an agent for fostering national integration, a feeling of pride in the cultural heritage and achievements of India. This course also aims to ensure that student teachers understand their responsibility for producing a future generation that undertakes its responsibility as an awakened citizen who avoids wastage of national resources and takes up a proactive role for the emergence of India as a strong and disciplined nation.

In addition to these, the course also seeks to enable each of the student teachers to respond to the needs of students from diverse cultural, linguistic, social and economic backgrounds; to be sensitive to gender issues, promote tolerance and social cohesion, provide special attention to students with learning disabilities, learn and apply new pedagogies and technologies, keep pace with current educational developments and initiatives; and keep oneself professionally engaged to update/upgrade knowledge and practice. Student teachers will be encouraged to comprehend how societal structures, context and historical patterns shape teacher identities on one hand and how teacher identities, beliefs, values, convictions and commitment shape the ethics, culture, norms and values on the other; thus, impacting the larger societal thoughts and actions. The

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Code: HMMJ0203

LTPC 2002 course also explores the relationship of the teacher with education development, community and society through different course units that talk of the teacher as a person and as a professional, the socio-cultural and technological contexts of the teacher and how they impact the teaching-learning process, the multiple roles, identities and expectations of a teacher. It invites the student teachers to be reflexive of one's thoughts, beliefs and actions and continuously take a gaze inside out so as to unbiasedly engage children in a reflective dialogue.

The course explores the agentic role of a teacher, how it gets influenced and how it influences the education system. It concludes with the re-calibrating of roles of teacher and teaching beyond the curricular boundaries as an architect of an inclusive, harmonious, and developing India.

5.5.2 Learning Outcomes

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

- examine the relationship between teacher beliefs, values, character, life history, social and cultural context and teaching critically,
- explain the teacher roles and characteristics; the personal and professional self; the teacher as a communicator, the charismatic influencer, the reflective practitioner, competent, learner and much more and their significant role in nurturing the posterity.
- differentiate between the narrow curricular aims of education and the broader educational aims and their role in shaping self, school and society,
- demonstrate an ability to develop positive classrooms through engaging in the ethic of care,
- demonstrate an ability to critically reflect on personal and collective practice so as to improve learning and teaching,
- conceptualize teacher agency, its individual, contextual, and structural dimensions and how it gets impacted and in turn shapes education.

UNIT - I

Understanding the Teacher: Exploring the Personal and Professional Teacher

- A. Exploring the wider Personal and General Social Context of Teacher: Life History, Teacher Beliefs, Values and Aspirations, Diverse Identities, Social Contexts and Commitment to Learning and Education.
- B. Exploring the Professional Teacher: Qualifications, Education in teaching, Attitude, Aptitude, Experience and Exposure.
- C. The Charismatic Teacher, the Communicator Teacher, The Missionary Teacher, The Competent Practitioner, The Reflective Practitioner, The Learning Teacher.
- D. Reflexive Practice: Nurturing the Professional Capital through collaborative and/or collective engagement with self, others, the social context.

UNIT - II

Nurturing the Teacher: A Dialogue beyond the curricular goals, for Life and Posterity

A. Teaching: One profession, many roles

- B. Teaching Character: Nurturing Teachers for Human Flourishing.
- C. Holistic Teacher Development: Nurturing the Panchakoshas.
- D. Teacher Values, Beliefs and current Philosophy of Teaching: A Reflective Dialogue.
- E. Developing an Ethic of Care in Teacher Education: Nurturing Teachers towards a pedagogy of care.

UNIT - III

Understanding and Fostering Teacher Agency: Role in shaping Education Systems of Tomorrow

- A. Teacher Agency: What is it and why does it matter?
- B. Individual, Cultural and Structural Dimensions of Teacher Agency.
- C. Teacher discourses, Philosophy, Relationships, Networks and Professional Development: Shaping teacher agency and Creative insubordination.
- D. Challenges and Issues inf fostering Teacher Agency: Performativity, Non-academic engagements, Systemic apathy, Policy and Practice gaps and others.
- E. Role of Teacher in shaping the educational policy, practice and reforms

UNIT - IV

Teacher as an Architect of the New India: Shaping the Society of Tomorrow

- A. Engaging in Critical Education: Dialogues on power relations associated with Gender, Ethnicity, Culture, Disability, Class, Poverty, the reproduction of disadvantage and realizing the true human potential.
- B. Being a Critical Teacher: Raising debates around rapid technological advancement and impact on individual, family and social life; the growing isolation and impact on mental and social health and well-being, changing relationships between the 'state' and the 'market' and their impact on formal education; the conceptualization of teacher, teaching and teacher roles, 'globalization' and the reconstructed nationalism shaping the socio-political milieu and impact on social psyche, growing materialistic urge, sensory drives and the gradual deterioration of the individual and societal character.

5.5.3 Suggestive Practicum

- 1. Take up a case study of any one teacher education Institution.
- 2. Write a biography of any one of your favourite teachers/ Educationists.

5.5.3 Suggestive Mode of Transaction

Teacher and Society is a reformatory course that invites teachers to re-think teachers and teaching. It awakens and inspires teachers to realize broader educational aims through an action and reflection cycle. The approach therefore would include a blend of lectures, in-class seminars, thinking exercises, critical reflections, group-work, case-based approaches, and enquiry-based learning.

• Learners would also be exposed to case studies featuring teachers from a representative crosssection of Schools in India and critically analyse their exercise of agentic force in school improvement and the improvement of teaching practice.

• Situating themselves in the geo-political context, the learners will get to critically engage in some of the policy dialogues.

. Learners would reflect on their practice as pre-service interns, knowledge, skills, and

understandings-and identify opportunities to apply course learnings to their school context.

5.5.5 Suggestive Mode of Assessment

Being a very thought-provoking course, the assessment would largely include critical thinking kind of assignments. The following are some exemplars.

1. Write your current teaching philosophy based on your beliefs and values.

2. Choose any one area of immediate societal concern like environmental degradation, increasing crime against women, cybercrimes, bullying or any other and draw an action plan that you as a teacher would undertake to mobilize self, school and society towards betterment.

3. Critical Reflections on popular debates around power relations associated with Gender, Ethnicity, Culture, Disability, Class, Poverty, and such others

These are just prototypes and institutes may choose either of these or think of other innovative assignments that would inculcate in the future teachers a sense of belonging for society.

5.5.6 Suggestive Reading Materials

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

DEPARTMENT OF INTEGRATED TEACHER EDUCATION PROGRAMME (ITEP)

SYLLABI Integrated B.Sc.-B.Ed. Degree Course (Semester 1st & 2nd)

(Disciplinary Courses)



Dr B R AMBEDKAR NATIONAL INSTITUTE OF TECHNOLOGY JALANDHAR-144 027 (PUNJAB) INDIA


Physical Chemistry-I

Course Content

SECTION-I

Mathematical Concepts and Evaluation of Analytical Data: Logarithm, laws of logarithms, Anti-logarithms, Graphical representation of linear equation, determination of slope, differentiation and integration of of functions like e^x , x^n , sin x, log x, accuracy and precision in chemical analysis, least square curve fitting, types of errors, mean, median and standard deviation.

SECTION-II

Gaseous States: Postulates of kinetic theory of gases, deviation from ideal behaviour, Van der Waal's equation of state. Critical Phenomena: PV isotherms of real gases, continuity of states, the isotherms of Van der Waal's equation, relationship between critical constants and Van der Waals constants, the law of corresponding states, reduced equation of state.

Molecular Velocities: Root mean square, average and most probable velocities. Qualitative discussion of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter. Liquefaction of gases

SECTION-III

Liquid State: Intermolecular forces, surface tension and viscosity of liquids and its determination. Structure of liquids (a qualitative description). Structural differences between solids, liquids and gases. Liquid crystals: Difference between liquids crystal, solid and liquid. Classification, structure of nematic and cholestric phases.

