

# CURRICULUM



FOR  
SECONDARY STAGE  
FOUR YEARS INTEGRATED TEACHER EDUCATION  
PROGRAMME (ITEP)

SESSION 2023-24 ON WARDS



DEPTT. OF PEOPLE EDUCATION AND MASS COMMUNICATION  
FACULTY OF ARTS  
MAHATMA GANDHI CHITRAKOOT GRAMODAYA  
VISHWAVIDHYALAYA, CHITRAKOOT, SATNA  
(M.P.),

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# FIRST SEMESTER

S-I

Credits-20

S. N.	Curricular components	Name of Courses	Credits	Hour's per week	Evaluation		Total Marks
					CFA	ESE	
1	Induction programme	Two weeks students induction programme	-	18	-	-	-
2	Foundations of education	Evolution of Indian Education	4	6	25	75	100
3	Disciplinary/Inter-disciplinary courses	Two disciplines from any of school curricular areas (as per NEP 2020)	4	6	25	75	100
		<ul style="list-style-type: none"><li>• Language and literature (Hindi and English)</li><li>• Social Sciences-History, Geography, Economics, Political Science etc.</li><li>• Physical Science- Physics, chemistry etc.,</li><li>• Mathematics</li><li>• Biological Sciences- Zoology, Botany etc.</li><li>• Business Studies, Accountancy etc</li></ul>	4	6	25	75	100
4	Ability enhancement and value-added courses	<ul style="list-style-type: none"><li>• Language-1 (as per 8th schedule of constitution of India)</li></ul>	4	6	25	75	100
		<ul style="list-style-type: none"><li>• Art and creative experiences (performing and visual art)</li></ul>	2	3	15	35	50
		<ul style="list-style-type: none"><li>• Understanding India (Indian ethos and Knowledge system)</li></ul>	2	3	15	35	50
			20	48	130	370	500

## 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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W. J. K.

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

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.





### 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.

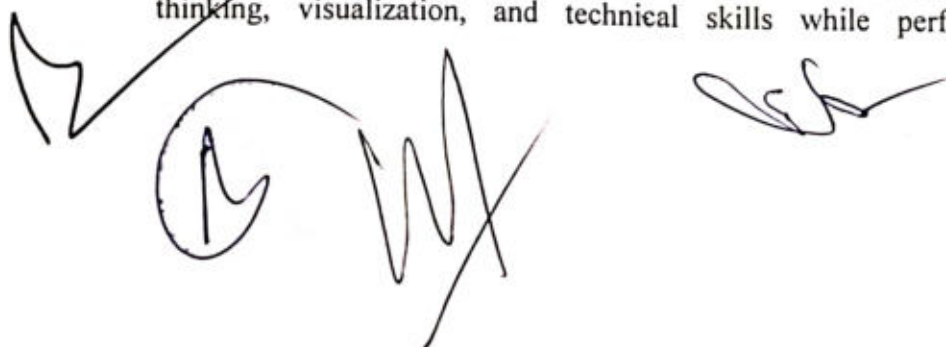
Therefore, educational practitioners that the students of MA Education aim to be, will need to bring an element of art in practices that they engage in. To be able to do this, they need an appreciation of art in general, familiarity with one art form, and basic skills and capabilities to be creative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

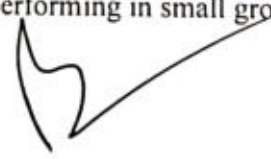
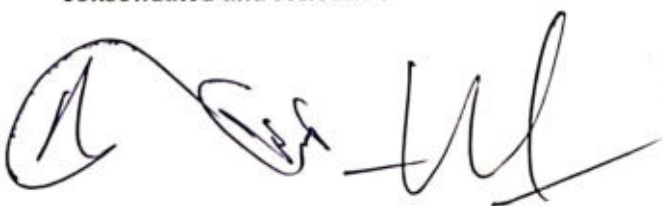
#### **Designing Puppets (6 Sessions)**

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.



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.

### 5.3.3 Pedagogy

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			
Sl. no	Topics	Session flow	Remarks
1	Aesthetics and art, art in everyday life.	Based on their experience	
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 of puppetry.	Presentations	
5	History of puppetry	Lecture	
6	Preparation- finger puppets	Hands on	
7	Preparation of masks	Hands on	
8	Preparing puppets	Hands on	
9	Performing individually	Practice	
10	Performing in pairs	Practice	
11	Performing in groups – 3, 4, 5.	Practice	
12	Assignments	Written.	

### 5.3.5 Suggestive Reading Materials

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

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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)

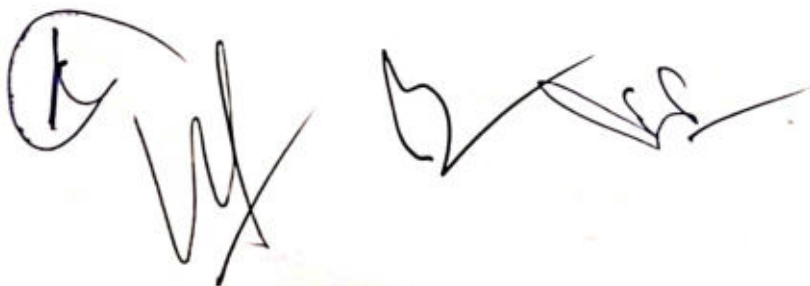
In this unit the basic idea of aesthetics and art, and ways in which the aesthetic dimension manifests itself in human life will be discussed. Using various examples of art, students will engage in identifying aesthetic aspects of daily life, develop aesthetic judgment, and gain familiarity with the 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.



