CENTRAL UNIVERSITY OF PUNJAB

CURRICULUM

INTEGRATED TEACHER EDUCATION PROGRAMME (ITEP)

B.Sc. B.Ed. (SECONDARY LEVEL)

Batch: 2024

Department of Education

Graduate Attribute

On successful completion of the four years Integrated Teacher Education Programme (ITEP)- B.Sc. B.Ed. Secondary level the teacher-trainees shall be able to develop disciplinary knowledge as well as requisite pedagogical skills necessary for secondary-level teaching. Further, they are expected to develop the qualities of a dynamic teacher and play a constructive role in individual and societal transformation.

Programme Learning Outcomes (PLOs)

After the completion of the Integrated Teacher Education Programme (ITEP)- B.Sc. B.Ed. Secondary the teacher-trainees shall be able to develop;

1. a comprehensive knowledge of the aims of education, curricular goals, competencies, and learning outcomes at the secondary level
2. procedural knowledge to perform and accomplish the professional tasks associated with teaching in secondary schools
3. understanding on effective pedagogical approaches for curriculum transaction.
4. skills in the assessment of student learning, including the selection of assessment methods, tools, and processes appropriate for secondary-level children.
5. understanding on learning needs of students with disability or other learning disabilities and delivering learning experiences in an inclusive and caring environment.
6. capacity in managing classroom activities and field-based learning, student behavior, and engaging with parents and other caregivers of secondary-level children as well as with community members.

CUPB B.Sc. B.Ed. Curriculum Structure

SEM	Foundations of Education	Disciplinary/Interdisciplinary Courses		Stage-Specific Content-cum-Pedagogy	Ability Enhancement & VAC	School Experience	Community Engagement and Services	Foundation Elective	Total CUP
		Discipline Major	Discipline Minor						
I	4	8	4	x	8	x	x	x	24
II	x	8	4	x	8	x	x	x	20
III	4	12	x	4	x	x	x	x	20
IV	4	12	4	4	x	x	x	x	24
V	x	12	4	4	2	2	x	x	24
VI	4	12	x	4	2	2	x	x	24
VII	4	x	x	x	4	12	x	x	20
VIII	6	x	x	x	4	4	2	4	20
Total	26	64	16	16	28	20	2	4	176

Semester-I

Two-Week Student Induction Programme					
Foundation Courses**					
Code	Name of Course	L	T	P	Credit
BSE.101	Evolution of Indian Education	4	0	0	4
Disciplinary/ Interdisciplinary Courses (One major and One minor) List of Major/Minor Subjects from Physical Sciences (Physics, Chemistry and Mathematics) List of Major/Minor Subjects from Biological Sciences (Chemistry, Botany and Zoology) # Candidate has to choose one minor other than the major					
Disciplinary Major Courses*					
Physics (Major)					
Code	Name of Course	L	T	P	Credit
BSE.102	Mechanics	3	0	0	3
BSE.103	Mathematical Physics	3	0	0	3
BSE.104	Physics Practical-I	0	0	2	1
BSE.105	Physics Practical-II	0	0	2	1
Chemistry (Major)					
BSE.106	Inorganic Chemistry-I (Atomic Structure and Chemical Bonding)	3	0	0	3
BSE.107	Organic Chemistry-I (Chemistry of Hydrocarbons and Alkyl Halides)	3	0	0	3
BSE.108	Inorganic Chemistry-I (Practical-I: Volumetric Analysis-I)	0	0	2	1
BSE.109	Organic Chemistry-I (Practical-II: Simple Techniques in Synthesis Lab)	0	0	2	1
Mathematics (Major)					
BSE.110	Algebra & Trigonometry	4	0	0	4
BSE.111	Calculus-I	4	0	0	4
Botany (Major)					
BSE.112	Microbiology and Phycology	3	0	0	3
BSE.113	Diversity of Cryptogams and Phanerogams	3	0	0	3
BSE.114	Microbiology and Phycology (Practical-I)	0	0	2	1
BSE.115	Diversity of Cryptogams and Phanerogams (Practical-II)	0	0	2	1
Zoology (Major)					
BSE.116	Biology of Non-Chordates	3	0	0	3
BSE.117	Cytology and Genetics	3	0	0	3
BSE.118	Biology of Non-Chordates (Practical-I)	0	0	2	1
BSE.119	Cytology and Genetics (Practical-II)	0	0	2	1
Minor (Candidate has to choose one minor other than the major)**					
Physics (Minor)					
BSE.120	Mechanics	3	0	0	3
BSE.121	Physics Practical-I	0	0	2	1
Chemistry (Minor)					
BSE.122	In-Organic Chemistry-I (Atomic Structure and Chemical Bonding)	3	0	0	3
BSE.123	In-Organic Chemistry-I (Practical-I Volumetric Analysis-I)	0	0	2	1

Mathematics (Minor)					
BSE.124	Algebra & Trigonometry	4	0	0	4
Botany (Minor)					
BSE.125	Microbiology and Phycology	3	0	0	3
BSE.126	Microbiology and Phycology (Practical-I)	0	0	2	1
Zoology (Minor)					
BSE.127	Biology of Non -Chordates	3	0	0	3
BSE.128	Biology of Non -Chordates (Practical-I)	0	0	2	1
Ability Enhancement & Value- Added Courses **					
Any one of the following language subjects (Punjabi/Hindi) as Language 1					
BSE.129	ਪੰਜਾਬੀ ਭਾਸ਼ਾ, **ਵਿਹਾਰਕ ਵਿਆਕਰਣ** ਅਤੇ ਸਭਿਆਚਾਰ	4	0	0	4
BSE.130	हिंदी भाषा का व्यावहारिक व्याकरण एवं लेखन	4	0	0	4
BSE.131	Arts (Performing and Visual) and Creative Expressions	1	0	0	1
BSE.132	Arts (Performing and Visual) and Creative Expressions-Practical	0	0	2	1
BSE.133	Understanding India (Indian Ethos and Knowledge Systems)-I	2	0	0	2
				Total	**24**

Note:

***Student must choose one major from Physics, Chemistry, Mathematics, Botany and Zoology)**

**** Student must choose one minor other than the major**

****Common Courses for all students**

Semester-II

Code	Name of Course	L	T	P	Credit
Disciplinary Major Courses					
Physics (Major)					
BSE.151	Electricity and Magnetism	3	0	0	3
BSE.152	Properties of matter, waves & acoustics	3	0	0	3
BSE.153	Physics Practical-I	0	0	2	1
BSE.154	Physics Practical-II	0	0	2	1
Chemistry (Major)					
BSE.155	Inorganic Chemistry-II (Chemistry of S, P, D & F Block Elements)	3	0	0	3
BSE.156	Physical Chemistry-I (States of Matter and Ionic Equilibria)	3	0	0	3
BSE.157	Inorganic Chemistry-II (Practical-I: Qualitative Analysis)	0	0	2	1
BSE.158	Physical Chemistry-I (Practical-II)	0	0	2	1
Mathematics (Major)					
BSE.159	Differential Equations	4	0	0	4
BSE.160	Calculus-II	4	0	0	4
Botany (Major)					
BSE.161	Plant Anatomy	3	0	0	3
BSE.162	Plant Systematics	3	0	0	3
BSE.163	Plant Anatomy (Practical-I)	0	0	2	1
BSE.164	Plant Systematics (Practical-II)	0	0	2	1

Zoology (Major)					
BSE.165	Biology of Chordates	3	0	0	3
BSE.166	Biochemistry and Physiology	3	0	0	3
BSE.167	Biology of Chordates (Practical-I)	0	0	2	1
BSE.168	Biochemistry and Physiology (Practical-II)	0	0	2	1
Minor (Candidate has to choose one minor other than the major)					
Physics (Minor)					
BSE.169	Electricity and Magnetism	3	0	0	3
BSE.170	Physics Practical -I	0	0	2	1
Chemistry (Minor)					
BSE.171	Inorganic Chemistry-II (Chemistry of S, P, D & F Block Elements)	3	0	0	3
BSE.172	Inorganic Chemistry-II (Practical-I Qualitative Analysis)	0	0	2	1
Mathematics (Minor)					
BSE.173	Differential Equations	4	0	0	4
Botany (Minor)					
BSE.174	Plant Systematics	3	0	0	3
BSE.175	Plant Systematics (Practical-II)	0	0	2	1
Zoology (Minor)					
BSE.176	Biology of Chordates	3	0	0	3
BSE.177	Biology of Chordates (Practical-I)	0	0	2	1
Ability Enhancement & Value- Added Courses **					
Any one of the following language subjects (Communicative English/Punjabi/Hindi) as Language 2 (Other than language 1)					
BSE.178	Communicative English	4	0	0	4
BSE.179	ਪੰਜਾਬੀ ਭਾਸ਼ਾ, **ਵਿਹਾਰਕ ਵਿਆਕਰਣ** ਅਤੇ ਸਭਿਆਚਾਰ	4	0	0	4
BSE.180	हिंदी भाषा का व्यावहारिक व्याकरण एवं लेखन	4	0	0	4
BSE.181	Teacher and Society	2	0	0	2
BSE.182	Understanding India (Indian Ethos and Knowledge Systems)-II	2	0	0	2
				Total	**20**

Note: Major course will remain the same as taken in Semester I
****Common Courses for all students**

Semester-III

Code	Name of Course	L	T	P	Credit
Foundation Courses*					
BSE.201	Child Development and Educational Psychology	4	0	0	4
Disciplinary Major Courses**					
Physics (Major)					
BSE.202	Electrodynamics	4	0	0	4
BSE.203	Fundamentals of Optics and Laser	4	0	0	4
BSE.204	Physics Practical-I	0	0	4	2
BSE.205	Physics Practical-II	0	0	4	2
Chemistry (Major)					

BSE.206	Organic Chemistry-II: (Chemistry of Oxygen and Nitrogen Containing Functional Groups)	4	0	0	4
BSE.207	Physical Chemistry -II (Chemical Thermodynamics and its Applications, Surface chemistry, colloids and polymers)	4	0	0	4
BSE.208	Organic Chemistry-II (Practical-I Qualitative Analysis)	0	0	4	2
BSE.209	Physical Chemistry -II (Practical-II Thermochemistry)	0	0	4	2
Mathematics (Major)					
BSE.210	Analysis and Vector Calculus	4	0	0	4
BSE.211	Partial Differential Equations	4	0	0	4
BSE.230	Numerical Methods	4	0	0	4
Botany (Major)					
BSE.212	Plant Physiology	4	0	0	4
BSE.213	Plant Ecology	4	0	0	4
BSE.214	Plant Physiology (Practical-I)	0	0	4	2
BSE.215	Plant Ecology (Practical-II)	0	0	4	2
Zoology (Major)					
BSE.216	Immunology	4	0	0	4
BSE.217	Biomolecules	4	0	0	4
BSE.218	Immunology (Practical-I)	0	0	4	2
BSE.219	Biomolecules (Practical-II)	0	0	4	2
Stage-Specific Content-cum-Pedagogy Course*					
BSE.229	Basics of Pedagogy at Secondary Stage*	4	0	0	4
				Total	**20**

Note:
***Common Courses for all students**
****Major course will remain the same as taken in Semester I**

Semester-IV

Code	Name of Course	L	T	P	Credit
Foundation Courses*					
BSE.251	Philosophical and Sociological Perspective of Education-I	4	0	0	4
Disciplinary Major Courses**					
Physics (Major)					
BSE.252	Quantum Mechanics	4	0	0	4
BSE.253	Computational Physics	4	0	0	4
BSE.254	Physics Practical-I	0	0	4	2
BSE.255	Physics Practical-II	0	0	4	2
Chemistry (Major)					
BSE.256	Inorganic Chemistry-III (transition and inner transition elements, Coordination Chemistry and Acid-Base Concept)	4	0	0	4
BSE.257	Organic Chemistry–III (Chemistry of Heterocyclic compounds, Natural products and biomolecules)	4	0	0	4

BSE.258	Inorganic Chemistry-III (Practical-I Volumetric Analysis-II)	0	0	4	2
BSE.259	Organic Chemistry III (Practical-II Quantitative Analysis)	0	0	4	2
Mathematics (Major)					
BSE.260	Abstract Algebra	4	0	0	4
BSE.261	Analytical and Solid Geometry	4	0	0	4
BSE.262	Complex Analysis	4	0	0	4
Botany (Major)					
BSE.263	Plant Metabolism	4	0	0	4
BSE.264	Plant Reproductive Biology	4	0	0	4
BSE.265	Plant Metabolism (Practical-I)	0	0	4	2
BSE.266	Plant Reproductive Biology (Practical-II)	0	0	4	2
Zoology (Major)					
BSE.267	Developmental Biology	4	0	0	4
BSE.268	Animal Physiology	4	0	0	4
BSE.269	Developmental Biology -(Practical-I)	0	0	4	2
BSE.270	Animal Physiology -(Practical-II)	0	0	4	2
Minor (Candidate has to choose one minor other than the major)					
Physics (Minor)					
BSE.276	Modern Physics	3	0	0	3
BSE.277	Physics Practical (Modern Physics)	0	0	2	1
Chemistry (Minor)					
BSE.278	Foundations of Physical Chemistry	3	0	0	3
BSE.279	Practical-(Physical Chemistry)	0	0	2	1
Mathematics (Minor)					
BSE.280	Algebra-I	4	0	0	4
Botany (Minor)					
BSE.212	Plant Physiology	3	0	0	3
BSE.214	Plant Physiology (Practical-I)	0	0	2	1
Zoology (Minor)					
BSE.281	Cytology	3	0	0	3
BSE.282	Practical-(Cytology)	0	0	2	1
Stage-Specific Content-cum-Pedagogy Courses (Any two as per the major and minor subject)*					
BSE.271	Pedagogy of Physics-I	2	0	0	2
BSE.272	Pedagogy of Chemistry-I	2	0	0	2
BSE.273	Pedagogy of Mathematics-I	2	0	0	2
BSE.274	Pedagogy of Botany-I	2	0	0	2
BSE.275	Pedagogy of Zoology-I	2	0	0	2
				Total	**24**

Note:

*Common Courses for all students

**Major and minor course will remain the same as taken in Semester I

Semester-V

Code	Name of Course	L	T	P	Credit
Disciplinary Major Courses**					

Physics (Major)					
BSE.301	Solid State Physics and Spectroscopy	4	0	0	4
BSE.302	Electronics (Analog & Digital)	4	0	0	4
BSE.303	Physics Practical-I	0	0	4	2
BSE.304	Physics Practical-II	0	0	4	2
Chemistry (Major)					
BSE.305	Inorganic Chemistry-IV (Organometallic, Reaction Mechanisms and Bioinorganic Chemistry)	4	0	0	4
BSE.306	Physical Chemistry-II (Quantum Chemistry)	4	0	0	4
BSE.307	Inorganic Chemistry-IV (Practical-I Gravimetric Analysis)	0	0	4	2
BSE.308	Physical Chemistry III: (Practical-II)	0	0	4	2
Mathematics (Major)					
BSE.309	Ring Theory and Laplace Transforms	4	0	0	4
BSE.310	Statics and Dynamics	3	1	0	4
BSE.311	Probability and Statistics	4	0	0	4
Botany (Major)					
BSE.312	Mycology and Pathology	4	0	0	4
BSE.313	Plant Genetics and Breeding	4	0	0	4
BSE.314	Mycology and Pathology (Practical-I)	0	0	4	2
BSE.315	Plant Genetics and Breeding (Practical-II)	0	0	4	2
Zoology (Major)					
BSE.316	Human Genetics	4	0	0	4
BSE.317	Concepts of Evolution and Systematics	4	0	0	4
BSE.318	Human Genetics (Practical-I)	0	0	4	2
BSE.319	Concepts of Evolution and Systematics (Practical-II)	0	0	4	2
Minor (Candidate has to choose one minor other than the major)					
Physics (Minor)					
BSE.327	Thermal and Nuclear Physics	3	0	0	3
BSE.328	Physics Practical (Thermal and Nuclear Physics)	0	0	2	1
Chemistry (Minor)					
BSE.329	Fundamental Concepts of Organic Chemistry and Spectroscopy	3	0	0	3
BSE.330	Practical-(Organic Chemistry)	0	0	2	1
Mathematics (Minor)					
BSE.331	Foundations of Probability, Statistics and Linear Algebra	4	0	0	4
Botany (Minor)					
BSE.264	Plant Reproductive Biology	3	0	0	3
BSE.266	Plant Reproductive Biology (Practical-II)	0	0	2	1
Zoology (Minor)					
BSE.332	Ecology and Environment	3	0	0	3
BSE.333	Practical-(Ecology and Environment)	0	0	2	1
Stage-Specific Content-cum-Pedagogy Courses (Any two as per the major and minor subject)*					
BSE.320	Pedagogy of Physics-II	2	0	0	2
BSE.321	Pedagogy of Chemistry-II	2	0	0	2
BSE.322	Pedagogy of Mathematics-II	2	0	0	2
BSE.323	Pedagogy of Botany-II	2	0	0	2
BSE.324	Pedagogy of Zoology-II	2	0	0	2