SECTION-IV

Chemical Kinetics-I: Chemical kinetics and its scope, rate of a reaction, factors influencing the rate of a reaction. Concentration dependence of rates, mathematical characteristics of simple chemical reactions – zero order, first order, second order, pseudo-order, half-life and mean life. Determination of the order of reaction – differential method, method of integration, method of half-life period and isolation method. Radioactive decay as a first order phenomenon.

SECTION-V

Chemical Kinetics-II: Theories of Chemical Kinetics: Effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy. Simple collision theory based on hard sphere model, transition state theory (equilibrium hypothesis). Expression for the rate

constant based on equilibrium constant and thermodynamic aspects. Catalysis and general characteristics of catalytic reactions, Homogeneous catalysis, acid-base catalysis and enzyme catalysis including their mechanisms, Michaelis Menten equation for enzyme catalysis and its mechanism.

Course Outcomes

At the end of the semester the students will able to:

- 1. Solve problems in physical chemistry by using appropriate methodologies
- 2. Calculate the physicochemical properties of gases and liquids.
- 3. Apply fundamental knowledge of chemical kinetics for studying of various reactions.
- 4. Explain the broad role of the chemists in physical chemical measurements and processes.

Recommended Books and/or Reference Materials

- 1. Castellan, G. W. Physical Chemistry 4th Ed., Narosa 2004.
- 2. Atkins, P., Paula, J.de, Atkins Physical Chemistry; 8th edition, Pubs: Oxford University Press, 2008.
- 3. Puri, B.R., Sharma, L.R., Pathania, M.S., Principles of Physical Chemistry; 43rd edition, Pubs: Vishal Publishing Co., 2008.
- 4. Levine, I.N., Physical Chemistry; 5th edition, Pubs: Tata McGraw HillPublishing Co. Ltd., 2002.
- 5. Engel, T. & Reid, P. Physical Chemistry 3rd Ed., Prentice-Hall, 2012.
- 6. Rao, C.N.R., University General Chemistry; Pubs: Macmillan India, 1985.
- Metz, C.R., Theory and Problems of Physical Chemistry; Schaum's Outline Series, 2nd edition, Pubs: McGraw-Hall Book Company, 1989.

SECTION-I

Atomic Structure: Wave mechanics: de Broglie equation, Heisenberg's Uncertainty Principle and its significance, Schrödinger's wave equation, significance of ψ and ψ^2 . Quantum numbers, radial and angular wave functions and probability distribution curves, Shapes of *s*, *p*, *d* and *f* orbitals. Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau's principle and its limitations. Electronic configurations of the elements and ions.

SECTION-II

Periodicity of Elements: History of periodic table. Classification of elements in *s*, *p*, *d*, *f* block.Position of elements in the periodic table. Effective nuclear charge and itscalculations. Shielding or screening effect, Slater rules, Atomic radii, Ionic and crystal radii, Covalent radii (octahedral and tetrahedral), Ionization enthalpy, Successive ionization enthalpies and factors affecting ionization energy. Applications of ionization enthalpy, Electron gain enthalpy, trends of electron gain enthalpy. Variation of electronegativity with bond order, partial charge, hybridization, group electronegativity. Anomalous behavior and diagonal relationship, inert pair effect, variability of oxidation states of transition elements, color and magnetic properties.

SECTION-III

Chemical Bonding-I: Weak Interactions -Hydrogen bonding, Vander Waals forces. Covalent Bond –Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions. BeF₂, BF₃, CH₄, PF₅, SF₆, IF₇, SnCI₂, XeF₄, BF₄, SnC₁₆. Valence shell electron pair repulsion (VSEPR) theory to NH₃, H₃O⁺, SF₄, CIF₃, ICl₂ and H₂O. MO theory, homonuclear (elements and ions of 1st and 2nd row), and heteronuclear (BO, CN⁻, CO, NO⁺, CO⁺, CN), diatomic molecules, multicenter bonding in electron deficient molecule (Boranes).Percentage ionic character from dipole moment and electronegativity difference.

SECTION-IV

Chemical Bonding-II: Ionic Solids – Concept of close packing, Ionic structures, (NaCl type, Zinc blende, Wurtzite, CaF₂ and antifluorite), radius ratio rule and coordination number, limitation of radius ratio rule, lattice defects, semiconductors.

Course Outcomes

- **CO1:** This course will equip students with the necessary chemistry knowledge concerning the basic areas of Inorganic chemistry.
- **CO2:** This course will equip students with basic concepts of atomic structure.
- **CO3:** The students will be able to predict various periodic properties of the elements based on basic understanding of modern periodic table
- CO4: The students will learn the different types of chemical bonding in inorganic compounds
- **CO5:** The student will be able to understand and predict the structural properties of ionic compounds

Books Suggested

1. Cotton, F.A., Wilkinson, G., Gaus, P.L., *Basic Inorganic Chemistry*; 2nd edition, Pubs: John Wiley and Sons, 1995.

2. Lee, J.D., Concise Inorganic Chemistry; 4th edition, Pubs: Chapman & Hall Ltd., 1991.

3. Shriver, D.E., Atkins, P.W., *Inorganic Chemistry*; 4th edition, Pubs: Oxford University Press, 2006.

4. Douglas, B., Medaniel, D., Atenander, J., *Concepts and Models of Inorganic Chemistry;* 3rd edition, Pubs: John Wiley and Sons Inc., 1994.

5. Miessler, G.L., Tarr, D.A., *Inorganic Chemistry;* 3rd edition, Pubs: Pearson 40 Education Inc., 2004.

6. Purcell, K.F., Kotz, J.C., Inorganic Chemistry; Pubs: W.B. Saunders Company, 1977.

7. Shriver, D.F. & Atkins, P.W. Inorganic Chemistry, Oxford University Press.

8. Puri, B.R., Sharma, L.R., Kalia, K.K., *Principles of Inorganic Chemistry;* 30th edition, Pubs: Milestones Publisher, 2006-07.

Physical Chemistry Lab-I

Course Content:

1. Surface Tension measurements

- a. To determine the surface tension of a given liquid by drop number method.
- b. To determine the surface tension of a given liquid by drop weight method.
- c. To determine the critical micelle concentration of a soap (sodium laurate) by surface tension measurements.
- d. To determine the unknown composition of a mixture of two liquids by surface tension measurements.

2. Viscosity measurements

- a. To determine the coefficient of viscosity of a given liquid by using Ostwald viscometer
- b. To determine the coefficient of viscosity of a binary mixture by using Ostwald viscometer.
- c. To study the variation of viscosity of aqueous sugar solutions with concentrations.

3. Refractive Index measurements

- a. To determine the refractive index of a given solvent by using Abbe's refractometer hence the specific and molar refraction.
- b. To determine the unknown composition of a given binary mixture by using Abbe's refractometer.

4. Molecular weight determination

- a. To determine the molecular weight of a compound by Rast's micro method.
- b. To find the mol. wt. of high polymer by using viscosity measurements.

Course Outcomes

At the end of semester students will be able to:

- **CO-1:** Carry out experiments to understand the Laws and concepts of physical chemistry.
- **CO-2:** Calculate and evaluate thermodynamic properties of pure or binary mixtures.
- **CO-3:** Understand the interfacial properties and apply in daily life.
- **CO-4:** Perform experiments for purity analysis by determination of physicochemical properties.

Recommended Books and/or Reference Materials

- 1. Khosla, B.D., Garg, V.C., Gulati, A., Senior Practical Physical Chemistry; 11th Edition, Pubs: R. Chand & Co., New Delhi, 2002.
- 2. Das, R.C., Behra, B., Experimental Physical Chemistry; Pubs: Tata McGraw

Hill Publishing Co. Ltd., 1983.