## 5.4 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 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 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

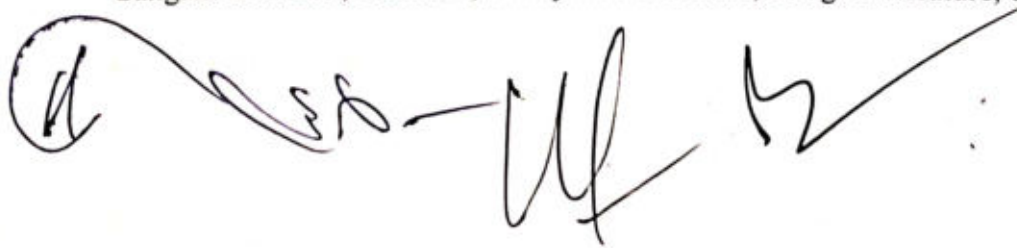
#### Introduction to the Knowledge of India

- 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.



### 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; 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.

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Part A - Introduction			
Program: Certificate		Class: B.Sc. I Year	Year: 2021   Session: 2021-2022
Subject: Physics			
1.	Course Code	S1-PHYS1T	
2.	Course Title	Thermodynamics and Statistical Physics (Paper 1)	
3.	Course Type (Core/Elective/Generic Elective/Vocational/...)	Core course	
4.	Pre- requisite (If any)	To study this course, a student must have had the subject Physics in 12 <sup>th</sup> class.	
5.	Course Learning Outcomes (CLO)	<ol style="list-style-type: none"> <li>1. The course would enable the students to understand the basic Physics of heat and temperature in relation to energy, work, radiation and matter.</li> <li>2. The students are expected to learn that "how laws of thermodynamics are used in a heat engine to transform heat into work".</li> <li>3. This course will also develop an understanding of the various concepts of statistics and the methods to apply them in thermodynamics.</li> <li>4. Students will understand the importance of studying statistical mechanics with the behavior of particles under classical and quantum conditions.</li> </ol>	
6.	Credit Value	4	
7.	Total Marks	Max. Marks: 25+75	Min. Passing Marks: 33

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**Part B - Content of the Course**

Total numbers of Lectures (in hours): 60

Unit	Topics	Number of Lectures
I	<p><b>Historical background &amp; Laws of thermodynamics</b></p> <p><b>1. Historical background:</b></p> <p>1.1. A brief historical background of thermodynamics and statistical Physics in the context of India and Indian culture, Contribution of S. N. Bose in statistical Physics.</p> <p><b>2. Laws of thermodynamics:</b></p> <p>2.1. Thermodynamical system and thermodynamical coordinates, Thermal equilibrium, Zeroth law of thermodynamics, The concept of path function and point function, Work done by and on the system.</p> <p>2.2. First law of thermodynamics, Internal energy as a state function, Reversible and irreversible change, Heat engine and its efficiency, Carnot's cycle, Carnot's engine and its efficiency, Carnot's theorem, Otto engine, Otto cycle, diesel engine.</p> <p>2.3. Second law of thermodynamics, Statement of Kelvin-Planck and Clapeyron, Absolute scale of temperature: Zero of absolute scale, Size of degree, Identity of a perfect gas scale and absolute scale.</p> <p><b>Keywords/Tags:</b> Thermodynamics, Internal energy, Heat engine, Absolute scale.</p>	12
II	<p><b>Entropy</b></p> <p>1. Concept of entropy, Clausius theorem, Entropy as a point function, Change in entropy in reversible and irreversible processes.</p> <p>2. Change in entropy of an ideal gas, Change in entropy when two liquids at different temperatures are mixed (or two bodies at different temperatures are kept in contact).</p> <p>3. Principle of increase of Entropy, Change in entropy of the universe in an irreversible process, Disorder and heat death of universe.</p> <p>4. Physical significance of Entropy, Temperature - entropy (T - S) diagram, third law of thermodynamics.</p> <p><b>Keywords/Tags:</b> Reversible process, Entropy, Ideal gas</p>	12
III	<p><b>Thermodynamic potentials and kinetic theory of gases</b></p> <p><b>1. Thermodynamic potential and its application:</b></p> <p>1.1. Thermodynamic potentials, Thermal equilibrium, Internal energy, Helmholtz free energy, Enthalpy and Gibbs free energy</p>	12

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1.2. Derivation of Maxwell's relations from thermodynamic potentials, Gibbs - Helmholtz equation, Thermodynamic energy equation for ideal and van der Waal gas.

1.3. TdS equation, Derivation of expressions for  $C_p - C_v$  and their special cases for ideal and van der Waal gases, derivation of the expression  $E_s/E_t = C_p / C_v$ .

1.4. Clausius - Clapeyron latent heat equation, Temperature change in adiabatic process, Principle of refrigeration, Joule - Thomson effect, Cooling by adiabatic demagnetization, Production and measurement of very low temperatures.

## 2. Kinetic theory of gases :

2.1. Behavior of a real gas and its deviation from an ideal gas, Virial equation, Andrews experiment on  $CO_2$  gas.

2.2. Critical constant, continuity of the liquid and gaseous state, Vapour and gas state, Boyle temperature, van der Waals equation for real gas, Values of critical constants, Law of the corresponding state.

**Keywords/Tags:** Potential, Enthalpy, Adiabatic, Real gas, Critical constant.

IV

## Classical Statistics

1. Probability, Distribution of N particles in two identical boxes, Probability of occurrence of either event, probability of composite events, Weightage probability.
2. Probability distribution and its narrowing with the increase in number of particles, Expression for average properties, constraints, Accessible and non - accessible microstates.
3. Ensemble theory (Micro-canonical, Canonical and Grand-canonical), Macro and micro states with examples, Principle of equal a priori probability, Concept of phase space.
4. Boltzmann Canonical distribution law: Application: average energy of one-dimensional harmonic oscillator,
5. Derivation of law of equipartition of energy from statistics, Equilibrium between two system in thermal contact and  $\beta$  parameter, Statistical interpretation of entropy and relation  $S = k \log W$ .
6. Boltzmann partition function and derivation of expression for Internal energy, Helmholtz free energy, Enthalpy and Gibbs free energy.