Ability Enhancement & Value- Added Courses *					
BSE.325	ICT in Education	1	0	1	2
School Experiences*					
BSE.326	Pre-Internship Practice (Demonstration Lessons and Peer Teaching)	0	0	4	2
				Total	**24**

Note:

***Common Courses for all students**

****Major and minor course will remain the same as taken in Semester I**

Semester-VI

Code	Name of Course	L	T	P	Credit
Foundations of Education*					
BSE.351	Assessment and Evaluation	2	0	0	2
BSE.352	Inclusive Education	2	0	0	2
Disciplinary Major Courses**					
Physics (Major)					
BSE.353	Thermal and Statistical Physics	4	0	0	4
BSE.354	Nuclear and Particle Physics	4	0	0	4
BSE.355	Physics (Practical-I)	0	0	4	2
BSE.356	Physics (Practical-II)	0	0	4	2
Chemistry (Major)					
BSE.357	Spectroscopic Techniques in Chemistry (molecular spectroscopy, UV-visible, FTIR, NMR and photochemistry)	4	0	0	4
BSE.358	Physical Chemistry-IV (Electrochemistry, Phase equilibria, Properties of Solutions and Chemical Kinetics)	4	0	0	4
BSE.359	Organic Chemistry-IV: (Practical-I Preparation of Organic Compounds)	0	0	4	2
BSE.360	Physical Chemistry -IV: (Practical-II)	0	0	4	2
Mathematics (Major)					
BSE.361	Linear Algebra	4	0	0	4
BSE.362	Number Theory	4	0	0	4
BSE.363	Graph Theory	4	0	0	4
Botany (Major)					
BSE.364	Plant Tissue Culture	4	0	0	4
BSE.365	Plant Molecular Biology	4	0	0	4
BSE.366	Plant Tissue Culture (Practical-I)	0	0	4	2
BSE.367	Plant Molecular Biology (Practical-II)	0	0	4	2
Zoology (Major)					
BSE.368	Principles of Ecology & Wild Life Management	4	0	0	4
BSE.369	Applied Zoology (Non chordates)	4	0	0	4
BSE.370	Ecology & Wildlife-(Practical-I)	0	0	4	2
BSE.371	Applied Zoology-(Practical-II)	0	0	4	2
Stage-Specific Content-cum-Pedagogy Courses (Any two as per the major and minor subject)*					
BSE.372	Pedagogy of Physics-III	2	0	0	2

BSE.373	Pedagogy of Chemistry-III	2	0	0	2
BSE.374	Pedagogy of Mathematics-III	2	0	0	2
BSE.375	Pedagogy of Botany-III	2	0	0	2
BSE.376	Pedagogy of Zoology-III	2	0	0	2
Ability Enhancement & Value- Added Courses *					
BSE.377	Mathematical & Quantitative Reasoning	2	0	0	2
School Experiences*					
BSE.378	School Observation (Field Practice)	0	0	4	2
				Total	**24**

Note:
***Common Courses for all students**
****Major course will remain the same as taken in Semester I**

Semester-VII

Code	Name of Course	L	T	P	Credit
Foundations of Education*					
BSE.401	Perspectives on School Leadership and Management	2	0	0	2
BSE.402	Curriculum Planning and Development	2	0	0	2
Ability Enhancement & Value- Added Courses*					
BSE.403	Art Education (Performing and Visual)	2	0	0	2
BSE.404	Sports Nutrition and Fitness	2	0	0	2
School Experiences*					
BSE.405	School-Based Research Project	0	0	4	2
BSE.406	Internship in Teaching	0	0	20	10
				Total	**20**

Note: *Common Courses for all students

Semester-VIII

Code	Name of Course	L	T	P	Credit
Foundations of Education*					
BSE.451	Philosophical and Sociological perspectives of Education-II	4	0	0	4
BSE.452	Education Policy Analysis	2	0	0	2
Any one Elective from the following offered courses (from BSE.453 to BSE.463) as per the choice of student-teachers*					
BSE.453	Adolescence Education	4	0	0	4
BSE.454	Education for Mental Health	4	0	0	4
BSE.455	Education for Sustainable Development	4	0	0	4
BSE.456	Emerging Technologies in Education	4	0	0	4
BSE.457	Gender Education	4	0	0	4
BSE.458	Guidance and Counselling	4	0	0	4
BSE.459	Human Rights Education	4	0	0	4
BSE.460	Peace Education	4	0	0	4

BSE.461	Sports and Fitness Education	4	0	0	4
BSE.462	Tribal Education	4	0	0	4
BSE.463	Economics of Education	4	0	0	4
Ability Enhancement & Value- Added Courses *					
BSE.464	Yoga and Understanding Self	2	0	0	2
BSE.465	Citizenship Education, Sustainability and Environmental Education	2	0	0	2
School Experiences*					
BSE.466	Post Internship (Review & Analysis)	0	0	4	2
BSE.467	Creating Teaching Learning Material	0	0	4	2
Community Engagement and Service*					
BSE.468	Community Engagement and Services	0	0	4	2
				Total	**20**

Note:
***Common Courses for all students**

Student Induction Programme

The activities under the induction program will include;

- Orientation program on different aspects of the ITEP and required courses and credit requirements;
- Physical activities like team sports and physical training/exercise sessions designed to inculcate team spirit, group cohesion, and bonding as well as physical and mental health;
- Participation in creative expression activities relating to visual and performing arts like painting, sculpture, pottery, music, dance, etc. to develop aesthetic sensibility and creativity;
- Motivational lectures by eminent people in the society, visits to local areas of cultural and historical importance and institutions such as Balvatikas/Anganwadi Centres, schools and higher education institutions, hospitals, local artisans, adult, and lifelong education activities to develop an understanding of the functioning of various institutions, community, and society;
- Familiarizing students with different Departments/Units within the institution and their roles, including visits to laboratories, workshops, facilities for sports, etc. to acquaint students with various facilities available in the institution.

Examination Process

Foundation Course/Disciplinary/ Interdisciplinary Courses (Major & Minor)			Stage-Specific Content-cum-Pedagogy Courses, Ability Enhancement & Value- Added Courses or any other theory courses up to 2 credits	
	Marks	Evaluation	Marks	Evaluation
Internal Assessment	25	Surprise tests=10 Marks (Per course three surprise tests will be conducted and the average of the best two tests will be taken into consideration) Assignments=5 Marks Term paper=10 Marks	-	-

Mid-semester test (MST)	25	Descriptive (Covering both short answer and long answer)	50	Descriptive (70%): (Covering both short answer and long answer) Objective (30%): Multiple choice questions
End-semester exam (ESE)	50	Descriptive (70%): (Covering both short answer and long answer) Objective (30%): Multiple choice questions	50	Descriptive (70%): (Covering both short answer and long answer) Objective (30%): Multiple choice questions
School Experiences, Community Engagement	Field Performance Based (Practical Record, Presentation, and Viva-Voce). The evaluation will be made by a committee (concerned mentor and one examiner) as will be constituted by the HoD.			
Practical Examinations (25 Marks)				
Distribution of Marks	Total Marks 25			
a) Experiment	10 Marks			
b) Brief Theory	05 Marks			
c) Viva–Voce	05 Marks			
d) Record (Practical file)	05 Marks			
*The practical examination will be conducted by the concerned course coordinator.				

SEMESTER-I

Course Title: Evolution of Indian Education

L	T	P	Cr
4	0	0	4

Course Code: BSE.101

Course Learning Outcomes:

At the end of the course the prospective teacher-trainees will be able to;

CLO1: To develop an understanding among student teachers of the meaning of education and education during ancient period in India

CLO2: To orient student teachers to the historical perspective of Indian education during Islamic period

CLO3: To develop an understanding of education development in India during colonial period

CLO4: To provide an overview of the evolution of education during post-independence period

Units/Hours	Contents	Mapping with CLOs
UNIT I **15 Hours**	Meaning, nature and scope of education, Aims of education, Individual and social, Agencies of education-Informal, formal and non-formal, Ancient Indian Education: Salient features of Vedic, Buddhist and Jain Education System.	**CLO1**
UNIT II **15 Hours**	Education during Islamic Period: Salient features of Islamic Education System. Finance and Management of educational institutions.	**CLO1 & CLO2**
UNIT III **10 Hours**	Colonial Education in India: Macaulay Minutes, Woods Despatch, Contribution of Indian thinkers: Mahatma Gandhi, Sri Aurobindo, Rabindranath Tagore,	**CLO2 & CLO3**
UNIT IV **20 Hours**	Education in Independent India, Overview of Constitutional values and educational provisions. Features of Mudaliar Commission 1952-53, Kothari commission 1964-66, NPE-1986, NEP 2020	**CLO3 & CLO4**

Suggestive Practicum

The course content transaction will include the following; Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, focus group discussion, surveys, short term project work, etc.

Suggestive Reading Materials

• Bhatia and Narang: Philosophical & Sociological Foundations Education Doaba House, New Delhi, 1992.
• Dash, B.N: Foundations of Education, Kalyani Publishers 14
• Saxena, N.R.S.: Principles of Education
• Govt. of India Ministry Report of Secondary Education Commission (1952–53).
• Prasad and Chandra: Sociological Foundations of Education, Deepak KSK Publishers, Delhi, 2006

• Sodhi, T.S. Philosophical and Sociological Foundations of Education, Bawa Publications, Patiala, 2007
• Taneja, V.R. Foundation of Education, Chandigarh, Mahindra Capital, Punjab, 2006.

PHYSICS (MAJOR)

Course Title: Mechanics
Course Code: BSE.102

L	T	P	Cr
3	0	0	3

Course Learning Outcomes;
At the end of the course the prospective teacher-trainees will be able to;
CLO1 enhance their knowledge regarding Cartesian and spherical polar coordinate systems and, the relationship of conservation laws.
CLO2 understand various forces in nature and Kepler Laws.
CLO3 acknowledge them Galilean transformation and Invariance and Focault pendulum.
CLO4 enrich them with Elastic collision in Lab and C.M. system and Rotational motion.

Unit/Hours	Contents	Mapping with CLOs
UNIT-I 13 hours	1. Frames of reference Laws of Mechanics, Inertial frames of reference, Galilean transformation equations, Hypothesis of Galilean invariance, Conservation of Momentum, Non inertial frames and fictitious forces, Rotating frames of reference, Centrifugal force and Coriolis force, Foucault's pendulum (Section 2.1 to 2.11of Mechanics by J C Upadhyaya) 2. Conservation of Energy Conservation laws, Conservative forces, Conservation of energy for a particle: Energy function, Potential energy curve, Non conservative forces (Section 5.1to 5.7, 5.10, 5.11of Mechanics by J C Upadhyaya)	CLO1
UNIT-II 12 hours	3. Linear and Angular Momentum Conservation of linear momentum, Centre of mass, , Centre of mass frame of reference, Collision of two particles, Deflection of a moving particle by a particle at rest, Rockets, Angular momentum and torque, Motion under central force, Areal velocity, Conservation of angular momentum with examples (Section 6.1 to 6.4,6.6 to 6.9 of Mechanics by J C Upadhyaya) 4. Potentials and Fields	CLO2C

	Central force, Inverse-square law force, Potential energy of a system of masses, Gravitational field and potential, Escape velocity, Keplar's laws, Newton's deductions from Keplar's laws (Section 7.1 to 7.4, 7.6to7.9, 7.18, 7.19 of Mechanics by J C Upadhyaya)	
UNIT-III 8 hours	5. Lagrangian formulations of Classical Mechanics Constraints, Generalized co-ordinates, Principle of virtual work, D'Alembert's principle, Lagrange's equations, Kinetic energy in generalized co-ordinates, Generalized momentum, Cyclic co-ordinates, Conservation laws and symmetry properties-Hamiltonian of a system	CLO3
UNIT-IV 12 hours	6. Special Theory of Relativity Electromagnetism and Galilean transformation, Michelson Morley experiment, Ether hypothesis, Postulates of Special Theory of Relativity, Lorentz transformation equations, Velocity transformation, Length contraction, Time dilation, Simultaneity, Mass in relativity, Mass and energy, Space-time diagram, Geometrical interpretation of Lorentz transformation, Principle of covariance, Four-vectors in Mechanics	CLO4

Suggestive Mode of Transaction

The course content transaction will include the following:

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, selections from theoretical readings, flipped learning, blended learning, demonstration, laboratory method

Textbooks for Study

1. Mechanics by J C Upadhyaya
2. Classical Mechanics by Takwale and Puranik
3. Classical Mechanics by Hans and Puri
4. Classical Mechanics by J C Upadhyaya

Reference books

1. Mechanics by D.S.Mathur
2. Classical Mechanics by Goldstein
3. Berkeley Physics course Vol 1
4. Feynman Lectures on Physics Vol 1
5. Elements of Mechanics – K Rama Reddy, S Raghavan & D V N Sarma- Universities Press
6. Introduction to Mechanics – Mahendra K Verma – Universities Press

PHYSICS (MAJOR)

Course Title: Mathematical Physics

L	T	P	Cr
3	0	0	3

Course Code: BSE.103
Course Learning Outcomes;
At the end of the course the prospective teacher-trainees will be able to;
CLO1 comprehend scalar and vector fields - gradient of a scalar function
CLO2 analyze special functions - beta and gamma functions - definitions - symmetry property of beta function
CLO3 reflect upon special types of matrices - symmetric and skew-symmetric matrices
CLO4 comprehend complex variables and fourier series

Unit/Hours	Contents	Mapping with CLOs
UNIT-I 10 hours	Vector Calculus Scalar and Vector Fields - Gradient of a Scalar function - Divergence of a Vector function - Curl - Line Integral, Surface Integral and Volume Integral (Simple Problems) - Gauss Divergence Theorem - Stoke's Theorem and Green's Theorem (Statement and Proof)- Spherical Polar Coordinates - Expressions for Gradient, Divergence, Curl and Laplacian Operator in Cartesian and Spherical Polar Coordinates.	CLO1
UNIT-II 10 hours	Special Functions Special Functions - Beta and Gamma Functions - Definitions - Symmetry Property of Beta function - Evaluation of Integrals using Beta function - Transformation of Beta function - Evaluation of Gamma Function - The value of Γ 1/2 - Transformations of Gamma function (Other forms) - Relation between Beta and Gamma functions - Simple Problems in beta and gamma functions - Series Solutions for Bessel, Legendre and Hermite Differential Equations.	CLO2
UNIT-III 10 hours	Matrices Special Types of Matrices - Symmetric and Skew-symmetric Matrices -Hermitian and Skew Hermitian Matrices - Orthogonal Matrices - Unitary Matrices -Properties - Characteristics Equation - Determination of Eigen values and Eigen vectors - Properties - Statement and Proof of Cayley - Hamilton Theorem - Simple Problems	CLO3

	- Inverse of Matrix by CH Theorem - Diagonalization of 2x2 Real Symmetric Matrices.	
UNIT-IV 15 hours	Complex Variables Basics of Complex Numbers and their Graphical Representation - Euler's Formula, De-Moivre's Theorem - Functions of Complex Variables - Limit, Continuity and Differentiability - Analytic Function -Definition - Cauchy-Riemann Conditions - Examples of Analytic Functions (Analyticity) - Cauchy-Riemann Conditions in Polar Form Fourier Series Fourier Series in the interval ($-\pi$ to π) - Definition – Dirichlet's Conditions (Statement Only) - Determination of Fourier Coefficients - Even and Odd Functions and their Fourier expansions. Sine and Cosine Periodic Functions - Simple Problems in Fourier Series in the interval ($-\pi$ to π) - Applications of Fourier series - Half Wave Rectifier and Saw Tooth Wave.	CLO4

Suggestive Mode of Transaction

The course content transaction will include the following:

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, selections from theoretical readings, flipped learning, blended learning, demonstration, laboratory method

Books for Study

1. Mathematical Physics, H. K. Dass, S. Chand & Co. Ltd. (2010).

2. Mathematical Physics, Sathya Prakash, Sultan Chand & Sons, New Delhi, Fifth Revised and Enlarged Edition, 2006, (Reprint 2007).