- 3. Levitt, B.P., Findlays Practical Physical Chemistry; 8th edition, Pubs: Longman Group Ltd., London & New York, 1978.
- 4. Yadav, J. B. Advanced Practical Physical Chemistry, KRISHNA PRAKASHAN MEDIA.

Vectors: Laws of vector algebra, triple products, ordinary derivative of a vector, the vector differential operator, gradient, divergence, curl and Laplacian. Vector identities, notion of line, surface and volume elements. Line, surface and volume integrals of the fields, Gauss' divergence theorem, Green's and Stokes Theorems (no rigorous proofs). Orthogonal curvilinear coordinate systems, gradient, divergence, curl and Laplacian in cartesian, spherical and cylindrical coordinate systems. Velocity and acceleration in cartesian, polar and cylindrical coordinate systems.

Complex Numbers: Brief Revision of complex numbers and their graphical representation. Euler's formula, De Moivre's theorem, exponential and trigonometric functions, logarithms hyperbolic functions, complex roots and powers, inverse trigonometric and hyperbolic.

Probability and statistics: Independent and dependent events, conditional probability. Bayes' theorem, independent random variables and functions of random variables, probability mass functions, probability distribution functions, special distributions: binomial, Poisson and normal. Sample mean and variance and their confidence intervals for normal distribution. Central limit theorem and law of large numbers.

Numerical Methods: Bisection method, Regula-Falsi method, Fixed point iteration method, Secant Method, Newton Raphson method, Newton forward interpolation method.

CO1	Develop an insight into physical Significance of Curl, Divergence, Gradient as well as different coordinate systems and their importance.
CO2	Analyze the use of complex numbers in various problems.
CO3	Evaluate the concepts of probabilities and distribution functions and apply those in different applications.
CO4	Apply the numerical methods in solving problems related to solutions of nonlinear equations and interpolation.

Course Outcomes: After completion of this course, students will be able to

Recommended books:

- 1. Mathematical Methods for Physics and Engineers, K.F Riley, M.P. Hobson and S. J. Bence, 3rd ed., 2006, Cambridge University Press.
- 2. Mathematical Methods in Physical Sciences, Mary L. Boas, Wiley.
- 3. Complex Variables: Schaum's Outline, McGraw Hill Education.
- 4. Statistics A Guide to the Use of Statistical Methods in the Physical Sciences, R.J. Barlow, Wiley.
- 5. Statistical data Analysis for The Physical Sciences by Adrian Bevan, Cambridge University Press.
- 6. Elementary Numerical Analysis, K.E. Atkinson, 3rd Edn., Wiley India Edition.
- 7. Introduction to Numerical Analysis, S.S. Sastry, 5th Edn., PHI Learning Pvt. Ltd.

Mechanics

Course Content

Reference frames: Inertial frames, Galilean transformations and invariance, transformation equations for inertial frames inclined to each other, Non-Inertial frames, Fictitious forces in a rotating frame of reference Centrifugal and Coriolis forces due to rotation of earth, Foucault's pendulum.

Conservation laws: Conservative forces, force as negative gradient of energy, nonconservative forces, conservation of linear momentum. System of particles, Center of mass, equation of motion of the CM, conservation of linear and angular momentum, conservation of energy, variable mass systems. Elastic and inelastic collisions.

Central forces motion: Motion under force obeying inverse square law, equivalent one body problem. Equation of motion under central force, equation of orbit and turning points, Kepler's Laws.

Dynamics of rigid bodies: Rigid body motion, moment of inertia, fixed axis rotations, moments of Inertia and products of Inertia, parallel and perpendicular axes theorem. Principal moments and axes. Determination of moment of inertia of discrete and continuous objects, kinetic energy of rotation, motion involving both translation and rotation.

Fluid Dynamics: Laminar or viscous flow, viscosity, coefficient of viscosity, Streamline and Turbulent Flow, Equation of Continuity, Bernoulli's theorem, Euler's theorem and their applications.

CO1	Analyze the use of frames of reference and their importance in the study of mechanics.
CO2	Evaluate the importance of conservation laws and their importance in solving mechanical problems.
CO3	Analyze the various aspects of motion of bodies under central forces.
CO4	Evaluate the motion of rigid bodies under different conditions.
CO5	Analyze and evaluate different types of fluid motion and its properties.

Course Outcomes: After completion of this course, students will be able to

Recommended books:

- 1. "Mechanics" by H.S. Hans and S.P. Puri, Tata McGraw-Hill Publishing Company Limited.
- 2. "Mechanics" by D.S. Mathur, S. Chand Publishing.

Reference texts:

- 1. "Physics for Scientists and Engineers with Modern Physics" by Serway and Jewett, Thomson Learning, Inc.
- 2. "An Introduction to Mechanics" by Daniel Kleppner & Robert J. Kolenkow, Tata McGraw-Hill.
- 3. "Introduction of Classical Mechanics" by R.G. Takwale & P.S. Puranik, Tata McGraw-Hill.
- 4. "Mechanics Berkeley Physics course" by Charles Kittel, Tata McGraw-Hill.

Physics Lab-1

List of programs

Basic of Programming

- 1. Write a program which prints the mass of an electron.
- 2. Write a program to calculate the total relativistic energy of an electron for a given linear momentum.
- 3. Print the abbreviation of journal name "Physical Review C" as "Phys. Rev. C".
- 4. Write a program to predict the nature of orbit based on the value of given eccentricity.
- 5. Write a program to calculate the sum and average of N numbers.
- 6. Write a program to calculate the dot product of two vectors whose components are given in the form of lists.
- 7. Write a program which converts the Cartesian coordinates to spherical polar coordinates and vice-versa.
- 8. Write a program which reads the data from the given file and calculates the mean, variance and standard deviation and save the result in a file.
- 9. Write a program to calculate the factorial of a given number and use your program to verify the Sterling formula for a given large value of N.
- 10. Write a program which calculates the non-relativistic and relativistic kinetic energy of an electron for velocities in range 0 to 0.99c (c is the speed of light). Plot both energies as a function of velocity.

Applications

- 1. Write a program to find out the roots of an equation by using the bisection method.
- 2. Write a program to find out the roots of an equation by graphical method and by using Newton's method.
- 3. Write a program to find out the roots of an equation by using the secant method.
- 4. Write a program to find out the probability of the number of heads appearing in the simultaneous throw of 'n' number of fair coins.
- 5. Write a program to plot a given complex number and its complex conjugate on the Argand plane. Calculate its modulus and draw a circle with centre at origin and radius equal to the modulus.

Course Outcome: After completing the lab course students will

CO1	Develop an insight into fundamentals of data type, operators and their use in programming
CO2	Apply the concepts like control structure, loops and functions in different programming problems.
CO3	Develop the programs to find the solutions of nonlinear equations.
CO4	Apply the concepts of programming in writing programs for probability and complex numbers.

Recommended Books

- 1. Learning Scientific Programming with Python, Christian Hill, Cambridge University Press (2016)
- 2. Computational Problems for Physics: With Guided Solutions Using Python, Rubin H. Landau, Manuel José Páez, CRC Press (2018).

Calculus

Course Content

SECTION-I

Review of limits, continuity, differentiation, Rolle's theorem, Mean value theorem, L'Hospital rule, Taylor's theorem, maxima and minima, Riemann integration, fundamental theorem of calculus.

SECTION-II

Calculus of several variables, partial differentiation, total derivative, homogeneous functions and Euler's theorem, Taylor's and Maclaurin's series, Taylor's theorem for functions of two variables, maxima and minima of functions of several variables, Lagrange's method of multipliers.

SECTION-III

Double and triple integrals, change of order of integration, change of variables, applications to evaluation of area, surface area and volume.

SECTION-IV

Scalar and vector fields; differentiation of vectors, velocity and acceleration, vector differential operators Del, Gradient, Divergence and Curl and their physical interpretations, formulae involving these operators, line, surface and volume integrals, solenoidal and irrotational vectors, Green's theorem, Gauss divergence theorem, Stoke's theorem and their applications.