**Keywords/Tags:** Probability, Microstate, Ensemble theory, Partition function.

12

## Quantum Statistics:

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1. Indistinguishability of particles and its consequences, Maxwell - Boltzmann statistics (Classical statistics): Maxwell- Boltzmann distribution law of velocity and speed, Maxwell - Boltzmann statistics and its distribution law.
2. Quantum statistics: Bose-Einstein statistics and distribution law, Derivation of Planck's radiation law from B-E statistics, Rayleigh - Jeans law, Wein's displacement law and Stefan's law.
3. Fermi - Dirac statistics and its distribution law, Explanation of free electron theory, Fermi level and Fermi energy.
4. Comparison between the Maxwell - Boltzmann, Bose-Einstein and Fermi - Dirac statistics.

**Keywords/Tags:** Indistinguishability, Velocity distribution, Fermi level.

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### Part C-Learning Resources

#### Text Books, Reference Books, Other resources

#### Suggested Readings:

1. Zemansky M. W. & Dittman R., "Heat and Thermodynamics", Tata McGraw-Hill.
2. Sears and Salinger, "Thermodynamics, Kinetic Theory & Statistical Thermodynamics", Narosa.
3. Garg S. C. & Ghosh C. K., "Thermal Physics", Tata McGraw-Hill.
4. Subrahmanyam N., Brij Lal, Hemne P.S., "Heat Thermodynamics and statistical", S. Chand, 2012.

#### Suggested equivalent online courses:

1. <https://www.edx.org/course/thermodynamics> Thermodynamics course.

### Part D-Assessment and Evaluation

#### Suggested Continuous Evaluation Methods:

Maximum Marks : 100

Continuous Comprehensive Evaluation (CCE) : 25marks University Exam (UE) 75 marks

<b>Internal Assessment :</b> Continuous Comprehensive Evaluation (CCE):25	Class Test Assignment/Presentation	15 10
<b>External Assessment :</b> University Exam Section: 75 Time : 02.00 Hours	Section(A) : Three Very Short Questions (50 Words Each) Section (B) : Four Short Questions (200 Words Each) Section (C) : Two Long Questions (500 Words Each)	03 x 03 = 09 04 x 09 = 36 02 x 15 = 30 Total 75

Any remarks/ suggestions:

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## B.Sc. 1 Year Chemistry Syllabus

CBCS Annual Pattern  
From Academic Year 2021-2022

### Paper I


#### Part A Introduction

<b>Program-CERTIFICATE</b>	Class-B.Sc.	Year- First	Session: 2021-2022
<b>Subject - Chemistry</b>			
Course Code	SI-CHEMIT		
Course Title	Fundamentals of Chemistry( Paper I)		
Course Type	Core Course		
Pre-requisite (if any)	To study this course our students must have had the subject <u>Chemistry</u> in class +2 or equivalent.		
Course Learning Outcomes (CLO)	By the end of this course students will learn the following aspects of Chemistry: <ol style="list-style-type: none"> <li>1. Ancient Indian chemical techniques.</li> <li>2. Various theories and principles applied to reveal atomic structure.</li> <li>3. Significance of quantum numbers.</li> <li>4. Concept of periodic properties of elements.</li> <li>5. Theories related to chemical bonding.</li> <li>6. Acid-base concept, ph. buffer.</li> <li>7. Factors responsible for reactivity of organic molecules.</li> <li>8. Basics and mechanism of chemical kinetics.</li> <li>9. Properties of electrolytes.</li> </ol>		
Credit Value	4		
Total Marks	Maximum Marks: CCI-25. University Exam (UE)- 75		Minimum Passing Marks: 33

#### Part B- Content of the course

**Total No. of Lectures-Tutorials-Practical (In hours per week):**

**L-T-P:60-0-30**

Unit	Topic	No. of lectures
1	(a) Chemical techniques in ancient India: General Introduction (b) Contribution of ancient Indian scientists in chemistry e.g. metallurgy, dyes, pigments, cosmetics, Ayurveda, Charak Samhita  Atomic Structure:  (i) Review of Bohr's theory and its limitations. Atomic spectrum of Hydrogen Dual nature of particles and waves. (Brook's equation, Heisenberg's	2+4  HOD Dept. Physical Science ANURAG V. CHITambari (B.Sc. CHEMISTRY) (2021-2022)

Uncertainty principle and its significance.

- (iii) Quantum numbers and their significance. Rules for filling electrons in various orbitals, Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau principle and its limitations, Variation of orbital energy with atomic number.

Electronic configurations of the atoms. Stability of half-filled and completely filled orbitals, concept of exchange energy, Relative energies of atomic orbitals, Anomalous electronic configurations.

**Keywords/Tags :** Metallurgy, Dyes, Cosmetics, Charak Samhita Hydrogen spectrum, Hund's rule, Aufbau principle.

2 Elementary idea of the following properties of the elements with reference to s & p-block elements in periodic table. 6

- Effective nuclear number (EAN), shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table.
- Atomic radii (van der Waals)
- Ionic and crystal radii.
- Covalent radii (octahedral and tetrahedral)

Detailed discussion of the following properties of the elements, with reference to s & p-blocks.

- Ionization energy- Successive ionization energy and factors affecting ionization energy. Applications of ionization energy.
- Electronegativity- Pauling's/ Mulliken's electronegativity scales. Variation of electronegativity with bond order, partial charge, hybridization.

**Keywords/Tags :** EAN, Atomic radii, Ionic Radii, Crystal Radii, Ionization Energy.

3 **Chemical Bonding** 20

i. Ionic Bonding: General characteristics of ionic bonding.

Ionic bonding & Energy: lattice & solvation energies and their importance in the context of stability and solubility of ionic compounds.

Statement of Born-Landé equation for calculation of lattice energy, Madelung constant, Born-Haber cycle and its applications. Covalent character in ionic compounds, polarizing power and polarizability, Fajan's rules.

ii. Covalent bonding: Lewis structure, Valence Bond theory (Heitler-London approach)

Hybridization- Concept, types ( $sp$ ,  $sp^2$ ,  $sp^3$ ,  $sp^3d$  and  $sp^3d^2$ ) with suitable examples of inorganic and organic molecules.