3. Mathematical Physics ,B. D. Gupta, Vikas Publishing house Pvt. Ltd. (2010)

Books for Reference

1. Mathematical Methods for Physicists, G. Arfken, (5th Edition), Academic Press, (2000).

2. Mathematical Physics, B.S. Rajput, 8th Edition,Pragati Prakashan(1978).

3. Foundations of Mathematical Physics, Sadri Hassani, Second Edition.Springer

4. Mathematical methods for Physics and Engineering, K.F.Riley, M.P.Hobson &S.J.Bence , Cambridge University Press, 3rd Edition

Course Title: Physics Practical-I

L	T	P	Cr
0	0	2	1

Course Code: BSE.104

Contents

1. Young's modulus-non uniform bending-using pin and microscope-(load-extension graph).
2. Young's modulus-uniform bending-using optic lever
3. Young's modulus-Angle between the tangents
4. Surface Tension-capillary rise method-radius by vernier microscope
5. Viscosity-Poiseuille's method –(Variable Pressure head, radius by mercury pellet method, sensibility method to find mass)
6. Moment of inertia-Flywheel

Course Title: Physics Practical-II

Course Code: BSE.105

L	T	P	Cr
0	0	2	1

Content

1. Moment of Inertia-Torsion Pendulum
2. Rigidity modulus-static torsion
3. Compound pendulum acceleration due to gravity, Radius of gyration
4. Liquid lens-Refractive index of liquid and glass
5. Spectrometer-solid prism-Refractive index of glass measuring angle of minimum deviation.
6. Spectrometer-solid prism- Dispersive power

CHEMISTRY (MAJOR)

Course Title: Inorganic Chemistry-I (Atomic Structure and Chemical Bonding)

Course Code: BSE.106

L	T	P	Cr
3	0	0	3

Course Learning Outcomes

At the end of the course the prospective teacher-trainees will be able to;

CLO1 develop understanding for the concepts of structure and bonding.

CLO2 appreciate the variation in the different types of structure and bonding exhibited by inorganic compounds.

CLO3 enrich their factual knowledge of chemistry related to ionic and covalent compounds.

CLO4 analyze the implications of Lewis theory, Valence bond theory

Units/Hours	Contents	Mapping with Course Learning Outcome

UNIT-I 11hours	Atomic Structure and Chemical Periodicity: The origin and distribution of the elements, The structure of the periodic table, The de Broglie relationship, The uncertainty principle, Schrodinger wave equation and its derivation, Energy quantization, Significance of wave function. The Born interpretation, Quantum numbers, Normal and orthogonal wave functions. Radial and angular probability distribution curves, the building up principle in many electron atoms, Penetration and shielding (The Slater's rules), Atomic parameters and their variation in periodic table, Electronegativity and various scales, Variation of electronegativity with partial charges and hybridization, Electro neutrality principle, Hardness and softness, Perturbation theory.	CLO 1
UNIT-II 11hours	Ionic Compounds-I: Concept of close packing and ionic structures, Properties of ionic substances, Occurrence of ionic bonding, the radius ratio rules, Efficiency of packing, Hexagonal close packing, Cubic close packing, Structures of different crystal lattices, Sodium chloride, Cesium chloride, Wurtzite, Zinc blende, Fluorite, Rutile, Cristobalite, Nickel arsenide, Pervoskite, Rhenium oxide, Calcium carbide, The calcite and aragonite structures.	CLO2
UNIT-III 11hours	Ionic Compounds-II: Lattice energy, Born-Haber cycle, the calculations of the lattice energy on the basis of Born-Lande equation, The predictive power of thermochemical calculations on ionic compounds. Covalent character in predominantly ionic compounds, Imperfections of crystals, Conductivity in ionic solids, Band theory, Intrinsic and photo excited semiconductors, Transistors, High temperature superconductors.	CLO3
UNIT-IV 12 hours	The Covalent Bond: The Lewis theory, Valence bond theory - A mathematical approach, Resonance, Valence Shell Electron Pair Repulsion Model (VSEPR theory), Prediction of structures and variation of bond angles on the basis of VSEPR theory, Shortcomings of VSEPR theory. Concept of hybridization, Rules for obtaining hybrid orbitals, Extent of d-orbital participation in molecular bonding (SO_2, PCl_5, SO_3), Molecular orbital theory (LCAO method), Symmetry of molecular orbitals, Applications of MOT to homo- and hetero-nuclear diatomic molecules, Molecular orbital energy level diagrams (Be_2, N_2, O_2, F_2, LiH, NO, CO, HCl, NO_2, BeH_2, NO_2).	CLO4

Suggestive Mode of Transaction

The course content transaction will include the following:

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Suggested Readings

- Cotton, F.A., Wilkinson, G., Gaus, P.L., Basic Inorganic Chemistry; 3rd edition, Pubs: John Wiley Sons. 1995.
- D. F. C. Shriver, P. W. Atkins and C. H. Langford, Inorganic Chemistry, ELBS Oxford, 1991.

- Douglas, B. McDamiel, D., Alexander, J., Concepts and Models of Inorganic Chemistry; 3rd edition, Pubs: John Wiley and Sons Inc., 1994.
- Inorganic Chemistry, A.G. Sharpe, ELBS.
- Inorganic Chemistry, W.W. Porterfield Addison-Wesley.
- J. D. Lee, Concise Inorganic Chemistry, ELBS, Oxford 1994.
- J. E. Huheey, E.A. Keiter, R. L. Keiter, Inorganic Chemistry, 4th Ed, Pearson Education, Singapore, 1999.
- Jolly, W.L., Modern Inorganic Chemistry; 2nd edition, Pubs: McGraw-Hill Publishing, Company Limited, 1991.
- Lee, J.D., Concise Inorganic Chemistry; 4th edition, Pubs: Chapman Hall Ltd., 1991.
- Miessler, G.L., Larr, D.A., Inorganic Chemistry; 3rd edition, Pubs: Pearson Education Inc., 2004.
- Purcell, K.F., Kotz, J.C., Inorganic Chemistry; Pubs: W.B. Saunders Company, 1977.
- Puri, B.R., Sharma, L.R., Kalia, K.C., Principles of Inorganic Chemistry; 30th edition, Pubs: Milestones Publisher, 2006-07.
- Shriver, D.E., Alkins, P.W., Langford, C.H., Inorganic Chemistry; 4th edition, Oxford Publisher: Oxford University Press, 2006.
- University General Chemistry, C.N.R. Rao, Macmillan.

CHEMISTRY (MAJOR)

Course Name: Organic Chemistry-I (Chemistry of Hydrocarbons and Alkyl Halides)

Course Code: BSE.107

L	T	P	Cr
3	0	0	3

Course Learning Outcomes:

At the end of the course the prospective teacher-trainees will be able to;

CLO1 : understand and apply key concepts in organic chemistry, including classification and nomenclature, electronic displacements, reaction mechanisms, and stereochemistry.

CLO2 : analyze reactions, and conformational analysis of alkanes, alkenes, alkynes, and cycloalkanes.

CLO3 : analyze and evaluate fundamental concepts of aromatic hydrocarbons, including aromaticity, electrophilic aromatic substitution, and reactions of polynuclear hydrocarbons.

CLO4 : evaluate the preparation methods, mechanisms, and reactivity of alkyl and aryl halides, as well as applications of organometallic compounds.

Units/Hours	Contents	Mapping with Course Learning Outcome
UNIT-I 11hours	**Basics of Organic Chemistry** Organic Compounds: Classification, and Nomenclature, Hybridization, Shapes of molecules, Influence of hybridization on bond properties. Electronic Displacements: Inductive, Electromeric, resonance and	

	Mesomeric effects, hyper conjugation and their applications; Dipole moment; Organic acids and bases; their relative strength.. Homolytic and Heterolytic fission with suitable examples. Curly arrow rules, formal charges; Electrophiles and Nucleophiles; Nucleophlicity and basicity; Types, shape and their relative stability of Carbocations, Carbanions, Free radicals and Carbenes. Introduction to types of organic reactions and their mechanism: Addition, Elimination and Substitution reactions. Stereochemistry: Fischer Projection, Newmann and Sawhorse Projection formulae and their interconversions; Geometrical isomerism: cis–trans and, syn-anti isomerism E/Z notations with C.I.P rules. Optical Isomerism: Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers, Molecules with two or more chiral-centres, Distereoisomers, meso structures, racemic mixture and resolution. Relative and absolute configuration: D/L and R/S designations.	CLO1
UNIT-II 11hours	**Chemistry of Aliphatic Hydrocarbons** Carbon-Carbon sigma bonds: Chemistry of alkanes: Formation of alkanes, Wurtz Reaction, Wurtz-Fittig Reactions, Free radical substitutions: Halogenation -relative reactivity and selectivity. Cycloalkanes and Conformational Analysis: Types of cycloalkanes and their relative stability, Baeyer strain theory, Conformation analysis of alkanes: Relative stability: Energy diagrams of cyclohexane: Chair, Boat and Twist boat forms; Relative stability with energy diagrams. Carbon-Carbon pi bonds: Formation of alkenes and alkynes by elimination reactions, Mechanism of E_1, E_2, E_1cb reactions. Saytzeff and Hofmann eliminations. Reactions of alkenes: Electrophilic additions their mechanisms (Markownikoff/ AntiMarkownikoff addition), mechanism of oxymercuration-demercuration, hydroboration-oxidation, ozonolysis, reduction (catalytic and chemical), syn and anti-hydroxylation (oxidation). 1,2 and 1,4 addition reactions in conjugated dienes and, Diels-Alder reaction; Allylic and benzylic bromination and mechanism, e.g. propene, 1-butene, toluene, ethyl benzene. Reactions of alkynes: Acidity, Electrophilic and Nucleophilic additions. Hydration to formcarbonyl compounds, Alkylation of terminal alkynes.	CLO2
UNIT-III 11hours	**Chemistry of Aromatic Hydrocarbons** Aromaticity: Hückel's rule, aromatic character of arenes, cyclic carbocations/carbanions and heterocyclic compounds with suitable examples. Electrophilic aromatic substitution: halogenation, nitration, sulphonation and Friedel-Craft's alkylation/acylation with their mechanism. Directing effects of the groups. Polynuclear Hydrocarbons: Reactions of naphthalene phenanthrene and anthracene Structure, Preparation and structure elucidation and important derivatives of naphthalene and anthracene; Polynuclear hydrocarbons.	CLO1
	Chemistry of Halogenated Hydrocarbons	

UNIT-IV 12 hours	Alkyl halides: Methods of preparation, nucleophilic substitution reactions – SN_1, SN_2 and SNi mechanisms with stereochemical aspects and effect of solvent etc.; nucleophilic substitution vs. elimination. Aryl halides: Preparation, including preparation from diazonium salts. Nucleophilic aromatic substitution; SNAr, Benzyne mechanism. Relative reactivity of alkyl, allyl/benzyl, vinyl and aryl halides towards nucleophilic substitution reactions. Organometallic compounds of Mg and Li – Use in synthesis of organic compounds.	CLO2

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Suggested Readings

- Eliel, E. L. &Wilen, S. H. *Stereochemistry of Organic Compounds*, Wiley: London, 1994.
- Finar, I. L. *Organic Chemistry (Volume 1)*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- Finar, I. L. *Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products)*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education.
- Fundamentals of Organic Chemistry, Solomons, John Wiley.
- Introduction to Organic Chemistry, Sireitwieser, Heathcock and Kosover, Macmilan.
- Kalsi, P. S. *Stereochemistry Conformation and Mechanism*, New Age International, 2005.
- McMurry, J.E. *Fundamentals of Organic Chemistry*, 7th Ed. Cengage Learning India Edition, 2013.
- Morrison, R. N. & Boyd, R. N. *Organic Chemistry*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- Solomons, T.W., Fryhle, C.B., Organic Chemistry; 9th edition, Pubs: Wiley India, 2007.
- Wade Jr., L.G., Singh, M.S., Organic Chemistry; 6th edition, Pubs: Pearson education, 2008.

CHEMISTRY (MAJOR)

Course Name: Inorganic Chemistry-I (Practical-I: Volumetric Analysis-I)

Course Code: BSE.108

L	T	P	Cr
0	0	2	1

Course Learning Outcomes

At the end of the course the prospective teacher-trainees will be able to;

CLO1 provide a positive, enjoyable learning experience based on sound scientific principles and practice.
CLO2 foster good laboratory practice and develop technical skills relevant to quantitative analysis.
CLO3 provide an environment which encourage an inquiring, investigate approach, developing competence and confidence
CLO4 supplement and reinforce chemical principles taught in the theory units.

Units/Hours	Contents	Mapping with Course Learning Outcome
UNIT-I	**Titrimetric Analysis** a. Calibration and use of apparatus b. Preparation of solutions of different Molarity/Normality of titrants	CLO1
UNIT-II	**Acid-Base Titrations** Estimation of carbonate and hydroxide present together in mixture. Estimation of carbonate and bicarbonate present together in a mixture. Estimation of free alkali present in different soaps/detergents	CLO2
UNIT-III	**Oxidation-Reduction Titrimetric** Estimation of Fe (II) and oxalic acid using standardized KMnO4 solution. Estimation of oxalic acid and sodium oxalate in a given mixture. Estimation of Fe (II) with $K_2Cr_2O_7$ using internal (diphenylamine, anthranilic acid) and external indicator.	CLO3
UNIT-IV	**Iodo / Iodimetric Titrations** Estimation of Cu (II) and using $K_2Cr_2O_7$ sodium thiosulphate solution (Iodimetrically). Estimation of (a) arsenite and (b) antimony in tartar-emetic iodimetrically Estimation of available chlorine in bleaching powder iodometrically	CLO4

Suggested Reading:

- Experimental Inorganic Chemistry, W.G. Palmer, Cambridge. Standard Methods of Chemical. Analysis, W.W. Scott: The Technical Press.
- Experiments in General Chemistry, C.N.R. Rao and U.C. Aggarwal, East-West Press
- Laboratory Manual in Organic Chemistry, R.K. Bansal, Wiley Eastern.
- Mendham, J., A. I. Vogel's *Quantitative Chemical Analysis 6th Ed.*, Pearson, 2009.
- V. Rogers, P.W.G. Smith and A.R. Tatchell, ELBS.
- Vogel's Qualitative Inorganic Analysis, revised, Svehla, Orient Longman.
- Vogel's Textbook of Practical Organic Chemistry, B.S. Furniss, A.J. Hannaford,

CHEMISTRY (MAJOR)

Course Name: Organic Chemistry-I (Practical-II: Simple Techniques in Synthesis Lab)

Course Code: BSE.109

L	T	P	Cr
0	0	2	1

Course Learning Outcomes

At the end of the course the prospective teacher-trainees will be able to;

CLO1: calibrate thermometers and determine the melting and boiling points of various organic

compounds.
CLO2: purify organic compounds through crystallization using different solvents and evaluate their purity.
CLO3: separate and identify mixtures of amino acids, sugars, and other compounds using different techniques.
CLO4: detect the presence of nitrogen, halogens, and sulfur in organic compounds through qualitative analysis.