Course Outcomes

Upon successful completion of the course, the student will be able to:

- (i) Compute limits, derivative and integrals.
- (ii) Evaluate integrals over a region in two and three dimensional geometry.
- (iii) Understand and analyse the theoretical & practical aspects of calculus.
- (iv) Apply the concepts of calculus to a variety of problem situation.

Reference/Text Books

- 1. G.B. Thomas and R.L. Finney, Calculus and Analytic Geometry, ISE Reprint, 9th Ed., Addison-Wesley, 1998.
- E. Kreyszig, Advanced Engineering Mathematics, 8th Ed., John Willey, Singapore, 2001.
- 3. R.K. Jain, S.R.K. Iyenger, Advances Engineering Mathematics, 2nd Ed., Narosa Publishing house, New Delhi 2003.
- 4. T. M. Apostol, Calculus, Volumes 1 & 2 (2nd Ed.), Wiley Eastern, 1980.

Algebra

Course Content

SECTION-I

Basic Algebra: Equivalence relations, Partitions, Division algorithm for integers, Primes, Unique factorization, Congruences, Theorems of Fermat and Euler.

SECTION-II

Groups: Definition of a group with examples and simple properties, Subgroups, Normal subgroups, Quotient groups, Group homomorphisms, Cayley's theorem, Permutation groups, Sylow's theorem, Abelian groups, non-abelian groups, Generation of groups, Cyclic groups, Coset decomposition, Lagrange's theorem for finite groups, Fundamental theorem of Homomorphism, Isomorphism theorems for groups.

SECTION-III

Rings: Definition of a ring with examples and simple properties, Ring homomorphism, Ideal and Quotient rings, Integral domains, Euclidean rings, Polynomial rings, Basic isomorphism theorems, Prime ideals and maximal ideals, Fields, Fields of quotients of an integral domain, Chinese remainder theorem, Euclidean domains, Principal ideal domains, Unique factorization domains.

Course Outcomes

Upon successful completion of the course, the student will be able to:

- (i) Understand many concepts in basic algebra and algebraic number theory.
- (ii) Recognize groups and classify them as permutation group, abelian group, cyclic group, etc.
- (iii) Realize the significance of Cayley's theorem, Sylow's theorem, Lagrange's theorem, fundamental theorem of homomorphism, and isomorphism theorems for groups.
- (iv) Acquire knowledge about the fundamental concept of rings, ideals, fields, and integral domain.

Text Books

- 1. I. N. Herstein, Topics in Algebra, Wiley Eastern Ltd. New Delhi, 1975.
- 2. J. A. Gallian, Contemporary Abstract Algebra, 7th Edition, Brooks/Cole Cengage Learning, USA, 2010.

- 1. K. D. Joshi, Foundations of Discrete Mathematics, Wiley Eastern, 1989.
- 2. T. T. Moh, Algebra, World Scientific, 1992.
- 3. M. Artin, Algebra, Prentice-Hall of India, 1994.
- 4. J. Stillwell, Elements of Algebra, Springer, 1994.
- 5. D. S. Dummit and R. M. Foote, Abstract Algebra, 2nd Edition, John Wiley, 2002.
- 6. S. Lang, Algebra, 3rd Edition, Springer (India), 2004.
- 7. T. W. Hungerford, Algebra, Springer (India), 2004

Section A (Theory)

Introduction: Different paradigms of computer programming language, Compiler, Interpreter, Assembler, Structure of C program, Compilation process.

Basics of C programming: Character sets, Identifiers, Keywords, Data Types, Constants, Enumeration Constants, variables, statements; Operators and Expressions: Arithmetic operator, Unary operator, Relational and Logical operator, Assignment operator, Bitwise operator, Ternary operator, Comma operator, precedence and associativity; Input/Output statements, Decision making statements: if – else, nested if-else, Switch statement; Looping statements, Pre-processor directives, Pointers, Pointer operators, Pointer arithmetics.

Arrays and Strings: Introduction to Arrays: Declaration, Initialization, one dimensional array.

File Processing: Files, Types of file processing: Sequential access, Random access.

Section B (Practical)

Following are the suggested list of experiments:

- 1. Exploring C programming basics and execution of sample programs.
- 2. Implementing the basic C programs for demonstrating the concepts of data types, operators and expressions.
- 3. Implement programs using expressions and statements e.g. exchange the values of two variables, circulate the values of n variables, distance between two points.
- 4. Program to Implement Various Control Structures: If statement, Switch case statement, do while loop, For loop, While loop
- 5. Program to implement recursion eg., gcd, tower of hanoi, etc.
- 6. Program to implement one dimensional and two dimensional arrays.
- 7. Program to implement structures.
- 8. Program to implement basic data structures.
- 9. Program for file handling operations.

*This is only the suggested list of Practicals. Instructors may frame additional Practicals relevant to the course contents.

Course Outcome:

CO1: Understand the fundamental concepts of C programming and its libraries to develop basic programs.

CO2: Develop skills to design, implement and debug programs using modular programming.

CO3: Analyze various concepts of C including basic data structures and file systems.

CO4: Evaluate the learned concepts for real-life problem solving. **Recommended Books:**

- 1. E. Balaguruswamy, "Programming in ANSI C", 8th Edition, 2019, McGraw Hill Education, ISBN: 978-93-5316-513-0.
- 2. KernighanBrian W. and Ritchie, Dennis M, The C Programming language, Dorling Kingsley (2008) 2nd ed.

3. Balagurusamy, E., Programming in ANSI C, TMH Publications (2007) 3rd ed.

Reference Books:

- 1. Let Us C Yashavant kanetkar BPB.
- 2. Absolute beginner's guide to C, Greg M. Perry, Edition 2, Publisher: Sams Pub., 1994.
- 3. Computer Programming and Data Structures by E Balagurusamy, Tata McGraw Hill.



Course Objectives

This course is intended to learn the basic chemistry of group 13-14 elements, 15-17 elements and concept close packing, various ionic structures, radius ratio rule, coordination number etc.It is anticipated that students taking this course should have basic knowledge of inorganic chemistry at the undergraduate level. The various topics of the syllabus are grouped under different units in order to bring forth importance of academic and laboratory skills for the undergraduate students.

Course Content

SECTION-I

Chemical Bonding-III: Lattice energy and Born-Haber cycle, solvation energy and solubility of ionic solids, polarizing power and polarisability of ions, Fajan's rule. Metallic bond-free electron, valence bond and band theories. Weak Interactions – Hydrogen bonding, Van der Waals forces.

SECTION-II

Chemistry of Noble Gases and s-Block Elements: Chemical properties of the noble gases, chemistry of xenon, structure and bonding in xenon compounds. Comparative study, diagonal relationships, salient features of hydrides, solvation and complexation tendencies including their function in biosystems, an introduction to alkyls and aryls.

SECTION-III

p-Block Elements-I: Comparative study (including diagonal relationship) of groups 13-14 elements, compounds like hydrides, oxides, oxyacids and halides of groups 13-14, hydrides of boron-diborane and higher boranes, borazine, borohydrides, fullerenes, carbides, fluorocarbons.

SECTION-IV

p-Block Elements-II: Comparative study of groups 15-17 elements, compounds like hydrides, oxides, oxyacids and halides of groups 15-17, silicates (structural principle), tetrasulphurtetranitride, basic properties of halogens, interhalogens and polyhalides.

Course Outcomes

CO1: This course will equip students with the necessary chemistry knowledge concerning the of groups 13-14 and 15-17 elements.

CO2: This course will equip students with basic concepts of close packing in ionic solids.