Ionic character in covalent compounds- dipole moment and percentage

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ionic character.

*Valence shell electron pair repulsion theory (VSEPR) theory:*  
Assumptions, need of theory, application of theory to explain geometries or shapes of some inorganic molecules and ions on the basis of VSEPR and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements such as:  $\text{NH}_3$ ,  $\text{H}_2\text{O}$ ,  $\text{SF}_4$ ,  $\text{ClF}_3$ ,  $\text{PCl}_5$ ,  $\text{SF}_6$ ,  $\text{ClF}_4$ ,  $\text{XeF}_4$ .

#### **Molecular orbital (MO) concept of bonding**

The approximations of the theory, Linear combination of atomic orbitals (LCAO) (elementary pictorial approach)

Rules for the LCAO method, bonding and antibonding MOs. Characteristics for s-s, s-p and p-p combinations of atomic orbitals, nonbonding combination of orbitals.

MO diagrams of homonuclear diatomic molecules:  $\text{H}_2$ ,  $\text{Li}_2$ ,  $\text{Be}_2$ ,  $\text{B}_2$ ,  $\text{C}_2$ ,  $\text{N}_2$ ,  $\text{O}_2$ ,  $\text{F}_2$ , and their ions.

Molecular orbitals of heteronuclear diatomic molecules:  $\text{CO}$ ,  $\text{NO}$ ,  $\text{CN}$ ,  $\text{HF}$ .

#### **Bond parameters:**

Definition and factors affecting - bond orders, bond lengths, bond angles.

*Keywords/Tags* : Ionic Bonding, Covalent Bonding, Hybridization, VSEPR Theory, LCAO, MO Diagrams, Bond Parameters

#### 4 **Acid-Base concept**

4

Arrhenius concept, Bronsted-Lowry's concept, conjugate acids and bases, relative strength of acids, Lewis concept, pH, buffer solutions, Acid-base neutralisation curves, Handerson equation.

Strength of organic acids and bases: Comparative study with emphasis on factors affecting pK values.

Indicator, choice of indicators.

*Keywords/Tags* : Acid-Base Concept, Bronsted-Lowry's Concept, Conjugate Acids And Bases, pH, Buffer Solution, Indicator.

#### 5 (a) **Fundamentals of Organic Chemistry**

12

Structure, shape and reactivity of organic molecules:

Physical Effects, Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation

Cleavage of Bonds: Homolysis and Heterolysis

Reactive Intermediates: Carbocations, Carbanions and free radicals.

Nucleophiles and electrophiles.

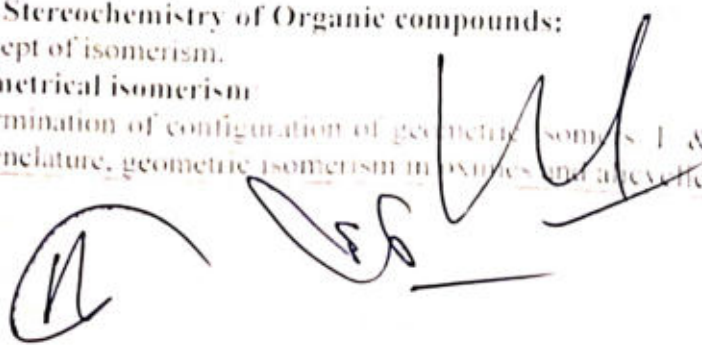
#### (b) **Stereochemistry of Organic compounds:**

Concept of isomerism.

#### **Geometrical isomerism**

Determination of configuration of geometric isomers, I & / system of nomenclature, geometric isomerism in oximes and alicyclic compounds.

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**Optical isomerism:**

Elements of symmetry, molecular chirality, enantiomers & their properties, stereogenic centre, optical activity of enantiomers, Concept of chirality (up to two carbon atoms); chiral and achiral molecules with two stereogenic centres, diastereomers, threo and erythro isomers, meso isomer, resolution of enantiomers, inversion, retention and racemization. Relative and absolute configuration, sequence rules, D & L, and R & S systems of nomenclature.

**Conformations and Conformational analysis**

Conformations of ethane, butane and cyclohexane. Interconversion of Wedge Formula, Newman, Sawhorse and Fischer representations.

**Keywords/Tags:** Electronic Displacements, Nucleophiles, Electrophiles, Isomerism, Molecular Chirality, Enantiomers, Sequence Rules, Conformation

**6 Chemical Kinetics:**

12

Rate of reaction, Definition and difference of order and molecularity. Derivation of rate constants for first, second, third and zero order reactions and examples. Derivation for half-life period. Methods to determine the order of reactions. Effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy.

**Ionic Equilibria:**

Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water, Common ion effect, Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Solubility and solubility product of sparingly soluble salts – applications of solubility product.

**Keywords/Tags:** Order Of Reaction, Molecularity Of Reaction, Arrhenius Equation, Activation Energy, Electrolytes, Salt Hydrolysis, Solubility Product.

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**Part C - Learning resources****Text Books, Reference Books, Other Resources****Text Books:**

1. Lee, J.D., Concise Inorganic Chemistry, ELBS, 1991.
2. Khara, H.C., Gurtu, J.N., Singh, J., Chemistry I or B.Sc. 1st Year, Pragati prakashan.
3. Bariyar, A. & Goyal, S., B.Sc. Chemistry Combined, (in Hindi) Krishna Educational Publishers Year-2019
4. Puri, B. R., Pathania, M.S., Sharma, I. R., Principles of Physical Chemistry, Vishal Publishing Co. 2020
5. Gurtu, J. N., Gurtu, A., Advanced Physical Chemistry, Pragati Prakashan, Meerut ISBN: 9789386633347, 9786633345. Edition, IV, 2017
6. Day, M.C. and Selbin, J. Theoretical Inorganic Chemistry, ACS Publications 1962
7. Bahl, A. & Bahl, B.S., Advanced Organic Chemistry, S. Chand, 2019