Units/ Hours	Course Content	Mapping with Course Content
	Checking the calibration of the thermometer Purification of organic compounds by crystallization using the following solvents: (i)Water (ii)Alcohol (iii)Alcohol-Water Determination of the melting points of above compounds and unknown organic compounds (Kjeldahl method and electrically heated melting point apparatus) Effect of impurities on the melting point – mixed melting point of two unknown organic compounds Determination of boiling point of liquid compounds. (Boiling point lower than and more than 100 °C by distillation and capillary method) Chromatography Separation of a mixture of two amino acids by ascending and horizontal paper chromatography Separation of a mixture of two sugars by ascending paper chromatography Separation of a mixture of o-and p-nitrophenol or o-and p-aminophenol by thin layer chromatography (TLC) and column chromatography. Detection of nitrogen, halogens and sulphur in organic compounds.	CLO1 CLO2

Suggested Readings

- Chandrika Parsad: Text book on Algebra and Theory of Equations, PothishalaPvt. Ltd., Allahabad.
- H.S. Hall and S.R. Knight: Higher Algebra, H.M. Publications, 1994.
- K.B. Dutta: Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd., New Delhi (2002).
- Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry*, Pearson Education (2009)
- S.L. Loney: Plane Trigonometry Part–II, Macmillan and Company, London.
- Shanti Narayan and P.K. Mittal: Text Book of Matrices.

MATHEMATICS (MAJOR)

Course Name: Algebra and Trigonometry

Course Code: BSE.110

L	T	P	Cr
4	0	0	4

Course Learning Outcomes

At the end of the course the prospective teacher-trainees will be able to;

CLO1 understand exponential and logarithmic function of a complex variable and De-Moivre's theorem.
CLO2 comprehend linear independence of row and column vectors.
CLO3 comprehend Eigen values, Eigen vectors, minimal and the characteristic equation of a matrix
CLO4 analyze Congruence of quadratic forms and matrices.

Units/Hours	Contents	Mapping with CLOs
UNIT-I 13 hours	a. Exponential and Logarithmic function of a complex variable. b. Expansion of trigonometric functions, Gregory's series, Summation of series. c. De-Moivre's theorem and its applications, circular & hyperbolic functions and their inverses.	CLO1
UNIT-II 13 hours	a. Linear independence of row and column vectors. Row rank, Column rank of a matrix, Equivalence of column and row ranks. b. Nullity of matrix, Applications of matrices to a system of linear (both homogeneous and non–homogeneous) equations. Theorems on consistency of a system of linear equations.	CLO2
UNIT-III 16 hours	a. Eigen values, Eigen vectors, minimal and the characteristic equation of a matrix. Cayley Hamilton theorem and its use in finding inverse of a matrix. b. Quadratic Forms, quadratic form as a product of matrices. The set of quadratic forms over a field.	CLO3
UNIT-IV 18 hours	a. Congruence of quadratic forms and matrices. Congruent transformations of matrices. Elementary congruent transformations. Congruent reduction of a symmetric matrix. Matrix Congruence of skew–symmetric matrices. b. Reduction in the real field. Classification of real quadratic forms in n variables. Definite, semi–definite and indefinite real quadratic forms. Characteristic properties of definite, semi– definite and indefinite forms.	CLO4

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, sblended learning, demonstration, laboratory method

Suggested Readings

- Chandrika Parsad: Text book on Algebra and Theory of Equations, Pothishala Pvt. Ltd., Allahabad.
- H.S. Hall and S.R. Knight: Higher Algebra, H.M. Publications, 1994.
- K.B. Dutta: Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd., New Delhi (2002).
- S.L. Loney: Plane Trigonometry Part–II, Macmillan and Company, London.
- Shanti Narayan and P.K. Mittal: Text Book of Matrices.

MATHEMATICS (MAJOR)

Course Title: Calculus-I

Course Code: BSE.111

L	T	P	Cr
4	0	0	4

Course Learning Outcomes

At the end of the course the prospective teacher-trainees will be able to;

CLO1 understand real number system and its properties.

CLO2 comprehend different successive differentiation theorems.

CLO3 increase their knowledge regarding Maxima and Minima of functions of single variable.

CLO4 comprehend asymptotes, tests for concavity and convexity.

Units/Hours	Contents	Mapping with CLOs
UNIT-I 18 hours	Real number system and its properties, lub, glb of sets of real numbers, limit of a function, Basic properties of limits. Continuous functions and classification of discontinuities, Uniform continuity, Differentiability of real valued functions of one variable, Differentiation of hyperbolic functions.	CLO1
UNIT-II 15 hours	Successive differentiation, Leibnitz theorem. Roll's theorem, mean value theorems & applications, Intermediate value theorems for derivatives, Taylor's and Maclaurin's theorem, Indeterminate forms.	CLO2
UNIT-III 15 hours	Maxima and Minima of functions of single variable, Asymptotes, Tangent and normal curvature of curves, radius of curvature.	CLO3
UNIT-IV 12 hours	Asymptotes, Tests for concavity and convexity, Points of inflexion, Multiple Points, Curvature, Tracing of Curves (Cartesian and Parametric coordinates only).	CLO4

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Suggested Readings:

- Erwin Kreyszig: Advanced Engineering Mathematics, John Wiley and Sons, 1999
- N. Piskunov: Differential and Integral Calculus, Peace Publishers, Moscow.
- Tom M. Apostol: Calculus: An Indian Adaptation, Wiley India, 2023

BOTANY (MAJOR)

Course Title: Microbiology and Phycology

L	T	P	Cr
3	0	0	3

Course Code: BSE.112

Course Learning Outcomes

At the end of the course the prospective teacher-trainees will be able to;
CLO1: understand microbial world, DNA virus (T-phage) and RNA virus (TMV)
CLO2: discriminate about various bacterial diseases
CLO3: explain algal general characteristics, ecology and distribution
CLO4: reflect on role of algae in the environment, agriculture, biotechnology and industry

Units/Hours	Contents	Mapping with CLOs
Unit-I 07 hrs	Introduction to microbial world, viruses, discovery, physiochemical and biological characteristics; classification (Baltimore), general structure with special reference to viroids and prions, General account of replication, DNA virus (T-phage), lytic and lysogenic cycle; RNA virus (TMV). viral diseases	CLO1
Unit-II 10 hrs	Bacterial discovery, general characteristics, types-archaebacteria, eubacteria, wall- less forms (mycoplasma and spheroplasts), cell structure, nutritional types, reproduction- vegetative, asexual and recombination (conjugation, transformation and transduction), Bacterial diseases, applied microbiology, economic importance of viruses with reference to vaccine production, role in research, medicine and diagnostics, and as causal organisms of plant diseases. Economic importance of bacteria with reference to their role in agriculture and industry (fermentation and medicine).	CLO2
Unit-III 15 hrs	Algal general characteristics, ecology and distribution; range of thallus organization; cell structure and components; cell wall, pigment system, reserve food (of only groups represented in the syllabus), flagella; Methods of reproduction, classification;	CLO3

	criteria, system of Fritsch, and evolutionary classification of Lee (only up to groups); cyanophyta, ecology and occurrence, range of thallus organization, cell structure, heterocyst, reproduction. economic importance; role in biotechnology. Morphology and life-cycle of nostoc. chlorophyta, general characteristics, occurrence, range of thallus organization, cell structure and reproduction. morphology and life-cycles of chlamydomonas, volvox, oedogonium, coleochaete, evolutionary significance of prochloron.	
Unit-IV 13 hrs	charophyta: General characteristics; occurrence, morphology, cell structure and life-cycle of chara, evolutionary significance, xanthophyta: general characteristics; range of thallus organization; Occurrence, morphology and life-cycle of vaucheria. phaeophyta: Characteristics, occurrence, range of thallus organization, cell structure and reproduction, morphology and life-cycles of ectocarpus and focus, rhodophyta: general characteristics, occurrence, range of thallus organization, cell structure and reproduction, morphology and life-cycle of polysiphonia. Role of algae in the environment, agriculture, biotechnology and industry.	CLO4

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Suggested Readings

1. Campbell, N.A., Reece, J.B., Urry, L.A., Cain, M.L., Wasserman, S.A., Minorsky, P.V., Jackson, R.B. (2008). Biology, 8th edition. San Francisco, California: Pearson Benjamin Cummings.
2. Kumar, H.D. (1999). Introductory Phycology, 2nd edition. New Delhi, Delhi: Affiliated East-West Press.
3. Lee, R.E. (2008). Phycology, 4th edition. Cambridge, Cambridge: Cambridge University Press,
4. Pelczar, M.J. (2001). Microbiology, 5th edition. New Delhi, Delhi: Tata McGraw-Hill Co.

Course Title: Diversity of Cryptogams and Phanerogams

Course Code: BSE.113

L	T	P	Cr
3	0	0	3

Course Learning Outcomes:

At the end of the course the prospective teacher-trainees will be able to;

CLO1: understand Bryophyta, reproduction and classification of hepaticopsida

CLO2: analyze Important characteristics of psilopsida, lycopsida, sphenopsida and pteropsida

CLO3: explain gymnosperms: general characters, classification of gymnosperms (chamberlin) cycadopsida

CLO4: reflect on angiosperms: Taxonomy: Introduction, hierarchy in classification

Units/Hours	Contents	Mapping with CLOs
Unit-I 07 hrs	Bryophyta: amphibians of plants kingdom displaying alternation of generations; structure, reproduction. classification of hepaticopsida (e.g. *marchantia*); anthocerotopsida (e.g. *anthoceros*), bryopsida (e.g. *funaria*).	CLO1
Unit-II 10 hrs	Pteridophytes: general characters, classification of pteridophytes (G.M. Smith), pterophyta or filicophyta: General characters, nephrolepis: occurrence, structure, systematic position reproduction and life cycle, stelar evolution, economic importance of pteridophytes Important characteristics of psilopsida, lycopsida, sphenopsida and pteropsida; structure, reproduction in *Rhynia*, structure and reproduction in *Lycopodium*, *Selaginella*, *Equisetum*, *Pteris and Marsilea.*	CLO2
Unit-III 15 hrs	Gymnosperms: general characters, classification of gymnosperms (chamberlin) cycadopsida: General characters, cycas: occurrence, structure, systematic position reproduction and life cycle, economic importance of gymnosperms	CLO3
Unit-IV 13 hrs	Angiosperms: Taxonomy: Introduction, hierarchy in classification, binomial nomenclature Plant morphology: root, Stem, leaf -Structure, types 3. I	CLO4

	Inflorescence: introduction, structure of typical inflorescence, types- racemose and cymose, Flower: introduction, structure of a typical flower (hibiscus), symmetry and types (hypogynous, epigynous, perigynous), Study of following families: Malvaceae, Amaryllidaceae	

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Suggested Readings:

- Goffinet B. (2008). Bryophyte Biology. Cambridge University Press, UK.
- Sambamurty, S.S. (2013). A Textbook of Bryophytes, Pteridophytes, Gymnosperms and Paleobotany. I K International Publishing House Pvt Ltd., India
- Sharma, O.P. (2014). Bryophyta. McGraw Hill Education Pvt Ltd., India.
- Srivastava, H.N., 2018, Diversity of Microbes and Cryptogams, Vol. I, Pradeep's Publication.
- Vashishta, P.C, Sinha, A.K, Kumar, A., (2010). Botany for Degree Students Pteridophyta (Vascular cryptogams). S.S. Chand Publications

Course Title: Microbiology and Phycology (Practical-I)

Course Code: BSE.114

L	T	P	Cr
0	0	2	1

Contents

1. Electron micrographs/models of viruses – T-Phage and TMV, line drawings/ photographs of lytic and lysogenic cycle.
2. Types of bacteria to be observed from temporary/permanent slides/photographs. Electron micrographs of bacteria, binary fission, endospore, conjugation, root nodule.
3. Gram staining.
4. Study of vegetative and reproductive structures of nostoc, chlamydomonas, volvox, oedogonium, coleochaete, chara, vaucheria, ectocarpus, fucus and polysiphonia, procholoron through electron micrographs, temporary preparations and permanent slides

Course Title: Diversity of Cryptogams and Phanerogams (Practical-II)

L	T	P	Cr
0	0	2	1

Course Code: BSE.115

Contents

1. Study of stages in the life cycle of Nephrolepis: Mounting of ramentum, hydathode, T.S. of rachis
2. T.S. of pinna of Nephrolepis passing through sorus
3. Stelar evolution with the help of permanent slides: Protostele: haplostele, actinostele, plectostele, mixed protostele, siphonostele: ectophloic, amphiphloic, dictyostele, eustele and atactostele
4. Economic importance of pteridophytes: Azolla, Nephrolepis, Selaginella
5. Cycas: T.S of leaflet (pinna)
6. Megasporophyll, microsporophyll, coralloid root, microspore, L.S. of ovule of Cycas – all specimens to be shown
7. Economic importance of gymnosperms: Pinus (turpentine, wood, seeds)
8. Plant morphology (Root, Stem, Leaf) : as per theory
9. Types of inflorescence and flower: as per theory
10. Salient features and economic importance of Malvaceae
11. Salient features and economic importance of Amaryllidaceae

ZOOLOGY (MAJOR)

Course Title: Biology of Non-Chordates

L	T	P	credit
3	0	0	3

Course Code: BSE.116

Course Learning Outcomes (CLO)

At the end of the course the prospective teacher-trainees will be able to;

CLO1: Demonstrate comprehensive identification abilities of non-chordate diversity.

CLO2: Explain structural and functional diversity of non-chordate.

CLO3: Enlist the characteristics of phylum Coelenterata and Helminthes.

CLO4: Differentiate between blood vascular system, excretion, nervous system and reproduction of Hirudinaria & Palaemon.

CLO5: Differentiate between blood vascular system, excretion, nervous system and reproduction of Pila and Asterias.