- CO3: The students will be able to understand the semi-conductors and chemical behaviour of ionic solids
- CO4: The students will be able to compare (including diagonal relationship) group 13-14 elements and 15-17 elements
- CO5: The students will learn the chemistry of groups 13-14 and 15-17 elements including hydrides of boron-diborane and higher boranes, fullerenes, carbides and fluorocarbons, basic properties of halogens, interhalogens and polyhalides

Books suggested

1. Cotton, F.A., Wilkinson, G., Gaus, P.L., Basic Inorganic Chemistry; 2nd edition, Pubs: John Wiley and Sons, 1995.

2. Lee, J.D., Concise Inorganic Chemistry; 4th edition, Pubs: Chapman & Hall Ltd., 1991.

3. Shriver, D.E., Atkins, P.W., Inorganic Chemistry; 4th edition, Pubs: Oxford University Press, 2006.

4. Douglas, B., Medaniel, D., Atenander, J., Concepts and Models of Inorganic Chemistry; 3rd edition, Pubs: John Wiley and Sons Inc., 1994,

5. Porterfeild, W.W., Wesky, A., Inorganic Chemistry; Pubs: Addison-Wesky Publishing Company, 1984.

6. Miessler, G.L., Tarr, D.A., Inorganic Chemistry; 3rd edition, Pubs: Pearson Education Inc., 2004,

7. Jolly, W.L., Modern Inorganic Chemistry; 2nd edition, Pubs: Tata McGraw-Hill Publishing Company Limited, 1991.

8. Purcell, K.F., Kotz, J.C., Inorganic Chemistry; Pubs: W.B.Saunders Company, 1977.

9. Puri, B.R., Sharma, L.R., Kalia, K.K., Principles of Inorganic Chemistry; 30th edition, Pubs: Milestones Publisher, 2006-07.

SECTION-I

Structure and Bonding: Hybridization, bond lengths and bond angles, bond energy, localized and delocalized chemical bond, Van der Waals interactions, resonance, hyperconjugation, aromaticity, inductive and field effects, hydrogen bonding.

Mechanism of Organic Reactions: Curved arrow notation, drawing electron movements with arrows, half-headed and double –headed arrows, homolytic and heterolytic bond breaking. Types of reagents- electrophiles and nucleophiles. Types of organic reactions.

SECTION –II

Reactive intermediates-Non classical carbocations, carbocations, carbanions, free radicals, carbenes, arynes and nitrenes (with examples). Assigning formal charges on intermediates and other ionic species. Methods of determination of reaction mechanism (product analysis, intermediates, isotope effects, kinetic and stereochemical studies).

SECTION-III

Stereochemistry of Organic Compounds I: Concept of isomerism, Types of isomerism. Optical isomerism – Elements of symmetry, molecular chirality, enantiomers, stereogenic center, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centers, diastereomers, threo and erythro, diastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization. Relative and absolute configuration, sequence rules, D & L and R & S systems of nomenclature.

SECTION-IV

Stereochemistry of Organic Compounds II: Geometric isomerism: Determination of configuration of geometric isomers. E & Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds. Conformational isomerism—Conformational analysis of ethane and n-butane; conformations of cyclohexane, axial and equatorial bonds, conformation of mono and disubstituted cyclohexane derivatives. Newman projection and Sawhorse formulae, Fischer and flying wedge formulae. Difference between configuration and conformation.

Course outcomes

CO-1: Students will develop a solid understanding of the fundamental principles of organic chemistry, including molecular structure, bonding, and functional groups.

- **CO-2:** Students will comprehend reaction mechanisms and electron flow in organic reactions, apply curved-arrow notation, and understand the role of intermediates.
- **CO-3:** Students will predict the products of various organic reactions, including mechanisms and stereochemistry, and explain the underlying principles that govern these transformations.
- **CO-4:** Students will integrate organic chemistry knowledge with concepts from related disciplines, such as physical chemistry, biochemistry, and materials science.

Books Suggested

- 1. Morrison, R.T., Boyd, R.N., Organic Chemistry, 6th Edition, Pubs : PrenticeHall, 1992.
- 2. Solomons, T.W., Fryhle, C.B., Organic Chemistry, 9th Edition, Pubs : Wiley India, 2007.
- 3. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- 4. 4. Mukherji, S.M., Singh, S.P., Kapoor, R.P., Organic Chemistry, Pubs : New Age International, 1985.
- 5. Kalsi, P. S. Stereochemistry Conformation and Mechanism, New Age International, 2005.

- 1. Determination of Rf-value of organic compounds by Thin Layer chromatography.
- 2. Determination of boiling point of liquid compounds. (boiling point lower than and more than 100 °C by distillation and capillary method).
- 3. Determination of melting point of an organic compounds.
- 4. Purification of compounds: By crystallization, fractional crystallization, distillation, fractional distillation, vacuum distillation, and steam distillation
- 5. Separation of two or more organic compounds by distillation.
- 6. Extraction of caffeine from tea leaves.
- 7. Synthesis of rose oil from rose petals.
- 8. Separation of organic compounds by column chromatography.
- 9. The preliminary examination of physical and chemical characteristics (physical state, colour, odor, ignition tests, melting point, and solubility test) of the following compounds:
 - Carbohydrates
 - carbonyl compounds ketones, aldehydes
 - Carboxylic acids, phenols.
- 10. Preparations of organic compounds Iodoform and Glucosazone.

Course outcomes:

- CO-1 Students will develop skills in maintaining accurate laboratory notebooks and writing clear, concise, and well-organized lab reports.
- CO-2 Students will identify and troubleshoot challenges that arise during experiments, proposing effective solutions based on scientific reasoning.
- CO-3 Students will engage effectively in group experiments, discuss findings with peers, and present experimental results in a coherent and concise manner.

Books Suggested (Laboratory Courses):

- 1. Vogel's book of Practical Organic Chemistry, Longman Scientific & Technical, 5th Edition.
- 2. Bansal, R.K., Laboratory Manual of Organic Chemistry; 3rd edition, Pubs: Wiley Eastern Limited, 1994.
- 3. Practical Organic Chemistry by F.G. Mann and B.C. Saunders.

Matrix algebra: Definition, basic algebra of matrices, commutator, power of matrices, functions of matrices, transpose of matrix, complex and Hermitian conjugates of matrix, inverse of a matrix, rank of a matrix, special type of square matrices (diagonal, symmetric and antisymmetric, Hermitian, unitary, normal), eigenvectors and eigenvalues of matrices, change of bases and similarity transformation, diagonalization of matrices, simultaneous linear equations, direct product of matrices.

Matrix algebra: Definition, basic algebra of matrices, commutator, power of matrices, functions of matrices, transpose of matrix, complex and Hermitian conjugates of matrix, inverse of a matrix, rank of a matrix, special type of square matrices (diagonal, symmetric and antisymmetric, Hermitian, unitary, normal), eigenvectors and eigenvalues of matrices, change of bases and similarity transformation, diagonalization of matrices, simultaneous linear equations, direct product of matrices.

Fourier Series: The Dirichlet conditions, the Fourier coefficients, symmetry considerations, discontinuous functions, non-periodic functions, integration and differentiation, complex Fourier series, Parseval's theorem.

Differential and partial differential equations: First order differential equations, separable variables, exact and inexact equations, integrating factors, Bernoulli's theorem, second order equation with constant and variable coefficients, general solutions of second order equation, complementary function and particular integral, Wronskian method, Series solutions of differential equations: power series and Frobenius method, Introduction to Legendre equations, Bessel equations and related polynomials, elementary idea of partial differential equations and their classification, solution of any one partial differential equation by separation of variable method.

CO1	Analyze the use of matrix algebra in various branches of Physics.
CO2	Develop insight into the importance and use of infinite series.
CO3	Evaluate the Fourier series of different kinds of periodic motion.
CO4	Analyze the solutions of various important differential equations and evaluate their applications.