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8. Kalsi, P. S., Stereochemistry Conformation and Mechanism, New Age International, 2005.
9. Finar, I.L., Organic Chemistry (Vol. I & II), E.L.B.S.
10. Morrison, R.T. & Boyd, R.N., Organic Chemistry, Pearson, 2010.
11. Clayden, J., Greeves, N., Warren, S., Wothers, P., Organic Chemistry, Oxford University Press, 2<sup>nd</sup> Edition, 2012.
12. Atkins' Physical Chemistry, 10<sup>th</sup> Edition, Oxford University Press, 2014

**Reference Books:**

**Reference Books:**

1. Prakash, S., Founders of Sciences in Ancient India, published by The Research Institute of Ancient Scientific Studies, New Delhi, 1965 (OCOLC)594302452.
2. Acharya Prafulla Chandra Ray - A Collection of Writings, Volume IIIA : A History of Hindu Chemistry (Volume-I), Editor : Prof. Anil Bhattacharyya, Publisher : University of Calcutta. . Online information:  
<https://www.caluniv.ac.in/news/APCR%20Publication/acharya-prafulla.html>
3. Chemistry in India, in Traditions & Practices of India, Textbook for Class XI, Module 2, Central Board of Secondary Education.
4. Subbarayappa, B.V., Chemistry and Chemical Techniques in India, Centre for Studies in Civilizations, 2004, ISBN 818758601X.
5. Huhegy, J.E., Keiter, E.A., Keiter, R.L., & Medhi, O.K., Inorganic Chemistry: Principles of Structure and Reactivity, Pearson Education India, 2006.
6. Douglas, B.E., McDaniel, D.H. & Alexander, J.J., Concepts and Models in Inorganic Chemistry, John Wiley & Sons, 1994.
7. Graham Solomon, T.W., Fryhle, C.B. & Snyder, S.A, Organic Chemistry, John Wiley & Sons, 12th Edition, 2016.
8. McMurry, J.E, Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.
9. Sykes, P., A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi (1988).
10. Barrow, G.M, Physical Chemistry, Tata McGraw-Hill (2007)

**Suggested equivalent online courses:**

(all URLs accessed in May 2021)

- MOOC: <https://alison.com/course/fundamentals-of-chemistry>
- NPTEL: <https://nptel.ac.in/courses/104/106/104106119> ;  
<https://nptel.ac.in/courses/104/101/104101121>
- MIT: <https://ocw.mit.edu/courses/chemistry/5-12-organic-chemistry-i-spring-2005/syllabus/>

**Web sources**

(all URLs accessed in May 2021)

<http://www.sydney.edu.au/science/chemistry/teaching/1108/Sharp/01Molecules.pdf>

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Part A: Introduction			
Program: Certificate Course		Class: B.Sc. 1 Year	Year: 2021
		Session: 2021-2022	
Subject: Mathematics			
1	Course Code	SI-MATHIT	
2	Course Title	Algebra, Vector Analysis and Geometry (Paper 1)	
3	Course Type	Core Course	
4	Pre-requisite (if any)	To study this course, a student must have had the subject Mathematics in class 12 <sup>th</sup> .	
5	Course Learning Outcomes (CLO)	<p>The course will enable the students to:</p> <ol style="list-style-type: none"> <li>1. Recognize consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix, using the rank of matrix.</li> <li>2. To find the Eigen values and corresponding Eigen vectors for a square matrix.</li> <li>3. Using the knowledge of vector calculus in geometry.</li> <li>4. Enhance the knowledge of three dimensional geometrical figures (eg. cone and cylinder).</li> </ol>	
6	Credit Value	Theory: 6	
7	Total Marks	Max. Marks: 25 + 75	Min. Passing Marks: 33

Part B: Content of the Course		
Total No. of Lectures (in hours per week): 3 hours per week		
Total Lectures: 90 hours		
Unit	Topics	No. of Lectures
I	1.1 Historical background: 1.1.1 Development of Indian Mathematics: Later Classical Period (500 -1250) 1.1.2 A brief biography of Varahamihira and Aryabhata 1.2 Rank of a Matrix 1.3 Echelon and Normal form of a matrix 1.4 Characteristic equations of a matrix 1.4.1 Eigen-values 1.4.2 Eigen-vectors	15
II	2.1 Cayley Hamilton theorem 2.2 Application of Cayley Hamilton theorem to find the inverse of a matrix. 2.3 Application of matrix to solve a system of linear equations 2.4 Theorems on consistency and inconsistency of a system of linear equations 2.5 Solving linear equations up to three unknowns	18

III	3.1 Scalar and Vector products of three and four vectors 3.2 Reciprocal vectors 3.3 Vector differentiation 3.3.1 Rules of differentiation 3.3.2 Derivatives of Triple Products 3.4 Gradient, Divergence and Curl 3.5 Directional derivatives 3.6 Vector Identities 3.7 Vector Equations	18
IV	4.1 Vector Integration 4.2 Gauss theorem (without proof) and problems based on it 4.3 Green theorem (without proof) and problems based on it 4.4 Stoke theorem (without proof) and problems based on it	15
V	5.1 General equation of second degree 5.2 Tracing of conics 5.3 System of conics 5.4 Cone 5.4.1 Equation of cone with given base 5.4.2 Generators of cone 5.4.3 Condition for three mutually perpendicular generators 5.4.4 Right circular cone 5.5 Cylinder 5.5.1 Equation of cylinder and its properties 5.5.2 Right Circular Cylinder 5.5.3 Enveloping Cylinder	24

**Keywords:**

Indian Mathematics, Rank of a Matrix, Scalar and Vector products, Vector differentiation, Vector identities, Vector integration, General equation of second degree, Tracing of conics, System of conics, Equation of cone, Equation of cylinder.