Units/Hours	Contents	Mapping with CLOs

UNIT I 12 hours	General principles of taxonomy and classification. Outline classification of Protozoa up to order. General Structural organization of Amoeba, Euglena and Plasmodium. Habit and habitat, structure, nutrition, osmoregulation and reproduction of Paramecium Locomotion in Protozoans- pseudopodial, ciliary and flagellar Nutrition in Protozoa Reproduction in Protozoa	CLO1
Unit – II 10 hours	Outline classification of Porifera and Coelenterata up to order. Habit, habitat, morphology, internal structure, reproduction of Sycon Canal system and skeleton in Sponges Habit, habitat, morphology, internal structure, nutrition and reproduction of Obelia Polymorphism in coelenterates, coral reefs	CLO2
Unit – II 10 hours	Outline classification of Platyhelminthes and Nematheminthes up to order. Habit and habitat, morphology, internal structure, reproduction and life –cycle of Fasciola, and Ascaris Parasitic adaptations in Helminthes	CLO3
Unit – IV 13 hours	Outline classification of Annelida and Arthropoda up to order. Habit and habitat, structure, nutrition, respiration, circulation, excretion, nervous system and reproduction of Hirudinaria & Palaemon Outline classification of Mollusca and Echinodermata up to order Habit and habitat, structure, nutrition, respiration, blood vascular system, excretion, nervous system and reproduction of Pila Habit and habitat, structure, nutrition, respiration, blood vascular system, excretion, nervous system and reproduction of Asterias	CLO4 CLO5

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Suggested Readings

1. Anderson D.T. (1999) Invertebrate Zoology, Oxford University Press
2. Ayyar, E.K and T. Ananthakrishnan. (1992). Manual of Zoology Vol.1 Invertebrates Part I and II, S.Viswanathan Printers and Publishers Pvt. Ltd.Madras.
3. Edward E. Ruppert, Robert D. Barnes (1994). Invertebrate Zoology; Saunders College Pub.
4. Jordan, E.L and P.S. Verma.(2009). Invertebrate Zoology, S.Chand and Co. Ltd. New Delhi.
5. Kotpal, R.L. (2021). Zoology Invertebrates. Rastogi Publications, Meerut.
6. Lal S.S. (2019). Practical Zoology Invertebrates. Rastogi Publications, Meerut.
7. Nair, N.C., N. Arumugam, N. Soundarapandian, T. Murugan and S. Leelavathy.(2010). A textbook of Invertebrates. Saras Publication, Nagercoil.
8. Rastogi V.B. (2021). Invertebrate Zoology. KedarNath Ram Nath , Meerut.

Course Title: Cytology and Genetics

Course Code: BSE.117

L	T	P	Cr
3	0	0	3

Course Learning Outcomes:

At the end of the course the prospective teacher-trainees will be able to;
CLO1: Elaborate the structure and function of all the cell organelles.
CLO2: understand the importance of the chromatin structure and its location.
CLO3: Familiarize with the basic principle of life, leading to the growth of an organism.
CLO4: Acquire the basic principles of genetics and how genes are inherited from one generation to another.
CLO5: Comprehend the Mendel's laws and the deviations from conventional patterns of inheritance.
CLO6: Analyze how environment plays an important role by interacting with genetic factors.

Units/Hours	Contents	Mapping with CLOs
UNIT I 12 hours	Structure and Function of Cell Organelles Plasma membrane: chemical structure—lipids and proteins, Fluid Mosaic Model Endomembrane system: Signal transduction-protein targeting through ER, sorting of protein in Golgi Complex, endocytosis, exocytosis Cytoskeleton: microtubules, microfilaments, intermediate filaments Mitochondria: Structure, oxidative phosphorylation Peroxisome and ribosome: structure and function	CLO1
UNIT II 11 hours	Nucleus and Chromatin Structure Structure and function of nucleus in eukaryotes, Biochemical composition of DNA and RNA DNA supercoiling, chromatin organization, structure of chromosomes Types of DNA and RNA Cell cycle, Cell Division and Cell Signalling, Cell division: mitosis and meiosis, Cell cycle and its regulation	CLO2 CLO3
UNIT III 10 hours	Mendelism and Sex Determination Basic principles of heredity: Mendel's laws, monohybrid and dihybrid crosses Complete and Incomplete Dominance Sex Determination: Genic Sex-Determining Systems, Sex Determination in Drosophila, Sex Determination in Human, Sex-linked traits, Dosage compensation	CLO4
UNIT IIV 12 hours	Extensions of Mendelism, Genes and Environment Extensions of Mendelism: Multiple Alleles, Gene Interaction Cytoplasmic Inheritance, Genetic Maternal Effects, Multifactorial traits Human Chromosomes and Patterns of Inheritance and Human	CLO5 CLO6

	karyotype (male and female) Chromosomal anomalies: Structural and numerical aberrations with examples Pedigree analysis: Patterns of inheritance with suitable examples of autosomal dominant, autosomal recessive, X-linked recessive and X-linked dominant traits in human	

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

References

1. Powar, C.B. (2005, Revised Edition). *Cell Biology*. Himalaya Publishing House.
2. Gupta, P.K. (2008, 3rd Edition). *Cell and Molecular Biology*. Rastogi Publications.
3. Verma, P.S., & Agarwal, V.K. (2010, Revised Edition). *Cell Biology (Cytology, Biomolecules and Molecular Biology)*. S. Chand & Company Ltd.
4. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., & Walter, P. (2015, 6th Edition). *Molecular Biology of the Cell*. Garland Science.
5. Strickberger, M.W. (2005, 3rd Edition). *Genetics*. Pearson Education.
6. Klug, W.S., Cummings, M.R., Spencer, C.A., & Palladino, M.A. (2012, 10th Edition). *Concepts of Genetics*. Pearson Education.
7. Gupta, P.K. (2010, Revised Edition). *Genetics*. Rastogi Publications.
8. Russell, P.J. (2010, 10th Edition). *iGenetics: A Molecular Approach*. Benjamin Cummings (Pearson).

Course Title: Biology of Non Chordates (Practical-I)

L	T	P	Cr
0	0	2	1

Course Code: BSE.118

Course Learning Outcomes (CLO)

At the end of the course the prospective teacher-trainees will be able to;

CLO2: Understand internal organization and skills- of staining and mounting of materials. (Temporary and permanent), of dissection,

ClO2: Display and labeling, of preparation of cultures of invertebrates by using common culture methods; laboratory observation of animal cell division.

Course Content

1. Study of museum specimens with respect to levels and patterns of organization biosystematics, biodiversity, adaptations, development stages,

population dynamics, ecological implications etc: Porifera –Sycon,Spongilla, Euplectella, Leucosolnia, Hylonema , Hypospongia, Euspongia:Coeleterata Hydra, Tubularia, Millepora, Physalia, Porpita, Vellela,

Aurelia, Tubipora, Alcyonium, Metridium, Pennatula, Grantia,Fungia,Gorgonia.

Helminthes: Fasciola, Taenia solium, Planaria, Ascaris, Ancyclostoma

Annelida: Nereis Heteroneresis, Aphrodite, Chaetoptreus. Arenicola,Pheretima, Hirudinarid

Arthropoda: Palaemong, Eupagurus, Scolopendra, Apis Peripatus.

Mollusca: Chiton, Pila, Aplysia, Helix, Denalium, Mytilus, Pinctda, Unio,Sepia, Loligo Octopus:

Echinodermata: Autedon, Holothuria, Cucumaria, Astropecten, Asterias,Echinus

2. Microscope : Simple and compound microscope, working mechanism and maintenance

3. Study of Permanent slides

Paramecium, Paramecium in Conjugation, paramecium binary fission,Euglena, Vorticella, Sycon L.S., Sycon T.S. , Hydra L.S., Hydra T.S,Cercaria larva, Metacercaria, Miracidium larva, Sporocyst larva, Redia

larva , Ascaris male and female T.S. , T.S. thorough , pharynx region,Gizzard and intestinal region of Earthworm, T.S. through buccal cavity of Hirudinaria, Zoea, Metazoea, Nauplius, Mysis, T.S. of gill of Unio.T.S. of the shell & mantle of Unio. Glochidium larva of Unio,

4. Dissections and/or its demonstration through

Charts/Models/Video/CD/digital alternative etc and/or preparation of working models of the different systems of the following animals.

1. Earthworm: Alimentary canal Nervous system, Reproductive system

2. Leech Alimentary canal

3. Cockroach: Mouthparts Digestive system, nervous system

4. prawn: Nervous system

5. pila: Nervous system

6. Culture of Paramecium, Euglena and Amoeba.

7. Study of bacterial and eukaryotic cell.

8. Slides of sub cellular components (Cell organelles)

9. Erythrocyte plasma membrane permeability.

10. Study of Karyotype and Ideogram of man.

11. Drosophila culture and lifecycle

ZOOLOGY (Major-Practical)

Course Title: Cytology and Genetics (Practical-II)

Course Code: BSE.119

L	T	P	Cr
0	0	2	1

Course Learning Outcomes:

At the end of the course the prospective teacher-trainees will be able to;

CLO1: To use simple and compound microscopes.

CLO2: To prepare slides and stain them to see the cell organelles.

Course Content

The students will conduct practical to:

- Study buccal epithelial cells by supra vital staining technique, mitochondria in buccal epithelial cells by Janus Green staining, Different stages of Mitosis in root tip of onion. and different stages of Meiosis in grasshopper testis.
- Prepare molecular models of nucleotides, amino acids, dipeptides using bead and stick method.
- Check the permeability of cells using salt solution of different concentrations (demonstration).
- Study permanent slides of parasitic Protozoan and museum specimens of parasitic Helminth.
- Learn the procedures for preparation of temporary stained/unstained slides.
- Study of mutant phenotypes of Drosophila.
- Study of sex chromatin (Barr bodies) in buccal smear and hair bud cells (Human).
- Prepare human karyotype (male and female) from Karyotype
- Study of abnormal Karyotypes- Down's Syndrome, Turner's Syndrome,
- Klinefelter's Syndrome from Karyotype sheets.
- Inheritance pattern of haemophilia and colour blindness.Qualitative tests for carbohydrates, reducing sugars, non-reducing sugars, lipids and proteins.
- Study of plant cell structure with the help of epidermal peel mount of Onion/*Rhoeo/Crinum.*
- Demonstration of the phenomenon of protoplasmic streaming in *Hydrilla* leaf.
- Measurement of cell size by the technique of micrometry.
- Counting the cells per unit volume with the help of haemocytometer. (Yeast/pollen grains).
- Study of cell and its organelles with the help of electron micrographs.
- Cytochemical staining of: DNA- Feulgen and cell wall in the epidermal peel of onion using Periodic Schiff's (PAS) staining technique.
- Study the phenomenon of plasmolysis and deplasmolysis.
- Study the effect of organic solvent and temperature on membrane permeability.
- Study different stages of mitosis and meiosis.

MINORS

PHYSICS (MINOR)

Course Title: Mechanics

L	T	P	Cr
3	0	0	3

Course Code: BSE.120
Course Learning Outcomes:
At the end of the course the prospective teacher-trainees will be able to;
CLO1 To enhance their knowledge regarding Cartesian and spherical polar co–ordinate systems, relationship of conservation laws.
CLO2 To understand various forces in nature and Kepler Laws.
CLO3 Acknowledge them Galilean transformation and Invariance and Focault pendulum.

CLO4 Enrich them with Elastic collision in Lab and C.M. system and Rotational motion.

Unit/Hours	Contents	Mapping with CLOs
UNIT-I 12 hours	1. Frames of reference Laws of Mechanics, Inertial frames of reference, Galilean transformation equations, Hypothesis of Galilean invariance, Conservation of Momentum, Non inertial frames and fictitious forces, Rotating frames of reference, Centrifugal force and Coriolis force, Foucault's pendulum (Section 2.1 to 2.11of Mechanics by J C Upadhyaya) 2. Conservation of Energy Conservation laws, Conservative forces, Conservation of energy for a particle: Energy function, Potential energy curve, Non conservative forces (Section 5.1to 5.7, 5.10, 5.11of Mechanics by J C Upadhyaya)	CLO1
UNIT-II 13 hours	3. Linear and Angular Momentum Conservation of linear momentum, Centre of mass, , Centre of mass frame of reference, Collision of two particles, Deflection of a moving particle by a particle at rest, Rockets, Angular momentum and torque, Motion under central force, Areal velocity, Conservation of angular momentum with examples (Section 6.1 to 6.4,6.6 to 6.9 of Mechanics by J C Upadhyaya) 4. Potentials and Fields Central force, Inverse-square law force, Potential energy of a system of masses, Gravitational field and potential, Escape velocity, Keplar's laws, Newton's deductions from Keplar's laws (Section 7.1 to 7.4, 7.6to7.9, 7.18, 7.19 of Mechanics by J C Upadhyaya)	CLO2
UNIT-III 8 hours	5. Lagrangian formulations of Classical Mechanics Constraints, Generalized co-ordinates, Principle of virtual work, D'Alembert's principle, Lagrange's equations, Kinetic energy in generalized co-ordinates, Generalized momentum, Cyclic co-ordinates, Conservation laws and symmetry properties-Hamiltonian of a system	CLO3

UNIT-IV 12 hours	6. Special Theory of Relativity Electromagnetism and Galilean transformation, Michelson Morley experiment, Ether hypothesis, Postulates of Special Theory of Relativity, Lorentz transformation equations, Velocity transformation, Length contraction, Time dilation, Simultaneity, Mass in relativity, Mass and energy, Space-time diagram, Geometrical interpretation of Lorentz transformation, Principle of covariance, Four-vectors in Mechanics	CLO4

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Textbooks for Study

1. Mechanics by J C Upadhyaya
2. Classical Mechanics by Takwale and Puranik
3. Classical Mechanics by Hans and Puri
4. Classical Mechanics by J C Upadhyaya

Reference books

1. Mechanics by D.S.Mathur
2. Classical Mechanics by Goldstein
3. Berkeley Physics course Vol 1
4. Feynman Lectures on Physics Vol 1
5. Elements of Mechanics – K Rama Reddy, S Raghavan & D V N Sarma- Universities Press
6. Introduction to Mechanics – Mahendra K Verma – Universities Press

Course Title Physics Practical-I

L	T	P	Cr
0	0	2	1

Course Code: BSE.121

Contents:

1. Young's modulus-non uniform bending-using pin and microscope-(load-extension graph).
2. Young's modulus-uniform bending-using optic lever
3. Young's modulus-Angle between the tangents
4. Surface Tension-capillary rise method-radius by vernier microscope
5. Viscosity-Poiseuille's method –(Variable Pressure head, radius by mercury pellet method, sensibility method to find mass)
6. Moment of inertia-Flywheel

CHEMISTRY (MINOR)

Course Title: In-Organic Chemistry-I (Atomic Structure and Chemical Bonding)

Course Code: BSE.122

L	T	P	Cr
3	0	0	3

Course Learning Outcomes:

At the end of the course the prospective teacher-trainees will be able to;

CLO1 comprehend the basic chemistry of aliphatic, aromatic hydrocarbons and stereochemistry of organic compounds.

CLO2 develop basic knowledge of organic reaction mechanisms, reactive intermediates, methods of formation

CLO 3 reflect upon knowledge of mechanism reaction of alkanes, cycloalkanes and alkyl halides

CLO 4 comprehend basic knowledge of reactions alkenes, aromatic compounds, alkyl halides and their derivatives.