Course Outcomes: After completion of this course, students will be able to

Recommended books:

- "Mathematical Methods for Physics and Engineers" K.F Riley, M.P. Hobson and S. J. Bence, 3rd ed., 2006, Cambridge University Press.
- 2. "Advanced Engineering Mathematics" by Erwin Kreyszig, Wiley India
- 3. "Mathematical Methods in Physical Sciences" by Mary L. Boas, Wiley.

Reference texts:

- 1. "Mathematical Methods for Physicists" by G. B. Arfken and H. J. Weber, Academic Press
- 2. "Mathematical Methods for Physicists: A Concise Introduction" by Tai L Chow, Cambridge University Press
- 3. "Advanced Mathematics for Engineers and Scientists: Schaum Outline Series", M. R Spiegel, McGraw Hill Education.

Unit-I

Electrostatic Field: Gauss's Law and its differential form. Electric field as gradient of electric potential, Potential of localized charge distribution, Electrostatic boundary conditions, Work and energy in electrostatics: energy of a point charge and continuous charge distribution, conductors, Laplace and Poisson equation, Solution of Laplace equation for simple cases, Method of Images: A point charge in presence of an infinite grounded conducting plane, Multipole expansion.

Unit-II

Electric Field in Matter: Polarization: mechanism of polarization of dielectrics, induced dipole moment and atomic polarizability; Field of polarized object: bound charges and their physical interpretation, Field inside dielectric, Gauss's law for dielectrics, Electric displacement vector, boundary conditions, Linear dielectrics, Energy stored in dielectric medium.

Unit-III

Magnetism: Lorentz force law, Ampere law in integral and differential form, Divergence of magnetic field, Magnetic vector potential and its relation with magnetic field, Magnetostatic boundary conditions, Magnetization: Torques and Forces on magnetic dipoles, Field of magnetized objects, Concept of bound currents, magnetic field inside matter, Ampere's law in magnetic materials, magnetic susceptibility and permeability, boundary conditions.

Unit-IV

Maxwell's equations and electromagnetic waves: Faraday's law of electromagnetic induction, Self and mutual inductance. Energy in magnetic fields, Modified form of Ampere's law, Maxwell's equations in free space, dielectric and conducting medium, Boundary conditions, Poynting's theorem, electromagnetic waves in free space, dielectric and conducting medium, reflection and refraction at a dielectric interface, transmission and reflection coefficients (normal incidence only).

CO 1	Develop the laws of electrostatics and applying those in different problems of electrostatic field
CO 2	Quantifying the impact on the properties of the matter under the action of electric fields.
CO 3	Quantifying the impact on the properties of the matter under the action of magnetic fields.
CO4	Develop the Maxwell equations for free space as well as conducting and non-conducting media.

Recommended books:

- 1. Introduction to Classical Electrodynamics by David Griffith, Prentice Hall.
- 2. Electricity and Magnetism, Edward M. Purcell and David Morin, Cambridge University

Further Readings:

- 1. Elements of Electromagnetism, Matthew N. O. Sadiku, Oxford Univ Press.
- 2. Classical Electrodynamics, Walter Greiner, Springer.

List of experiments

- 1. To find the impedance of the LCR circuit.
- 2. To study the effect of voltmeter resistance on the voltage measurement.
- 3. Determination of permittivity of different materials.
- 4. To investigate the equipotential line of electric fields.
- 5. To verify the relationship of speed of light with permeability and permittivity of air.
- 6. To study the magnetic field of a circular conductor as a function of the current, distance and radius.
- 7. To verify Faraday and Lenz law of induction.
- 8. Measurement of resistance by using four probe setup.
- 9. Study of M-H curve of a magnetic material.
- 10. Study of P-E curve for polar material.
- 11. Determination of transition temperature of BaTiO₃ and other materials using permittivity vs temperature measurement.
- 12. Observations and measurements using an electric energy meter and measurement of wattage of a given bulb or heater.
- 13. To study the efficiency of an electric kettle or heater element with varying input voltage.
- 14. Study of variation of magnetic field with distance along the axis of solenoidal system and effect of number of turns of the coil.
- 15. To study the intensity response of photovoltaic/solar cell and verify inverse-square law of radiations of photovoltaic cell.

Course Outcomes: After completion of this course, students will be able to

CO1	Develop an insight to measure the resistance, voltage, current and impedance of circuit.
CO2	Understand the production of magnetic field by the flow of current and its variation.
CO3	Quantifying the impact of electric field on the properties of dielectric materials.
CO4	Quantifying the impact of magnetic fields on the magnetic properties of materials.

Recommended Books:

- 1. "Practical Physics by C.L. Arora.
- 2. "A Laboratory Manual of Physics for Undergraduate Classes" by D.P. Khandelwal.

SECTION-I

Ordinary differential equations of first order: initial and boundary conditions, Solution of first order ordinary differential equations by separation of variables, homogeneous equations, linear equations, Exact differential equations, integrating factors, Equations of the first order and higher degree, Clairaut's equation.

SECTION-II

Linear differential equations with constant coefficients, Complimentary functions and particular integral, Cauchy's homogenous linear equations, Legendre's linear equation, Method of variation of parameters, Method of undetermined coefficients, simultaneous linear equations with constant coefficients.

SECTION-III

Series solutions of differential equations, Bessel and Legendre equations, Bessel and Legendre functions, Sturm-Liouville problem.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

- (i) Solve first order nonlinear differential equations and linear differential equations of higher order using various techniques.
- (ii) Classify differential equations and recognise an appropriate solution method for a given problem.
- (iii) Obtain series solution of differential equations.
- (iv) Solve differential equations arising in any engineering/science applications.

Reference/Text Books:

- 1. W.E. Boyce, R. DiPrima, Elementary differential equations, 8th Ed., John Wiley, 2005.
- 2. R.S. Senger, Ordinary differential equations with Integration, Prayal Publ. 2000.
- 3. M.D. Raisinghania, Ordinary and Partial differential equation, S. Chand publishing, 2013.
- G.F. Simmons, Differential equations with applications and historical notes, CRC Press, 2016.

SECTION-I

Algebraic and order properties of \mathbb{R} , Absolute value of a real number; Bounded above and bounded below sets, Supremum and infimum of a nonempty subset of \mathbb{R} .

The completeness property of \mathbb{R} , Archimedean property, Density of rational numbers in \mathbb{R} , Definition and types of intervals, Nested intervals property; Neighborhood of a point in \mathbb{R} , Open and closed sets in \mathbb{R} .

SECTION-II

Convergent sequence, Limit of a sequence, Bounded sequence, Divergent sequences, Limit theorems, Operations on convergent sequences, Operations on divergent sequences, Monotone sequences, Monotone convergence theorem, Subsequences, Bolzano-Weierstrass theorem for sequences, Limit superior and limit inferior for bounded sequence, Cauchy sequence, Cauchy's convergence criterion.

SECTION-III

Convergence and divergence of infinite series of real numbers, Necessary condition for convergence, Cauchy criterion for convergence; Tests for convergence of positive term series: Integral test, Basic comparison test, Limit comparison test, D'Alembert's ratio test, Cauchy's *n*th root test; Alternating series, Leibniz test, Absolute and conditional convergence.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

- (i) Understand many properties of the real line ℝ and learn to define sequence in terms of functions from N to a subset of ℝ.
- (ii) Recognize bounded, convergent, divergent, Cauchy and monotonic sequences and to calculate their limit superior, limit inferior, and the limit of a bounded sequence.
- (iii) Apply the ratio, root, alternating series and limit comparison tests for convergence and absolute convergence of an infinite series of real numbers.
 - Know how abstract ideas and rigorous methods in Real Analysis can be applied to practical problems.

Reference/Text Books:

- Bartle, Robert G., & Sherbert, Donald R. (2015). *Introduction to Real Analysis* (4th ed.). Wiley India Edition. New Delhi.
- Bilodeau, Gerald G., Thie, Paul R., & Keough, G. E. (2010). An Introduction to Analysis (2nd ed.). Jones and Bartlett India Pvt. Ltd. Student Edition. Reprinted 2015.