**Part C - Learning Resources**

Text Books, Reference Books, Other Resources

**Suggested Readings:****Text Books:**

1. K. B. Datta: Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd. New Delhi 2000.
2. Shanti Narayan: A Text Book of Vector Calculus, S. Chand & Co., New Delhi, 1987.
3. S. L. Loney: The Elements of Coordinate Geometry Part-1, New Age International (P) Ltd., Publishers, New Delhi, 2016.
4. P. K. Jain and Khalil Ahmad: A text book of Analytical Geometry of Three Dimensions, Willey Eastern Ltd, 1999.
5. Gerard G. Emch, R. Sridharan, M. D. Srinivas: Contributions to the History of Indian Mathematics, Hindustan Book Agency, Vol. 3, 2005.

## 6. मध्य प्रदेश हिन्दी ग्रंथ अकादमी की पुस्तकें।

**Reference Books:**

1. Chandrika Prasad: A Text Book on Algebra and Theory of Equations, Pothishala Pvt. Ltd., Allahabad, 2017.
2. N. Jacobson: Basic Algebra Vol. I and II, W. H. Freeman, 2009.
3. I. S. Luther and I. B. S. Passi: Algebra Vol. I and II, Narosa Publishing House, 1997.
4. N. Saran and S. N. Nigam: Introduction to Vector Analysis, Pothishala Pvt. Ltd. Allahabad, 1990.
5. Murray R. Spiegel: Vector Analysis, Schaum Publishing Company, New York, 2017.
6. Gorakh Prasad and H. C. Gupta: Text Book on Coordinate Geometry, Pothishala Pvt. Ltd. Allahabad, 2000.
7. P. K. Jain and Khalil Ahmad: A text book of Analytical Geometry of Two Dimensions, Macmillan Indian Ltd., 1994.
8. S. L. Loney: The Elements of Coordinate Geometry Part-2, Macmillan, 1923.
9. N. Saran and D. N. Gupta: Three Dimensional Coordinate Geometry, Pothishala Pvt. Ltd. Allahabad, 1994.
10. R. J. T. Bell: Elementary Treatise on Coordinate Geometry of Three Dimensions, Macmillan India Ltd., 1994.
11. Bibhutibhusan Datta and Avadhesh Narayan Singh: History of Hindu Mathematics, Asia Publishing House, 1962.

**Suggested Digital Platforms Web links:**

<https://epgp.inflibnet.ac.in>

<https://freevidelectures.com/university/iit-roorkee>

<https://www.highereducation.mp.gov.in/?page=xhZlQmpZwkylQo2b%2Fy5G7w%3D%3D>

<https://www.bhojvirtualuniversity.com>

**Suggested Equivalent online courses:**

<https://nptel.ac.in/courses/111105122/>

<https://nptel.ac.in/courses/111107112/>

<https://nptel.ac.in/courses/111/101/111101080/>


**Part D: Assessment and Evaluation****Suggested Continuous Evaluation Methods:**

Maximum Marks:	100
Continuous Comprehensive Evaluation (CCE):	25 Marks
University Exam (UE):	75 Marks


<b>Internal Assessment:</b> Continuous Comprehensive Evaluation (CCE)	Class Test	15
	Assignment/Presentation	10
	<b>Total Marks: 25</b>	
<b>External Assessment:</b> University Exam (UE) Time: 02.00 Hours	Section (A): Three Very Short Questions (50 Words Each)	03 × 03 = 09
	Section (B): Four Short Questions (200 Words Each)	04 × 09 = 36
	Section (C): Two Long Questions (500 Words Each)	02 × 15 = 30
	<b>Total Marks: 75</b>	





**Theory Syllabus**

Part A Introduction			
Programme : Certificate Course	Class : B.Sc.	Year : 1 year	Session : 2021-2022
<b>Subject: Zoology</b>			
1	Course Code	<b>SI-ZOOLIT</b>	
2	Course Title	<b>Animal Diversity: Non-Chordata (Paper - 1)</b>	
3	Course Type (Core Course/Elective/Generic Elective/Vocational/.....)	Core Course	
4	Pre-requisite (if any)	To study this course a student must have had the subject Biology in 12 <sup>th</sup> Class *	
5	Course Learning outcomes (CLO)	<p>Upon completion of the course students should be able to</p> <ol style="list-style-type: none"> <li>1. Learn about the importance of systemic, taxonomy and phylogeny to get a concrete idea of evolution of non-chordate phyla.</li> <li>2. Understand the various morphological, anatomical structures and functions of animals of different phyla.</li> <li>3. Get the knowledge about economic, ecological and medical significance of various animals in human welfare.</li> <li>4. Understand the important parasites and their control measures.</li> </ol>	
6	Credit Value	4	
7	Total Marks	Max. Marks: 25+75	Min. Passing Marks:33

  
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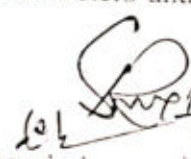