Units/Hours	Contents	Mapping with Course Learning Outcome
UNIT-I 11hours	Atomic Structure and Chemical Periodicity: a.The origin and distribution of the elements, The structure of the periodic table, The de Broglie relationship, The uncertainty principle, Schrodinger wave equation and its derivation, Energy quantization, Significance of wave function. The Born interpretation, Quantum numbers, Normal and orthogonal wave functions. b.Radial and angular probability distribution curves, the building up principle in many electron atoms, Penetration and shielding (The Slater's rules), Atomic parameters and their variation in periodic table, Electronegativity and various scales, Variation of electronegativity with partial charges and hybridization, Electro neutrality principle, Hardness and softness, Perturbation theory.	CLO1 CLO2
UNIT-II 11hours	Ionic Compounds-I: a.Properties of ionic substances, Occurrence of ionic bonding, the radius ratio rules, Efficiency of packing, Hexagonal close packing, Cubic close packing, b.Structures of different crystal lattices, Sodium chloride, Cesium chloride, Wurtzite, Zinc blende, Fluorite, Rutile, Cristobalite, Nickel arsenide, Pervoskite, Rhenium oxide, Calcium carbide, The calcite and aragonite structures.	CLO1 CLO2

UNIT-III 11hours	Ionic Compounds-II: a.Lattice energy, Born-Haber cycle, the calculations of the lattice energy on the basis of Born-Lande equation, The predictive power of thermochemical calculations on ionic compounds. b.Covalent character in predominantly ionic compounds, Imperfections of crystals, Conductivity in ionic solids, Band theory, Intrinsic and photo excited semiconductors, Transistors, High temperature superconductors.	CLO2 CLO3
UNIT-IV 12 hours	The Covalent Bond: a.The Lewis theory, Valence bond theory - A mathematical approach, Resonance, Valence Shell Electron Pair Repulsion Model (VSEPR theory), Prediction of structures and variation of bond angles on the basis of VSEPR theory, Shortcomings of VSEPR theory. b.Concept of hybridization, Rules for obtaining hybrid orbitals, Extent of d-orbital participation in molecular bonding (SO2, PCl5, SO3), Molecular orbital theory (LCAO method), Symmetry of molecular orbitals, Applications of MOT to homo- and hetero-nuclear diatomic molecules, Molecular orbital energy level diagrams (Be2, N2, O2, F2, LiH, NO, CO, HCl, NO2, BeH2, NO2).	CLO2 CLO4

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Suggested Readings:

- Cotton, F.A., Wilkinson, G., Gaus, P.L., Basic Inorganic Chemistry; 3rd edition, Pubs: John Wiley Sons. 1995.
- D. F. C. Shriver, P. W. Atkins and C. H. Langford, Inorganic Chemistry, ELBS Oxford, 1991.
- Douglas, B. McDamiel, D., Alexander, J., Concepts and Models of Inorganic Chemistry; 3rd edition, Pubs: John Wiley and Sons Inc., 1994.
- Inorganic Chemistry, A.G. Sharpe, ELBS.
- Inorganic Chemistry, W.W. Porterfield Addison-Wesley.
- J. D. Lee, Concise Inorganic Chemistry, ELBS, Oxford 1994.
- J. E. Huheey, E.A. Keiter, R. L. Keiter, Inorganic Chemistry, 4th Ed, Pearson Education, Singapore, 1999.
- Jolly, W.L., Modern Inorganic Chemistry; 2nd edition, Pubs: McGraw-Hill Publishing, Company Limited, 1991.

- Lee, J.D., Concise Inorganic Chemistry; 4th edition, Pubs: Chapman Hall Ltd., 1991.
- Miessler, G.L., Larr, D.A., Inorganic Chemistry; 3rd edition, Pubs: Pearson Education Inc., 2004.
- Purcell, K.F., Kotz, J.C., Inorganic Chemistry; Pubs: W.B. Saunders Company, 1977.
- Puri, B.R., Sharma, L.R., Kalia, K.C., Principles of Inorganic Chemistry; 30th edition, Pubs: Milestones Publisher, 2006-07.
- Shriver, D.E., Alkins, P.W., Langford, C.H., Inorganic Chemistry; 4th edition, Oxford Publisher: Oxford University Press, 2006.
- University General Chemistry, C.N.R. Rao, Macmillan.

CHEMISTRY (MINOR)

Course Title: Inorganic Chemistry-I (Practical-I -Volumetric Analysis)

Course Code: BSE.123

L	T	P	Cr
0	0	2	1

Course Learning Outcomes:

At the end of the course the prospective teacher-trainees will be able to;

CLO1 To gain a positive, enjoyable learning experience, soundly based on scientific principles and practice.

CLO2 To cultivate good laboratory practice and develop technical skills relevant to quantitative analysis.

CLO3 To develop an environment which encourage an inquiring, investigate approach, developing competence and confidence

CLO4 To supplement and reinforce chemical principles taught in the theory units

Unit/Hours	Content	Mapping with Course Content
Unit-I 5 hours	Titrimetric Analysis Calibration and use of apparatus Preparation of solutions of different Molarity/Normality of titrants	CLO1
Unit-II 10 hours	Acid-Base Titrations Estimation of carbonate and hydroxide present together in mixture. Estimation of carbonate and bicarbonate present together in a mixture. Estimation of free alkali present in different soaps/detergents	CLO2

Unit-III 10 hours	Oxidation-Reduction Titrimetric Estimation of Fe (II) and oxalic acid using standardized KMnO4 solution. Estimation of oxalic acid and sodium oxalate in a given mixture. Estimation of Fe (II) with K2Cr2O7 using internal (diphenylamine, anthranilic acid) and external indicator.	CLO3
Unit-IV 5 hours	Iodo / Iodimetric Titrations Estimation of Cu(II) and K2Cr2O7 using sodium thiosulphate solution (Iodimetrically). Estimation of (a) arsenite and (b) antimony in tartar-emetic iodimetrically Estimation of available chlorine in bleaching powder iodometrically	CLO4

Suggested Readings:

- Experimental Inorganic Chemistry, W.G. Palmer, Cambridge. Standard Methods of Chemical. Analysis, W.W. Scott: The Technical Press.
- Experiments in General Chemistry, C.N.R. Rao and U.C. Aggarwal, East-West Press.
- Laboratory Manual in Organic Chemistry, R.K. Bansal, Wiley Eastern.
- Mendham, J., A. I. Vogel's *Quantitative Chemical Analysis 6th Ed.*, Pearson, 2009.
- Vogel's Qualitative Inorganic Analysis, revised, Svehla, Orient Longman.
- Vogel's Textbook of Practical Organic Chemistry, B.S. Furniss, A.J. Hannaford, V. Rogers, P.W.G. Smith and A.R. Tatchell, ELBS.

MATHEMATICS (MINOR)

Course Name: Algebra and Trigonometry

Course Code: BSE.124

L	T	P	Cr
4	0	0	4

Course Learning Outcomes:

At the end of the course the prospective teacher-trainees will be able to;

CLO1 to understand exponential and logarithmic function of a complex variable and De-Moivre's theorem.
CLO2 to comprehend linear independence of row and column vectors.
CLO3 to comprehend Eigen values, Eigen vectors, minimal and the characteristic equation of a matrix
CLO3 to solve problems on congruence of quadratic forms and matrices.

Units/Ho	Contents	Mapping

urs		with CLOs
UNIT-I	a. Exponential and Logarithmic function of a complex variable. b. Expansion of trigonometric functions, Gregory's series, Summation of series. c. De-Moivre's theorem and its applications, circular & hyperbolic functions and their inverses.	
UNIT-II	a. Linear independence of row and column vectors. Row rank, Column rank of a matrix, Equivalence of column and row ranks. b. Nullity of matrix, Applications of matrices to a system of linear (both homogeneous and non–homogeneous) equations. Theorems on consistency of a system of linear equations.	
UNIT-III	a. Eigen values, Eigen vectors, minimal and the characteristic equation of a matrix. Cayley Hamilton theorem and its use in finding inverse of a matrix. b. Quadratic Forms, quadratic form as a product of matrices. The set of quadratic forms over a field.	
UNIT-IV	a. Congruence of quadratic forms and matrices. Congruent transformations of matrices. Elementary congruent transformations. Congruent reduction of a symmetric matrix. Matrix Congruence of skew–symmetric matrices. b. Reduction in the real field. Classification of real quadratic forms in n variables. Definite, semi–definite and indefinite real quadratic forms. Characteristic properties of definite, semi– definite and indefinite forms.	

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Suggested Readings:

- Chandrika Parsad: Text book on Algebra and Theory of Equations, Pothishala Pvt. Ltd., Allahabad.
- H.S. Hall and S.R. Knight: Higher Algebra, H.M. Publications, 1994.
- K.B. Dutta: Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd., New Delhi (2002).
- S.L. Loney: Plane Trigonometry Part–II, Macmillan and Company, London.
- Shanti Narayan and P.K. Mittal: Text Book of Matrices.

BOTANY (MINOR)

Course Title: Microbiology and Phycology

Course Code: BSE.125

L	T	P	Cr
3	0	0	3

Course Learning Outcomes:

At the end of the course the prospective teacher-trainees will be able to;

CLO1: understand microbial world, DNA virus (T-phage) and RNA virus (TMV)

CLO2: discriminate about various bacterial diseases

CLO3: explain algal general characteristics, ecology and distribution

CLO4: reflect on role of algae in the environment, agriculture, biotechnology and industry

Units/Hours	Contents	Mapping with CLOs
Unit-I 07 hrs	Introduction to microbial world, viruses, discovery, physiochemical and biological characteristics; classification (Baltimore), general structure with special reference to viroids and prions, General account of replication, DNA virus (T-phage), lytic and lysogenic cycle; RNA virus (TMV). viral diseases	CLO1
Unit-II 10 hrs	Bacterial discovery, general characteristics, types-archaebacteria, eubacteria, wall- less forms (mycoplasma and spheroplasts), cell structure, nutritional types, reproduction- vegetative, asexual and recombination (conjugation, transformation and transduction), Bacterial diseases, applied microbiology, economic importance of viruses with reference to vaccine production, role in research, medicine and diagnostics, and as causal organisms of plant diseases. Economic importance of bacteria with reference to their role in agriculture and industry (fermentation and medicine).	CLO2
Unit-III 15 hrs	Algal general characteristics, ecology and distribution; range of thallus organization; cell structure and components; cell wall, pigment system, reserve food (of only groups represented in the syllabus), flagella; Methods of reproduction, classification;	CLO3

	criteria, system of Fritsch, and evolutionary classification of Lee (only up to groups); cyanophyta, ecology and occurrence, range of thallus organization, cell structure, heterocyst,reproduction.economic importance; role in biotechnology. Morphology and life-cycle of nostoc. chlorophyta, general characteristics, occurrence, range of thallus organization, cell structure and reproduction. morphology and life-cycles of chlamydomonas, volvox, oedogonium, coleochaete, evolutionary significance of prochloron.	
Unit-IV 13 hrs	charophyta: General characteristics; occurrence, morphology, cell structure and life-cycle of chara, evolutionary significance, xanthophyta: general characteristics; range of thallus organization;Occurrence, morphology and life-cycle of vaucheria. phaeophyta: Characteristics, occurrence, range of thallus organization, cell structure and reproduction, morphology and life-cycles of ectocarpus and focus, rhodophyta: general characteristics, occurrence, range of thallus organization, cell structure and reproduction, morphology and life-cycle of polysiphonia. Role of algae in the environment, agriculture, biotechnology and industry.	CLO4

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Suggested Readings:

1. Campbell, N.A., Reece, J.B., Urry, L.A., Cain, M.L., Wasserman, S.A., Minorsky, P.V., Jackson, R.B. (2008). Biology, 8th edition. San Francisco, California: Pearson Benjamin Cummings.
2. Kumar, H.D. (1999). Introductory Phycology, 2nd edition. New Delhi, Delhi: Affiliated East-West Press.
3. Lee, R.E. (2008). Phycology, 4th edition. Cambridge, Cambridge: Cambridge University Press,
4. Pelczar, M.J. (2001). Microbiology, 5th edition. New Delhi, Delhi: Tata McGraw-Hill Co.

Course Title: Microbiology and Phycology (Practical-I)

Course Code: BSE.126

L	T	P	Cr
0	0	2	1

Contents

1. Electron micrographs/models of viruses – T-Phage and TMV, line drawings/ photographs of lytic and lysogenic cycle.
2. Types of bacteria to be observed from temporary/permanent slides/photographs. Electron micrographs of bacteria, binary fission, endospore, conjugation, root nodule.
3. Gram staining.

Study of vegetative and reproductive structures of nostoc, chlamydomonas, volvox, oedogonium, coleochaete, chara, vaucheria, ectocarpus, fucus and polysiphonia, procholoron through electron micrographs, temporary preparations and permanent slides

ZOOLOGY (MINOR)

Course Title: Biology of Non Chordates

Course Code: BSE.127

L	T	P	credit
3	0	0	3

Course Learning Outcomes (CLO)

At the end of the course the prospective teacher-trainees will be able to;

CLO1: Demonstrate comprehensive identification abilities of non-chordate diversity.

CLO2: Explain structural and functional diversity of non-chordate.

CLO3: Enlist the characteristics of phylum Coelenterata and Helminthes.

CLO4: Differentiate between blood vascular system, excretion, nervous system and reproduction of Hirudinaria & Palaemon.

CLO5: Differentiate between blood vascular system, excretion, nervous system and reproduction of Pila and Asterias.

Course Content

Units/Hours	Contents	Mapping with CLOs

UNIT I 12 hours	• General principles of taxonomy and classification. Outline classification of Protozoa up to order. • General Structural organization of Amoeba, Euglena and Plasmodium. • Habit and habitat, structure, nutrition, osmoregulation and reproduction of Paramecium • Locomotion in Protozoans- pseudopodial, ciliary and flagellar Nutrition in Protozoa • Reproduction in Protozoa	CLO1
Unit – II 10 hours	• Outline classification of Porifera and Coelenterata up to order. • Habit, habitat, morphology, internal structure, reproduction of Sycon • Canal system and skeleton in Sponges • Habit, habitat, morphology, internal structure, nutrition and reproduction of Obelia • Polymorphism in coelenterates, coral reefs	CLO2
Unit – II 10 hours	• Outline classification of Platyhelminthes and Nematheminthes up to order. • Habit and habitat, morphology, internal structure, reproduction and life –cycle of Fasciola, and Ascaris • Parasitic adaptations in Helminthes	CLO3
Unit – IV 13 hours	• Outline classification of Annelida and Arthropoda up to order. • Habit and habitat, structure, nutrition, respiration, circulation, excretion, nervous system and reproduction of Hirudinaria & Palaemon • Outline classification of Mollusca and Echinodermata up to order • Habit and habitat, structure, nutrition, respiration, blood vascular system, excretion, nervous system and reproduction of Pila • Habit and habitat, structure, nutrition, respiration, blood vascular system, excretion, nervous system and reproduction of Asterias	CLO4 CLO5

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Learning Resources

1. Anderson D.T. (1999) Invertebrate Zoology, Oxford University Press
2. Ayyar, E.K and T. Ananthakrishnan. (1992). Manual of Zoology Vol.1 Invertebrates Part I and II, S.Viswanathan Printers and Publishers Pvt. Ltd.Madras.
3. Edward E. Ruppert, Robert D. Barnes (1994). Invertebrate Zoology; Saunders College Pub.
4. Jordan, E.L and P.S. Verma.(2009). Invertebrate Zoology, S.Chand and Co. Ltd. New Delhi.
5. Kotpal, R.L. (2021). Zoology Invertebrates. Rastogi Publications, Meerut.

6. Lal S.S. (2019). Practical Zoology Invertebrates. Rastogi Publications, Meerut.
7. Nair, N.C., N. Arumugam, N. Soundarapandian, T. Murugan and S. Leelavathy.(2010). A textbook of Invertebrates. Saras Publication, Nagercoil.
8. Rastogi V.B. (2021). Invertebrate Zoology. KedarNath Ram Nath , Meerut.

Course Title: Biology of Non Chordates (Practical-I)

L	T	P	Credit
0	0	2	1

Course Code: BSE.128

Course Learning Outcomes (CLO)

At the end of the course the prospective teacher-trainees will be able to;

CLO2: Understand internal organization and skills- of staining and mounting of materials. (Temporary and permanent), of dissection,

ClO2: Display and labeling, of preparation of cultures of invertebrates by using common culture methods; laboratory observation of animal cell division.