- Denlinger, Charles G. (2011). *Elements of Real Analysis*. Jones and Bartlett India Pvt. Ltd. Student Edition. Reprinted 2015.
- 4. Ajit and Kumaresan, A Basic Course in Real Analysis, CRC Press, 2014.

SECTION-I

Matrix operations, The inverse of a matrix, Linear dependence and independence of vectors, rank of matrices, Row reduction and echelon forms, reduction to normal form, Systems of linear equations, Solution sets of linear systems, eigen values, eigen vectors, Cayley Hamilton Theorem.

SECTION-II

Vector spaces, Subspaces, Algebra of subspaces, Quotient spaces, Linear combination of vectors, Linear span, Linear independence, Basis and dimension, Dimension of subspaces.

SECTION-III

Successive differentiation and Leibnitz theorem. Limit (ϵ - δ definition), Continuity, Discontinuity, properties of continuous functions. Differentiability, Chain rule of differentiation, Mean value theorems, Taylor's and Maclaurin theorems.

SECTION-IV

Curve sketching using first and second derivative tests, Graphs with asymptotes, Beta and Gamma functions, Double and triple integrals, change of order of integration, change of variables, applications to evaluation of area, surface area and volume.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

- (i) Recognize consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix, using rank.
- (ii) Find eigenvalues and corresponding eigenvectors for a square matrix.
- (iii) Understand the concept of linear independence of vectors over a field, the idea of a finite dimensional vector space, basis of a vector space and the dimension of a vector space.
- (iv) Evaluate integrals over a region in two- and three-dimensional geometry.

Reference/Text Books:

- Kolman, Bernard, & Hill, David R. (2001). Introductory Linear Algebra with Applications (7th ed.). Pearson Education, Delhi. First Indian Reprint 2003.
- Lay, David C., Lay, Steven R., & McDonald, Judi J. (2016). Linear Algebra and its Applications (5th ed.). Pearson Education.
- 3. Shanti Narayan, Elements of Real Analysis, S. Chand & Company, New Delhi.

- 4. E. Kreyszig, Advanced Engineering Mathematics, 8th Ed., John Willey, Singapore, 2001.
- R. K. Jain, S.R.K. Iyenger, Advances Engineering Mathematics, 2nd Ed., Narosa Publishing house, New Delhi 2003.

CYMI0203

Course Content

SECTION-I

Colloidal State: Definition of colloids, classification of colloids. Solids in liquids (sols): Properties; stability of colloids, protective action, Hardy-Schulze rules, gold number. Liquids in liquids (emulsions) : Types of emulsions, preparation. Emulsifier. Liquids in solids (gels): Classification, preparation and properties, inhibition, general applications of colloids.

SECTION-II

Phase Equilibria: Introduction, phase, component and degree of freedom, Gibbs phase rule, phase equilibria of one component system—water, CO₂ and S systems. Phase equilibria of two component system, simple eutectic, Bi-Cd system, desiliverisation of lead, (KI-H2O) system. Freezing mixtures, acetone-dry ice. Lower and upper critical solution temperature. Effect of impurity on consolute temperature, Nernst distribution law and applications.

SECTION-III

Thermochemistry: Standard state, types of enthalpy of reactions, standard enthalpy of formation, Hess's Law of heat summation and its applications. Heat of reaction, Enthalpy of neutralization. Bond dissociation energy and its calculation from thermochemical data, temperature dependence of enthalpy. Kirchhoff's equation.

SECTION-IV

Photochemistry: Interaction of radiation with matter, difference between thermal and photochemical processes. Laws of photochemistry: Grothus–Drapper law, Stark–Einstein law, Jablonski diagram, flourescence, phosphorescence, chemiluminescence, Stern-Volmer equation, non–radiative processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions–energy transfer processes (simple examples).

Course Outcome

At the end of the semester the students will able to:

- 1. Differentiate between colloidal solutions, suspension and emulsions.
- 2. understand importance of phase equilibria in daily life.
- 3. Calculate the parameter defining the thermochemistry of chemical reactions.
- 4. Explain the types of photochemical reactions and photophysical processes.

Recommended Books and/or Reference Materials

- 1. Atkins, P., Paula, J.de, Atkins Physical Chemistry; 8th edition, Pubs: Oxford University Press, 2008.
- 2. Castellan, G. W. Physical Chemistry 4th Ed., Narosa 2004.
- 3. Rao, C.N.R., University General Chemistry; Pubs: Macmillan India, 1985.
- 4. Puri, B.R., Sharma, L.R., Pathania, M.S., Principles of Physical Chemistry; 43rd edition, Pubs: Vishal Publishing Co., 2008.
- 5. Levine, I.N., Physical Chemistry; 5th edition, Pubs: Tata McGraw HillPublishing Co. Ltd., 2002.
- 6. Engel, T. & Reid, P. Physical Chemistry 3rd Ed., Prentice-Hall, 2012.
- 7. Levine, I.N., Physical Chemistry; 5th edition, Pubs: Tata McGraw Hill Publishing Co. Ltd., 2002.
- 8. S. H. Maron, C. F. Prutton, Principles of Physical Chemistry, CBS Publishers And Distributors PVT LTD; 4th edition, 2017.

Unit-I

Vector Calculus: Introduction to cartesian, cylindrical and spherical polar coordinates, Basic ideas of Vector Calculus, Gradient, Divergence, curl and their physical significance, path independence of gradient of scalars, Gauss's divergence theorem, Stoke's theorem.

Electrostatic Field: Gauss's Law and its differential form. Electric field as gradient of electric potential, Potential of localized charge distribution, Work and energy in electrostatics: energy of a point charge and continuous charge distribution.

Unit-II

Electric Field in Matter: Polarization: Mechanism of polarization of dielectric, induced dipole moment and atomic polarizability, Gauss's law for dielectrics, Electric displacement vector, Linear dielectrics.

Unit-III

Magnetism: Lorentz force law, Ampere law in integral and differential form, Divergence of magnetic field, Magnetization: Torques and Forces on magnetic dipoles, Field of magnetized objects, Concept of bound currents, magnetic field inside matter.

Unit-IV

Maxwell's Equations: Faraday's law of electromagnetic induction, Modified form of Ampere's law, Maxwell's equations in free space, determination of the velocity of light in vacuum using Maxwell equations.

Course	Outcome:	

CO1	Develop an insight into Physical Significance of Curl, Divergence, Gradient and their importance in the development of Electrodynamics.
CO2	Quantifying the impact on the properties of the matter under the action of electric fields.
CO3	Quantifying the impact on the properties of the matter under the action of magnetic fields.
CO4	Develop Maxwell's equations for free space.

Recommended books:

- 1. Introduction to Classical Electrodynamics by David Griffith, Prentice Hall.
- 2. Electricity and Magnetism, Edward M. Purcell and David Morin, Cambridge University

Further Readings:

- 1. Elements of Electromagnetism, Matthew N. O. Sadiku, Oxford Univ Press
- 2. Classical Electrodynamics, Walter Greiner, Springer

Physical Chemistry Lab M-I

Course Content

CYMI0232

1. Density measurements

- a. To determine density of a pure solvent by using pycnometer.
- b. To study the variation of density with concentration of a binary mixture.

2. Viscosity measurements

- a. To determine the coefficient of viscosity of a given liquid by using Ostwald viscometer
- b. To determine the coefficient of viscosity of a binary mixture by using Ostwald viscometer.
- c. To determine composition of an unknown binary mixture of two liquids by viscosity measurements.

3. Surface Tension measurements

- a. To determine the surface tension of a given liquid by drop number method.
- b. To determine the surface tension of a given soap solution.
- c. To determine the unknown composition of a mixture of two liquids by surface tension measurements.