  
**Dr. U.S. Parmar**  
 Chairman  
 Central Board of Studies  
 Subject - Zoology  
 Date - 29.05.2021

**Part B-Content of the Course**

**Total No. of Lectures-Tutorials-Practical (in hours per week): 2 hours per week**

L-T-P

Unit	Topics	No. of Lectures
I	<p><b>Taxonomy, Phylogeny and Protozoa</b></p> <p><b>1. Taxonomy</b></p> <p>1.1 Elementary knowledge of Zoological Nomenclature and International Code</p> <p>1.2 Classification of Animal Kingdom upto Phylum of acoelomate and coelomate non-chordates according to Parker and Haswell 7<sup>th</sup> edition</p> <p><b>2. Phylogeny</b></p> <p>2.1 Definition and Examples</p> <p><b>3. Protozoa</b></p> <p>3.1 Phylum Protozoa: General characters of the phylum and outline classification up to classes with distinctive characters and suitable examples</p> <p>3.2 Structure, life history and pathogenicity of malarial parasite (<i>Plasmodium vivax</i>)</p> <p>3.3 Protozoa and disease</p> <p><b>Keywords/Tags:</b> ICZN, Classification, Protozoa, <i>Plasmodium</i>.</p>	11
II	<p><b>Porifera, Coelenterata</b></p> <p><b>1. Porifera</b></p> <p>1.1 Phylum Porifera: General characters of the phylum and outline classification up to classes with distinctive characters and suitable examples</p> <p>1.2 Type study of <i>Sycon</i></p> <p>1.3 Canal system of Sponges</p> <p><b>2. Coelenterata</b></p> <p>2.1 Phylum Coelenterata: General characters of the phylum and outline classification up to classes with distinctive characters and suitable examples</p> <p>2.2 Type Study of <i>Obelia</i></p> <p>2.3 Corals and Coral reef formation</p> <p><b>Keywords/Tags:</b> Classification, Porifera, <i>Sycon</i>, Coelenterata, <i>Obelia</i>, Coral reefs.</p>	<p align="right">   <b>HOD</b>  <b>Dept. Physical Sciences</b>  <b>M.G.C.G.V. Chitrakoot</b>  <b>Batna (M.P.)</b> </p> <p align="center"></p>
III	<p><b>Platyhelminthes, Nematelminthes, Annelida</b></p> <p><b>1. Platyhelminthes</b></p> <p>1.1 Phylum Platyhelminthes: General characters of the phylum and outline classification up to classes with distinctive characters and suitable examples</p> <p>1.2 External morphology and life history of Liver fluke</p> <p><b>2. Nematelminthes</b></p> <p>2.1 Phylum Nematelminthes: General characters of the phylum and outline classification up to classes with distinctive characters and suitable examples</p>	<p align="center"></p> <p align="center">      </p>

	<p>2.2 Pathogenic symptoms of Nematodes and diseases</p> <p><b>3. Annelida</b></p> <p>3.1 Phylum Annelida: General Characters of the phylum and outline classification up to classes with distinctive characters and suitable examples</p> <p>3.2 Type study of Earthworm (<i>Pheretima</i>)</p> <p>3.3 Structure and significance of Trochophore larva</p> <p><b>Keywords/Tags:</b> Classification, Platyhelminthes, Liver Fluke, Nematode disease, Annelida, <i>Pheretima</i>, Trochophore.</p>	
IV	<p><b>Arthropoda, Mollusca</b></p> <p><b>1. Arthropoda</b></p> <p>1.1 Phylum Arthropoda: General Characters of the phylum and outline classification up to classes with distinctive characters and suitable examples</p> <p>1.2 Type study of Prawn</p> <p>1.3 Larval forms of crustacea</p> <p>1.4 Insects as a vector of human disease</p> <p><b>2. Mollusca</b></p> <p>2.1 Phylum Mollusca: General characters of the phylum and outline classification up to classes with distinctive characters and suitable examples</p> <p>2.2 Type study of <i>Pila</i></p> <p>2.3 Structure and Significance of Glochidium larva</p> <p><b>Keywords/Tags:</b> Classification, Arthropoda, Prawn, Crustacea larva, Insects, Mollusca, <i>Pila</i>, Glochidium.</p>	<p>12</p> <p><i>DSM</i></p>
V	<p><b>Echinodermata, Hemichordata</b></p> <p><b>1. Echinodermata</b></p> <p>1.1 Phylum Echinodermata: General characters of the phylum and outline classification up to classes with distinctive characters and suitable examples</p> <p>1.2 External features and water vascular system of Starfish (<i>Asterias</i>)</p> <p>1.3 Larval forms of Echinodermata</p> <p><b>2. Hemichordata</b></p> <p>2.1 Phylum Hemichordata: General characters of the phylum hemichordate and relationship with non-chordates and chordates</p> <p>2.2 <i>Balanoglossus</i> – External morphology</p> <p>2.3 Structure and significance of Tornaria larva</p> <p><b>Keywords/Tags:</b> Classification, Echinodermata, <i>Asterias</i>, Echinodermata larvae, Hemichordata, <i>Balanoglossus</i>, Tornaria.</p>	<p>12</p> <p><b>MOO</b> <b>Dept. Physical Sciences</b> <b>M.G.C.G.V. Chitrakoot</b> <b>Batna (M.P.)</b></p> <p><i>(Signature)</i></p>

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*(Signature)*

29.05.2021  
(Chairman)  
C.B.O.S. Zool.

*(Signature)*



Part C-Learning Resources  
Text Books, Reference Books, Other resources

Suggested readings

1. Parker, J, Haswell, WA, "A Text Book of Zoology", VII edition, Vol. I & II, Low Price Publications, Delhi, 1990.
2. Barnes, RD, "Invertebrate Zoology", VII Edition, Cengage Learning, India, 2006.
3. Pechenik, JA, "Biology of the Invertebrates" McGraw-Hill Educations, VII Edition, 2015.
4. Sedgwick, A, "A Students Text Book of Zoology", Vol.I, II & Vol. III., Low Price Publications, Delhi, 1990.
5. Dhami and Dhami, "Invertebrate Zoology" R., Chand & Co., India, 2009.
6. Jordan and Verma, "Invertebrate Zoology," S. Chand & Company, New Delhi, 2013.
7. Agarwal, VK, "Zoology for Degree Students: Non-Chordata", S Chand & Company, 2017.
8. Kotpal, R, "Modern Text Book of Invertebrates", Rastogi Publications, Meerut, 2017
9. Kotpal, R, "Protozoa to Echinodermata (Phylum Series)", Rastogi Publications, Meerut, 2017.
10. <https://zoologylearningpoint.wordpress.com>
11. <https://zoologyresources.com>

Suggested equivalent online courses:

1. Swayam Online Courses  
<https://storage.googleapis.com/uniquecourses/online.html>
2. National Digital Library  
<https://ndl.iitkg.ac.in/>
3. e-PG Pathshala (MHRD) Portal(<https://epgp.inlibnet.ac.in/>)
4. Animal diversity <https://swayam.gov.in/courses/5686/animal-diversity>  
Advances in Animal Diversity, Systemics and Evolution  
(<https://swayam.gov.in/courses/5686-zoology>)
5. Science Direct Open Access Content  
(<https://www.sciencedirect.com/book/9781843342038/open-access>)

21/5/21  
MOD  
Dept. Physical Sciences  
M.G.C.G.V. Chitrakoot  
Satna (M.P.)