Course Content

1. Study of museum specimens with respect to levels and patterns of organization biosystematics, biodiversity, adaptations, development stages,

population dynamics, ecological implications etc: Porifera –Sycon,Spongilla, Euplectella, Leucosolnia, Hylonema , Hypospongia, Euspongia:Coeleterata Hydra, Tubularia, Millepora, Physalia, Porpita, Vellela,

Aurelia, Tubipora, Alcyonium, Metridium, Pennatula, Grantia,Fungia,Gorgonia.

Helminthes: Fasciola, Taenia solium, Planaria, Ascaris, Ancyclostoma

Annelida: Nereis Heteroneresis, Aphrodite, Chaetoptreus. Arenicola,Pheretima, Hirudinarid

Arthropoda: Palaemong, Eupagurus, Scolopendra, Apis Peripatus.

Mollusca: Chiton, Pila, Aplysia, Helix, Denalium, Mytilus, Pinctda, Unio,Sepia, Loligo Octopus:

Echinodermata: Autedon, Holothuria, Cucumaria, Astropecten, Asterias,Echinus

2. Microscope : Simple and compound microscope, working mechanism and maintenance

3. Study of Permanent slides

Paramecium, Paramecium in Conjugation, paramecium binary fission,Euglena, Vorticella, Sycon L.S., Sycon T.S. , Hydra L.S., Hydra T.S,Cercaria larva, Metacercaria, Miracidium larva, Sporocyst larva, Redia

larva , Ascaris male and female T.S. , T.S. thorough , pharynx region,Gizzard and intestinal region of Earthworm, T.S. through buccal cavity of Hirudinaria, Zoea, Metazoea, Nauplius, Mysis, T.S. of gill of Unio.T.S. of the shell & mantle of Unio. Glochidium larva of Unio,

4. Dissections and/or its demonstration through

Charts/Models/Video/CD/digital alternative etc and/or preparation of working models of the different systems of the following animals.

1. Earthworm: Alimentary canal Nervous system, Reproductive system

2. Leech Alimentary canal

3. Cockroach: Mouthparts Digestive system, nervous system

4. prawn: Nervous system

5. pila: Nervous system

6. Culture of Paramecium, Euglena and Amoeba.

7. Study of bacterial and eukaryotic cell.

8. Slides of sub cellular components (Cell organelles)

9. Erythrocyte plasma membrane permeability.

10. Study of Karyotype and Ideogram of man.

11. Drosophila culture and lifecycle

Language 1
Punjabi

Course Title: ਪੰਜਾਬੀ ਭਾਸ਼ਾ, **ਵਿਹਾਰਕ ਵਿਆਕਰਣ** ਅਤੇ ਸਭਿਆਚਾਰ

L	T	P	Credits
4	0	0	4

Course Code: BSE.129

Course Learning Outcomes:
ਇਸ ਕੋਰਸ ਨੂੰ ਪੂਰਾ ਕਰਨ ਉਪਰੰਤ ਵਿਦਿਆਰਥੀ:

CLO1: ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਦੀ ਬਣਤਰ ਅਤੇ ਵਿਕਾਸ ਪ੍ਰਕਿਰਿਆ ਉਲੀਕ ਸਕਣਗੇ।
CLO 2: ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਅਤੇ ਵਿਆਕਰਨ ਦੇ ਬੁਨਿਆਦੀ ਸੰਕਲਪਾਂ ਤੋਂ ਜਾਣੂ ਹੋਣਗੇ।
CLO 3: ਪੰਜਾਬੀ ਸਭਿਆਚਾਰ ਅਤੇ ਲੋਕਧਾਰਾ ਦੇ ਬੁਨਿਆਦੀ ਪੱਖਾਂ ਤੋਂ ਜਾਣੂ ਹੋਣਗੇ।
CLO4: ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਦੇ ਵਿਆਕਰਨ ਦੀ ਵਰਤੋਂ ਵਿਹਾਰਕ ਹੁਨਰ ਵਿੱਚ ਕਰਣਗੇ

Unit/Hours	Content	Mapping with CLOs
ਯੂਨਿਟ – 1 14 ਘੰਟੇ	**ਭਾਸ਼ਾ ਦੀ ਪਰਿਭਾਸ਼ਾ ਅਤੇ** ਪ੍ਰਕ੍ਰਿਤੀ • **ਧੁਨੀਆਂ, ਅੱਖਰ ਅਤੇ ਵਿਆਕਰਨ** • ਪੰਜਾਬੀ **ਧੁਨੀਆਂ ਦਾ ਵਰਗੀਕਰਨ (ਸਵਰ ਅਤੇ ਵਿਅੰਜਨ)**	CLO 1 CLO 2

ਯੂਨਿਟ – **2** **16** ਘੰਟੇ	ਸ਼ਬਦ **ਦੀ** ਪਰਿਭਾਸ਼ਾ ਅਤੇ ਕਿਸਮਾਂ **(**ਰਚਨਾ ਅਤੇ ਸਰੋਤ ਦੇ ਆਧਾਰ 'ਤੇ**)** • ਵਾਕਾਂ ਦੀ ਪਰਿਭਾਸ਼ਾ ਅਤੇ ਕਿਸਮਾਂ **(**ਬਣਤਰ ਦੇ ਆਧਾਰ 'ਤੇ**)** ਸ਼ਬਦਾਂ ਦੀਆਂ ਵਿਆਕਰਨਿਕ ਸ਼੍ਰੇਣੀਆਂ **(**ਨਾਂਵ, ਪੜਨਾਂਵ, ਵਿਸ਼ੇਸ਼ਣ, ਕਿਰਿਆ**)** • ਸ਼ਬਦ ਬਣਤਰ **(**ਸੰਯੋਜਕ, ਮਿਸ਼ਰਿਤ, ਅਗੇਤਰ, ਪਿਛੇਤਰ**)** • ਕਹਾਵਤਾਂ ਅਤੇ ਮੁਹਾਵਰੇ	**CLO 1** **CLO 2**
ਯੂਨਿਟ – 3 **16 ਘੰਟੇ**	ਪੰਜਾਬੀ ਸਭਿਆਚਾਰ ਮੁੱਢਲੀ ਜਾਣਕਾਰੀ**:** ਡਾ**.** ਜਸਵਿੰਦਰ ਸਿੰਘ ਲੋਕਧਾਰਾ ਅਤੇ ਸਾਹਿਤ**:** ਵਣਜਾਰਾ ਬੇਦੀ ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਦੀ ਬਣਤਰ**:** ਡਾ**.** ਬਲਦੇਵ ਸਿੰਘ ਚੀਮਾ	**CLO 1** **CLO 3**
ਯੂਨਿਟ – 4 **14 ਘੰਟੇ**	ਅਸ਼ੁੱਧਤਾ ਸੁਧਾਈ **(**ਸ਼ਬਦਾਂ ਅਤੇ ਵਾਕਾਂ ਦੇ ਪੱਧਰ 'ਤੇ**)** • ਪੱਤਰ ਲਿਖਣਾ **(**ਰਸਮੀ ਅਤੇ ਗੈਰ ਰਸਮੀ**)**	**CLO 4**

ਸਹਾਇਕ ਪੁਸਤਕ ਸੂਚੀ

1. **ਬਰਾੜ, ਬੂਟਾ ਸਿੰਘ.** ***ਪੰਜਾਬੀ ਵਿਆਕਰਣ: ਸਿਧਾਂਤ ਤੇ ਵਿਹਾਰ.*** **ਚੇਤਨਾ ਪ੍ਰਕਾਸ਼ਨ, ਲੁਧਿਆਣਾ, 2008.**
2. **ਪੁਆਰ, ਜੋਗਿੰਦਰ ਸਿੰਘ ਅਤੇ ਹੋਰ.** ***ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਦਾ ਵਿਆਕਰਨ: ਭਾਗ 1.*** **1992. ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਅਕਾਦਮੀ, ਜਲੰਧਰ, 2016.**
3. ਹਰਕੀਰਤ ਸਿੰਘ ਅਤੇ ਉੱਜਲ ਸਿੰਘ ਬਾਹਰੀ, *ਭਾਸ਼ਾ ਵਿਗਿਆਨ ਅਤੇ ਪੰਜਾਬੀ ਭਾਸ਼ਾ*, ਬਾਹਰੀ ਪਬਲਿਸ਼ਰਜ਼, ਦਿੱਲੀ, **1973.**
4. **ਕਸੇਲ, ਕਿਰਪਾਲ ਸਿੰਘ ਅਤੇ ਪਰਮਿੰਦਰ ਸਿੰਘ,** ***ਪੰਜਾਬੀ ਸਾਹਿਤ ਦੀ ਉਤਪਤੀ ਤੇ ਵਿਕਾਸ,*** **15ਵਾਂ ਸੋਧਿਆ ਐਡੀਸ਼ਨ, ਲਾਹੌਰ ਬੁਕ ਸ਼ਾਪ, ਲੁਧਿਆਣਾ, 2013.**
5. ਖਹਿਰਾ, ਭੁਪਿੰਦਰ ਸਿੰਘ, *ਲੋਕਯਾਨ, ਭਾਸ਼ਾ ਅਤੇ ਸਭਿਆਚਾਰ*, ਪੈਪਸੂ ਬੁੱਕ ਡਿਪੂ, ਪਟਿਆਲਾ
6. **ਗਿੱਲ, ਹਰਜੀਤ ਸਿੰਘ,** ***ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਅਤੇ ਸਭਿਆਚਾਰ ਦਾ ਵਿਸ਼ਵਕੋਸ਼,*** **ਪੰਜਾਬੀ ਯੂਨੀਵਰਸਿਟੀ, ਪਟਿਆਲਾ.**
7. ਬਰਾੜ, ਬੂਟਾ ਸਿੰਘ, *ਪੰਜਾਬੀ ਭਾਸ਼ਾ: ਸ੍ਰੋਤ ਤੇ ਸਰੂਪ*, ਵਾਰਿਸ ਸ਼ਾਹ ਫਾਊਂਡੇਸ਼ਨ, ਅੰਮ੍ਰਿਤਸਰ, **2004.**
8. **ਰੰਧਾਵਾ, ਮਹਿੰਦਰ ਸਿੰਘ,** ***ਪੰਜਾਬ,*** **ਭਾਸ਼ਾ ਵਿਭਾਗ, ਪਟਿਆਲਾ, 1960.**

Language 1
Hindi

Course Title: हिंदी भाषा का व्यावहारिक व्याकरण एवं लेखन

L	T	P	Credit
4	0	0	4

Course Code: BSE.130

पाठ्यक्रम अधिगम परिणाम(**CLO**)**:**

इस पाठ्यक्रम को पढ़ने के उपरांत वद्यिार्थी ;

CLO-1 हिंदी भाषा के ध्वनि और वर्ण के मूल नियमों का विश्लेषण करेंगे

CLO-2 हिंदी भाषा के शब्द भंडार एवं वाक्य-संरचना का तुलनात्मक मूल्यांकन करेंगे

CLO-3 हिंदी भाषा की शब्द निर्माण प्रक्रिया एवं व्याकरणिक कोटियों का विश्लेषण करेंगे
CLO-4 हिंदी भाषा के व्याकरण का व्यावहारिक कौशल में प्रयोग करेंगे

Course Contents:

Unit/Hours	Content	Mapping with CLOs
UNIT I Hours: 15	• **भाषा की परिभाषा एवं प्रकृति** • **ध्वनि, वर्ण और व्याकरण** • **हिंदी की ध्वनियों का वर्गीकरण (स्वर और व्यंजन)** **अभ्यास : भाषा की परिभाषा , भाषा के ध्वनि एवं वर्ण के मूल नियमों का विश्लेषण करेंगे।**	CLO-1
UNIT II Hours: 15	• **शब्द की परिभाषा और भेद (रचना एवं स्रोत के आधार पर)** • **वाक्य की परिभाषा और भेद (संरचना के आधार पर)** **अभ्यास :शब्द की परिभाषा, उसकी उत्पत्ति एवं भेद का मूल्यांकन करेंगे।**	CLO-2
UNIT III Hours: 15	• **शब्दों की व्याकरणिक कोटियाँ (संज्ञा, सर्वनाम, विशेषण, क्रिया)** • **शब्द निर्माण (संधि, समास, उपसर्ग, प्रत्यय)** • **लोकोक्ति एवं मुहावरे** **अभ्यास : व्याकरणिक कोटियों का अध्ययन करेंगे।**	CLO-3
UNIT IV Hours: 15	• **अशुद्धि शोधन (शब्द एवं वाक्य के स्तर पर)** • **पत्र लेखन (औपचारिक एवं अनौपचारिक)** **अभ्यास : संधि, समास, उपसर्ग एवं प्रत्यय से परिचिति होंगे।**	CLO-4

Transaction Mode: Lecture; Video, Recitation, PPT, Group Discussion; Seminar, Self-learning, Text book analysis

अध्ययन के लिए पुस्तकें

- **किशोरीदास वाजपेयी: हिंदी व्याकरण, लोक भारती प्रकाशन, इलाहाबाद.2012**
- **कामता प्रसाद गुरु: हिंदी व्याकरण, नयी किताब प्रकाशन, नयी दिल्ली. 2019**
- **वासुदेवनंदन: आधुनिक हिंदी व्याकरण और रचना, भारती भवन पब्लिशिर्स एंड वितरक, पटना, 2014**

Course Title: Arts (Performing and Visual) and Creative Expressions
Course Code: BSE.131

L	T	P	Cr
1	0	0	1

Course Learning Outcomes;
At the end of the course the prospective teacher-trainees will be able to;

CLO1: Articulate the importance of aesthetics and art in education

CLO2: Demonstrate their familiarity with and appreciation of theatre

CLO3: Learn basic theatre tools of improvisation, ideation, and creation of a script

CLO4: Create a short performance with educational possibilities

Unit/Hours	Contents	Mapping with CLOs

Unit 1 5 Hours	Introduction to Performing Arts: Theatre/Drama/Music, Arts and Aesthetic in Education, Drama in education, Art and Craft in education	CLO 1
Unit 2 3 Hours	Concept of theatre, history and development of Theatre, Introduction to Puppets designing	CLO 2
Unit 3 4 Hours	Performing arts and script writing, analysis of script writing, Role play, story-telling, story writing, poems and newspaper article writing	CLO 3
Unit 4 3 Hours	Educational play production process	CLO 4

Suggested Books:

- Beyer, L.E. (2000). The arts, popular culture and social change. Falmer Press, London.
- Gair, S. B. (1980). Writing the arts into individualized educational programs. Art Education, 33(8), 8–11.
- Finlay, V. (2014). The brilliant History of Color in Art. Getty Publications, Finlay.
- Shirley, G. (2000). Art, an A to Z guide. Franklin Watts, New York.
- Vaze, P. (1999). How to Draw and Paint Nature. JyosnaPrakashan, Mumbai Ward,
- A. (1993). Sound and Music. Franklin Watts, New York

Course Title: Arts (Performing and Visual) and Creative Expressions-Practical
Course Code: BSE.132

L	T	P	Cr
0	0	2	1

Course Learning Outcomes
At the end of the course the prospective teacher-trainees will be able to;

CLO1: Articulate the importance of Performing Arts in education
CLO2: Design the theatre Puppets
CLO3: Learn basic theatre tools of improvisation, ideation, and creation of a script
CLO4: Perform educational play

Unit/Hours	Contents	Mapping with CLOs
Unit 1 7 Hours	Practical Process of Performing Arts: Theatre/Drama/Music, Art and Craft in education	CLO 1
Unit 2	Theatre Puppets designing	CLO 2

7 Hours	Practical aspects of Play production process	
Unit 3 8 Hours	Script writing, analysis of script writing, Role play, story-telling, story writing, poems and newspaper article writing	CLO 3
Unit 4 8 Hours	Rehearsal of any educational play of production Final stage performing with proposal/Project	CLO 4

Practical Examinations (25 Marks)	
Distribution of Marks	Total Marks 25
a) Performing art – Theatre, Drama, Music, Script Writing/ Puppets designing (Anyone)	10 Marks
b) Educational Play	05 Marks
c) Viva-Voce	05 Marks
d) Record (Practical file)	05 Marks
*The practical examination will be conducted by the concerned course coordinator.	