4. Refractive Index measurements

- a. To determine the refractive index of a given solvent by using Abbe's refractometer.
- b. To determine specific and molar refraction of a given solvent by using Abbe's refractometer.
- c. To determine refractive index of a binary mixture by using Abbe's refractometer and to determine the unknown composition of a binary mixture.

Course Outcomes

At the end of semester the students will be able to:

- 1. Carry out experiments to understand the Laws and concepts of physical chemistry.
- 2. Calculate and evaluate physicochemical properties of pure or binary mixtures.
- 3. Understand the interfacial and optical properties and apply in daily life.
- 4. Perform physical chemistry experiments for purity analysis.

Recommended Books and/or Reference Materials

- 1. Khosla, B.D., Garg, V.C., Gulati, A., Senior Practical Physical Chemistry; 11th Edition, Pubs: R. Chand & Co., New Delhi, 2002.
 - 2. Das, R.C., Behra, B., Experimental Physical Chemistry; Pubs: Tata

McGraw Hill Publishing Co. Ltd., 1983.

- 3. Levitt, B.P., Findlays Practical Physical Chemistry; 8th edition, Pubs: Longman Group Ltd., London & New York, 1978.
- 4. Yadav, J. B. Advanced Practical Physical Chemistry, KRISHNA PRAKASHAN MEDIA.

Physics Minor Lab-1

List of experiments

- 1. To find the impedance of the LCR circuit.
- 2. To study the effect of voltmeter resistance on the voltage measurement.
- 3. Determination of permittivity of different materials.
- 4. To investigate the equipotential line of electric fields.
- 5. To verify the relationship of speed of light with permeability and permittivity of air.
- 6. To study the magnetic field of a circular conductor as a function of the current, distance and radius.
- 7. To verify Faraday and Lenz law of induction.
- 8. Measurement of resistance by using four probe setup.
- 9. Study of M-H curve of a magnetic material.
- 10. Study of P-E curve for polar material.
- 11. Determination of transition temperature of BaTiO₃ and other materials using permittivity vs temperature measurement.
- 12. Observations and measurements using an electric energy meter and measurement of wattage of a given bulb or heater.
- 13. To study the efficiency of an electric kettle or heater element with varying input voltage.
- 14. Study of variation of magnetic field with distance along the axis of solenoidal system and effect of number of turns of the coil.
- 15. To study the intensity response of photovoltaic/solar cell and verify inverse-square law of radiations of photovoltaic cell.

Course Outcomes: After completion of this course, students will be able to

CO1	Develop an insight to measure the resistance, voltage, current and impedance of circuit.
CO2	Understand the production of magnetic field by the flow of current and its variation.
CO3	Quantifying the impact of electric field on the properties of dielectric materials.
CO4	Quantifying the impact of magnetic fields on the magnetic properties of materials.

Recommended Books:

- 1. "Practical Physics by C.L. Arora.
- 2. "A Laboratory Manual of Physics for Undergraduate Classes" by D.P. Khandelwal.

Section A (Theory)

Data Types, Expressions, and Statements: Python interpreter and interactive mode, debugging; values and types: int, float, Boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments.

Control Flow Functions, and Strings: Conditions - Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration - state, while, for, break, continue.

Lists, Tuples, Dictionaries: Lists - list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples - tuple assignment, tuple as a return value.

Section B (Practical)

Following are the suggested list of experiments:

- 1. Exploring Python basics and setting up the development environment
- 2. Implementing basic Python programs for demonstrating the concepts of python data types, operators and different data structures e.g. find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.
- 3. Implement programs using expressions and statements e.g. exchange the values of two variables, circulate the values of n variables, distance between two points.
- 4. Implementing functions in Python and using inbuilt modules.
- 5. Creating and importing user-defined modules in Python.
- 6. Writing python programs for showing the use of anonymous and inner functions.
- 7. Develop programs using modular programming e.g. square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.
- 8. Design and implement programs using basic data structures e.g. simple sorting, histogram, Students marks statement, Retail bill preparation.
- 9. Data manipulation using Pandas library: Reading and writing data, manipulating data using various operations
- 10. Data handling using files: word count, copy file, Voter's age validation, Marks range validation (0-100).

*This is only the suggested list of Practicals. Instructors may frame additional Practicals relevant to the course contents.

Course Outcomes

CO1: Understand the fundamentals of Python programming and use of its libraries to construct programs.

CO2: Apply the learned skills to design, implement and debug programs using modular programming.

CO3: Analyze a real time system by applying various concepts of python including basic data structures and file systems.

CO4: Evaluate the learned concepts for real-life problem solving.

Recommended Books

- 1. Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.
- 2. Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem-Solving and Programming", 1st Edition, BCS Learning & Development Limited, 2017.
- 3. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012

Reference Books:

- 1. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021.
- 2. Martin C. Brown, "Python: The Complete Reference", 4th Edition, McGraw Hill, 2018.
- 3. David Beazley, Brian K. Jones, Python Cookbook: Recipes for Mastering Python 3", Third Edition, 2013.
Course Contents

SECTION A (THEORY)

Semiconductor Diodes: Ideal versus Practical Diodes, Diode Equivalent Circuits, Zener Diodes, Light-Emitting Diodes. Diode applications Half-Wave Rectifier, Full-Wave rectifiers, Clippers Clampers, Zener Diode as a Voltage regulator. Practical Applications of diodes.

Bipolar Junction Transistor: Transistor construction, operation, Transistor Amplifying action, Operating point, Biasing configurations, Practical applications such as relay, transistor switch, alarm system with a constant current source (CCS), Voltage level indicator.

Field-Effect Transistors: Construction and characteristic of JFET, Transfer characteristics, Depletion type MOSFET and Enhancement- Type MOSFET.

Digital Electronics: Number Systems, Introduction to logic gates, K-map, Combinational circuits, Half-adder, Full-adder, Multiplexer, De-multiplexer, Coder and Encoder.

SECTION B (PRACTICAL)

- 1. To study the V-I characteristics of Diode
- 2. To study the Zener diode as a voltage regulator
- 3. To study the Half-Wave and Full-Wave rectifier circuits using diode
- 4. To study the clipper and Clamper circuit using diode
- 5. To plot a load line for a CE amplifier and show effect of input signal on Q-point
- 6. To demonstrate use of BJT as an amplifier
- 7. To demonstrate working of a JFET and study its V-I characteristics
- 8. To demonstrate working of a LED
- 9. Verification of truth tables of logic gates -OR, AND, NOT, NAND, NOR and Ex-OR.
- 10. Verification of NAND and NOR gates as universal gates
- 11. Design and verification of the truth tables of Half and Full adder circuits.
- 12. Verification of the truth table of the Multiplexer using IC 74150 and De-Multiplexer using IC 74154
- 13. Verify the truth table of decoder driver 7447/7448.

Course Outcomes

CO1: Ability to apply basic concepts of diode circuits and its practical applications

CO2: Capability to use bipolar junction transistors in circuits and its application as an amplifier.

CO3:Understanding the principle and working of Field effect transistors

CO4: Ability to analyze the digital circuits and its applications in real-world scenarios.

- Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory" 10th edition, Pearson Education, 2009.
- 2. Mano M. Morris, "Digital Design", Pearson Education, 3rd edition, 2006

Reference Books

- Millman, Jacob, Halkias Christos C and Satyabratajit, "Electronic Devices and Circuits" 3rd edition, Tata McGraw- Hill, New Delhi, 2010
- Malvino and Leach, "Digital principles and Applications", Tata McGraw Hill, 5th edition, 2003.
- **3.** Sedra, Adel S and Smith, Kenneth C, "Microelectronic Circuits" 4th edition, Oxford University Press, New York, 1997
- 4. Flecther, "An Engineering Approach to Digital Design", PHI, 1st edition 2009