Dr. U.S. Parmar  
Chairman

Central Board of Studies  
Subject - Zoology

Date - 29.05.2021

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**Part A Introduction**

Program: Certificate		Class: B.Sc. 1 <sup>st</sup> year	Year : 2021	Session: 2021-22
<b>Subject: Botany</b>				
1	Course Code	SI-BOTAT		
2	Course Title	Applied Botany (Paper 1)		
3	Course Type (Core Course/Elective/Generic Elective/Vocational/.....)	Core Course		
4	Pre-requisite (if any)	To study this course, a student must have had the subject Biology/ Life Sciences/ Agriculture in class/12th		
5	Course Learning outcomes (CLO)	By the end of this course the student should have: <ul style="list-style-type: none"> <li>• Understood the significance and role of botany.</li> <li>• Learnt the basic aspects of applied botany.</li> <li>• Gained knowledge about employment opportunities in field of botany</li> <li>• Gained knowledge about start-up opportunities in the field of botany</li> <li>• Learnt about opportunities of social services</li> <li>• Gain knowledge about best health practices</li> </ul>		
6	Credit Value	04 Credits		
7	Total Marks	Max. Marks: 25+75	Min. Passing Marks:33	

**Part B- Content of the Course**

Total No. of Lectures- 60 Hours Tutorials- 00 Practical -00 ( 04 hours per week):

L-T-P:

Unit	Topics	No. of Lectures
I	1.1 Introduction, objectives and importance of Applied botany 1.2 History and evolution of botany 1.3 Relation of plants to man and relation with other services 1.4 Various disciplines of botany and their applications to human welfare	12
II	1.1 Definition and types of pollution and pollutants 1.2 Phytoremediation: Air, water, soil, noise and thermal pollutants (Any 5 plants with botanical name, family) and their role in pollution control. 1.3 Bioremediation: definition and types	12
III	1.1 Ancient agricultural practices 1.2 Modern agriculture practices: Polyhouse, Drop irrigation, hydroponics, computer-based agriculture.	12

7/12/2025  
 HOD  
 Dept. Physical Sciences  
 M.G.C.G.V. Calicut  
 Sanna (M.P.)

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	terrace farming. 1.3 Organic farming: Introduction, objective and brief technique 1.4 Horticulture: Definition and role in human welfare 1.5 Forestry: Definition, branches and role in human welfare 1.6 Silviculture: Definition and management practices	
IV	1.1 Role of Botany in Rural development 1.2 Ethnobotany: Introduction and importance 1.3 Ethnomedicine: Definition and examples. (Local name, Botanical name, family and importance of Neem, Aloe, Clove, Ginger, Tulsi, Turmeric, Giloy, Emblica, Ashwagandha, Arandi) 1.4 Ethno-fibres: Definition and examples (Local name, Botanical name, family and importance of Ankara, Coconut, elephant grass, cotton) 1.5 Ethno-food crops: Definition and examples (Local name, Botanical name, family and importance of Garadu, Singada, Kutaki, Sama, Kodo, Bathua, Sehjan, Jowar, Makka, Bajra, Jau)	12
V	1.1 Plant tissue culture: Definition, types and Importance. 1.2 DNA Recombinant technique: Introduction, tools and importance 1.3 Role of recombination in present era 1.4 Bioinformatics: Definition, concept and tools 1.5 Introduction of bioinformatics software; Basic idea of BLAST and FASTA Importance of bioinformatics	12

Keywords/Tags: Applied Botany, History of Botany, Evolution of Botany, Botany in human welfare, Pollution, Pollutants, Phytoremediation, Bioremediation, Hydroponics, polyhouse, Terrace farming, Organic farming, Horticulture, Silviculture, Ethnobotany, Ethnomedicine, Ethno-food crops, Bioinformatics, BLAST, FASTA, Recombinant DNA, Plant tissue culture

### Part C-Learning Resources

Text Books, Reference Books, Other resources

- Sources:
1. Prasad R. and McMahon K. "Plants and Society" McGraw Hill Education, 2007
  2. Prasad R., Rodriguez H. G. and Thakur A. S. "Applied Botany" American Academic Press, 2017
  3. Prasad R. S. "Forest Botany" M/s Bishen Singh Mafendra Pal Singh 2012.
  4. Agrahari R. P. "Environmental Ecology, Biodiversity, Climate Change and Disaster Management" McGraw Hill Education, 2020
  5. Sharma D. K. "Biodiversity Conservation: Current Status and Future Strategies" Write and Print Publication, 2017
  6. Singh J. "Biodiversity Environment and Sustainability" AD Publications Pvt Ltd/ 2008
  7. Gupta P. K. "Molecular Biology and Genetic Engineering" Rastogi Publications, 2005
  8. Sharma V., Mehta J. V. and Shankar A. "Bioinformatics" Rastogi Publications, 2008



Handwritten signatures and dates: (Dr. K. W. SHAH) 25/5/21

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2. Suggestive digital platforms web links

Suggested equivalent online courses:

### Part D-Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks : 100

Continuous Comprehensive Evaluation (CCE) : 25marks University Exam (UE) 75 marks

<b>Internal Assessment :</b> Continuous Comprehensive Evaluation (CCE):25	Class Test Assignment/Presentation	15 10 Total =25
<b>External Assessment :</b> University Exam Section: 75 Time : 02:00 Hours	Section(A) : Three Very Short Questions (50 Words Each) Section (B) : Four Short Questions (200 Words Each) Section (C) : Two Long Questions (500 Words Each)	03 x 03 = 09 04 x 09 = 36 02 x 15 = 30 Total 75

Any remarks/ suggestions:

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(Dr. K. W. SHAH)



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Dept. Physical Sciences  
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Satna (M.P.)

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