Suggested Books:

- Beyer, L.E. (2000). The arts, popular culture and social change. Falmer Press, London. Gair,
- S. B. (1980). Writing the arts into individualized educational programs. Art Education, 33(8), 8–11.
- Finlay, V. (2014). The brilliant History of Color in Art. Getty Publications
- Finlay. Shirley, G. (2000). Art, an A to Z guide. Franklin Watts, New York.
- Vaze, P. (1999). How to Draw and Paint Nature. Jyosna Prakashan, Mumbai
- Ward, A. (1993). Sound and Music. Franklin Watts, New York

Course Title: Understanding India (Indian Ethos and Knowledge Systems)-I
Course Code: BSE.133

L	T	P	Cr
2	0	0	2

Course Learning Outcomes:
At the end of the course the prospective teacher-trainees will be able to;

CLO1: Interpret and appreciate ancient Indian knowledge, traditions and its culture.
CLO2: Examine and Interpret Indian Arts and Literature in context of spirituality, identity and globalization.
CLO3: Comprehend basis of law and its various sources as well as philosophy of Chanakyaniti for modern day India.
CLO4: Analyze the Evolution and Impact of the Indian Economy from stone Age to the Gupta period of Indian history
CLO5: Critique the **importance** of revisiting India's ancient knowledge, traditions, and culture, and f**ormulate** strategies for integrating these insights into modern society's governance, economy, and cultural practices.

Units/Hours	Contents	Mapping with CLOs
UNIT I 6 Hours	Introduction to the Knowledge of India: Definition & scope; Relevance of this knowledge. Need to revisit our ancient knowledge, traditions, and culture	**CLO1** **CLO5**
UNIT II 8 Hours	**Culture, Art and Literature:** Fine arts (traditional art forms, contemporary arts, arts & spirituality, arts and Identity, and art and globalization); Performing Arts (Indian dance systems, traditional Indian pieces of music, visual arts, folk arts, etc.). Literature (Sanskrit literature, Indian poetry, folk literature, Indian fiction)	**CLO2** **CLO5**
UNIT III 8 Hours	**Polity and Law:** Kingship & types of government (oligarchies, republics); Local administration (village administration); -Basis of Law: Dharma & its sources; Criminal Justice: police, jails, and punishments; Lessons from Chanakyaniti for modern-day India	**CLO3** **CLO5**
UNIT IV **8 Hours**	**Economy:** 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). Understanding Arthashastra: Ideas & Criticism; Locating relevance of ancient Indian economic thought in modern-day Indian Economy.	**CLO4** **CLO5**

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Suggested Readings:

- Bhattacharyya, K. (2009). *Dharma and Its Sources in Ancient Indian Law*. Oxford University Press.
- Bhagat, S. (2017). *Art and Identity in India: Cultural Expressions and Globalization*. Oxford University Press.
- Chattopadhyaya, B. D. (2006). *Economic History of Ancient India: From the Stone Age to the Seventh Century AD*. Munshiram Manoharlal Publishers.
- Kumar, R. (2016). Indian Art: Tradition and Continuity. Vikas Publishing.
- Rao, C. (2014). *The Indian Knowledge System: Tradition and Modernity*. Oxford University Press.
- Sarma, P. (2015). *The Performing Arts of India: Classical Dance, Music, and Theatre*. Anmol Publications.
- Srinivasan, M. (2014). *Local Government and Administration in Ancient India*. Kaveri Book Service.

SEMESTER-II

PHYSICS -MAJOR

Course Title: Electricity and Magnetism
Course Code: BSE.151

L	T	P	Cr
3	0	0	3

Course Learning Outcomes:
At the end of the course the prospective teacher-trainees will be able to;
CLO1 develop the skills on the electrostatics techniques for calculating potential
CLO2 enrich their theoretical knowledge on the electric field in the matter
CLO3 comprehend the knowledge on the magnetostatics

CLO4 develop the understanding on the magnetostatics field in matter

Unit/Hours	Contents	Mapping with CLOs
UNIT-I 13 hours	1. Electrostatics Electrostatic field – Coulomb's law, Electric field, Continuous charge distributions -Divergence and curl of electrostatic field, Field lines and Gauss law, The divergence of E, Applications of Gauss law, Curl of E - Electric potential – Comments on potential, Poisson's equation and Laplace's equation, The potential of a localized charge distribution, Electrostatic boundary conditions – Work and energy in electrostatics, The work done in moving a charge, The energy of point charge distribution, The Energy of a continuous charge distribution, Comments on Electrostatic energy – Conductors, Basic properties of conductors, Induced charges, The Surface charge on a conductor, The force on surface charge, Capacitors. (Sections 2.1 to 2.5 of Introduction to Electrodynamics by David J Griffiths) 2. Special Techniques for Calculating Potentials Laplace's equation in One Dimension, Two Dimensions and Three Dimensions, Uniqueness theorems - Method of images, The classic image problem, induced surface charge, force and energy. (Sections 3.1 to 3.2.3 of Introduction to Electrodynamics by David J Griffiths)	CLO1
UNIT-II 12 hours	3 . Electric fields in matter Polarization – Dielectrics, Induced dipoles, Alignment of polar molecules, Polarization – The field of a polarized object , Bound charges, Physical interpretation of bound charges, The field inside a dielectric – The electric displacement – Gauss's law in presence of 13	CLO2

	dielectrics, Boundary conditions for D – Linear dielectrics, Susceptibility, Permittivity, Dielectric constant, Energy in dielectric systems, Forces on dielectrics, Polarizability and susceptibility. (Sections 4.1 to 4.4.1, 4.4.3, 4.4.4 of Introduction to Electrodynamics by David J Griffiths)	
UNIT-III 10 hours	4 . Magnetostatics The Lorentz force law – Magnetic fields, Magnetic forces, cyclotron motion, cycloid motion, Currents, Linear, Surface and Volume current density – Biot -Savart law, The magnetic field of steady current – Divergence and curl of B, Straight line currents, Applications of Ampere's law, Magnetic field of a toroidal coil, Comparison of magnetostatics and electrostatics – Magnetic vector potential , Vector potential, Magnetostatic boundary conditions. (Sections 5.1 to 5.4.2 of Introduction to Electrodynamics by David J Griffiths)	CLO3
UNIT-IV 10 hours	5. Magnetostatic fields in matter Magnetisation – Diamagnets, Paramagnets and Ferromagnets, Torques and forces on magnetic dipoles, Effect of a magnetic field on atomic orbits, Magnetization – Field of a magnetised object, Bound Currents, Physical interpretation, Magnetic field inside matter – Auxiliary field H, Ampere's law in magnetised materials, Boundary conditions – Linear and nonlinear media, Magnetic susceptibility and permeability, Ferromagnetism. (Sections 6.1 to 6.4 of Introduction to Electrodynamics by David J Griffiths)	CLO4

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Textbook for study

Introduction to Electrodynamics by David J Griffiths, 3rd Ed.

Books for reference

1. Electricity and magnetism by Arthur F Kip
2. Physics Vol. II by Resnick and Halliday

PHYSICS (MAJOR)

Course Title: Properties of Matter, Waves & Acoustics
Course Code: BSE.152

L	T	P	Cr
3	0	0	3

Course Learning Outcomes:
At the end of the course the prospective teacher-trainees will be able to;
CLO1 comprehend properties of matter
CLO2 understand the concept and application of harmonic oscillator
CLO3 reflect upon wave motion, general equation of wave motion
CLO4 understand waves in different mediums

Unit/Hours	Contents	Mapping with CLOs
UNIT-I 13 hours	Properties of Matter Elasticity: Basic ideas, Work Done per Unit Volume, Relations between elastic constants,Poisson's Ratio, Limiting Values of Poisson's Ratio, Twisting Couple on a Cylinder (or a Wire), Torsion pendulum, Determination of Rigidity Modulus, Bending of Beams, Bending Moment, Cantilever Loaded at Free End, Depression of a Beam Supported at the Ends and Loaded at the Centre (weight of the beam neglected), Determination of Y by Bending of a Beam, I form of Girders. (Sections: 8.1 to 8.18, 8.22 to8.23, 8.26 to 8.27, 8.29 to 8.30, 8.33 to 8.34 Elements of Properties of Matter by D.S. Mathur)	CLO1
UNIT-II 12 hours	Harmonic Oscillator Periodic Motion, Simple Harmonic Motion and Harmonic Oscillator, Energy of a Harmonic Oscillator, Examples of Harmonic Oscillator, Anharmonic Oscillator, Composition of Two Simple Harmonic Motions of Equal Periods in a Straight Line, Composition of Two Rectangular Simple Harmonic Motions of Equal Periods: Lissajous Figures, Damping Force, Damped Harmonic Oscillator, Examples of Damped Harmonic Oscillator, Power Dissipation, Quality Factor, Forced Harmonic Oscillator (Sections: 9.1 to 9.4, 9.7, 9.10 to 9.11, 10.1 to 10.4 to 10.6 of Mechanics by J.C Upadhyaya)	CLO2
UNIT-III 10 hours	Waves Wave Motion, General Equation of Wave Motion, Plane Progressive Harmonic Wave, Energy Density for a Plane Progressive Wave, Intensity of a Wave, Transverse Waves in Stretched Strings, Modes of Transverse Vibrations of Strings, Longitudinal Waves in Rods and Gases, Fourier's Theorem, Wave Velocity and Group Velocity	CLO3

	(Sections:11.1 to 11.9, 11.12 to 11.13 of Mechanics by J.C Upadhyaya)	
UNIT-IV 10 hours	Acoustics Intensity of Sound- Decibel and Bel, Loudness of Sound, Noise Pollution, Ultrasonics: Production of Ultrasonic Waves- Piezo Electric Crystal Method, Determination of Velocity of Ultrasonic Waves in a Liquid - Acoustic Grating, Application of Ultrasonic Waves, Reverberation, Sabine's Formula (Derivation not required), Absorption Coefficient, Acoustics of Buildings (Sections: 4.10 to 4.13, 5.1 to 5.3, 5.7 to 5.10, 5.12 to 5.15 of Properties of Matter and Acoustics by R.Murugeshan & Kiruthiga Sivaprasath)	CLO4

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Books for Study

1. Elements of Properties of Matter by D.S. Mathur 2008
2. Mechanics by J.C Upadhyaya 2003
3. Properties of Matter and Acoustics by R.Murugeshan & Kiruthiga Sivaprasath 2005

Reference

1. Mechanics -- D.S. Mathur
2. Text book of Sound –Brij Lal& Subramaniam
3. Text book of Sound –Khanna .D.R. & Bedi.R.S.
4. Berkeley Physics course Vol 3 on Waves

Course Title Physics Practical-I

Course Code: BSE.153

L	T	P	Cr
0	0	2	1

1.Deflection magnetometer-TAN A, Tan B positions

2. Deflection magnetometer -Tan C Position-moment of moments

3. Searle's vibration magnetometer-moment & ratio of moments

4. Box type vibration magnetometer-m & Bh

5. Melde's string arrangement-Frequency, relative density of solid (both modes)

6. Mirror galvanometer-figure of merit

Course Title Physics Practical-II

Course Code: BSE.154

L	T	P	Cr
0	0	2	1

1. Potentiometer-measurement of resistance
2. Potentiometer-calibration of ammeter
3. Ballistic Galvanometer- BG constant using HMS-then find Bh.
4. B.G.-Comparison of capacities Desauty's method.
5. Spectrometer- i-d curve
6. Verification of Kirchoff's laws, Verification of Thevenin's theorem

CHEMISTRY (MAJOR)

Course Title: Inorganic Chemistry-II Chemistry of S, P, D & F Block Elements

Course Code: BSE.155

L	T	P	Cr
3	0	0	3

Course Learning Outcomes:

At the end of the course the prospective teacher-trainees will be able to;

CLO 1 To develop understanding for the concepts of periodic table.

CLO 2 To develop understanding of periodic properties and their variation in groups and periods

CLO 3 Enrich their factual knowledge of chemistry related to inorganic compounds

Units/Hours	Contents	Mapping with Course Learning Outcome
UNIT-I 11hours	a.Periodicity of Elements: Introduction of s, p, d, f block elements, the long form of periodic table. Detailed discussion of periodic properties of the elements b.Comparative Study of s and p Block Elements: IA-VII A and Zero Groups: General remarks about each group, trends in electronic configuration, structure of elements, atomic and ionic, Radii, ionization potential, electron affinity, electronegativity, oxidation states, inert pair effect, catenation and heterocatenation, first and second row amomalies, the use of d orbitals by non-metals, the use of p orbitals in bonding. Important classes of Compounds of s and p block.	CLO1 CLO3

UNIT-II 11hours	a.Alkali Metals: Oxides, hydroxides, peroxides and super oxides, halides, hydrides, solutions of metals in liquid ammonia, complexes crowns and cryptands and podands. b.Alkaline Earth Metals: Solutions of the metals in liquid ammonia, hydroxides, oxides, sulfates, hydrides, halides, carbides, structures of calcium carbide, structures of basic beryllium acetate Be4O(CH3COO)6, beryllium oxalate complexes Be(OX)2. Structure of chlorophyll `a'.	CLO2 CLO3
UNIT-III 11hours	a.Group III (Boron Group): Oxides, halides and hydrides of group III elements, boron sesquioxide and borates structure of borates, trihalides and lower halides of boron, preparation of boron hydrides reactions and structures of boranes. b.Group IV (Carbon Group): Structure and allotropy of the elements, types and structure of carbides, oxides of carbon and silicon, types and structures of silicates, Organo-silicon compounds and the silicones, halides of IV group elements. Group V (Nitrogen Group): Hydrides, properties and structure of ammonia, hydrazine, hydroxylamine, trihalides and Pentahalides of V groups elements, oxides of nitrogen, structure of N2O, NO, N2O3, N2O4 and N2O5, oxo acids of nitrogen and phosphorous, phosphazenes and cyclophosphazenes.	CLO 2 CLO 3
UNIT-IV 12 hours	a.Group VI (Oxygen Group): Structure and allotropy of the elements. Oxides of sulfur (structure of SO2 and SO3) oxoacids of sulfur halides of sulfur, selenium and tellurium, compounds of Sulfur and nitrogen (S4N4). b.Group VII: Oxides of halogens (OF2, O2F2, Cl2O, ClO2, Cl2O6, BrO2, I2O5) (structures), Preparation, reaction and structure interhalogen compounds. (ClF3, BrF3, I2, Cl5, IF5, IF7) Polyhalides, basic properties of halogens. Zero Group: Clatharate compounds, preparation, structure and bonding of noble gas compounds (XeF2, XeF4, XeF6, XeO3, XeO2F2, XeO4).	CLO2 CLO3

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Suggested Readings:

- Cotton, F.A., Wilkinson, G., Gaus, P.L., Basic Inorganic Chemistry; 2nd edition, Pubs: John Wiley and Sons, 1995.
- Douglas, B., Medaniel, D., Atenander, J., Concepts and Models of Inorganic Chemistry, 3rd edition, Pubs: John Wiley and Sons Inc., 1994,
- F.A. Cotton and G. Wilinson, Advanced Inorganic Chemistry, Interscience Publishers.
- Inorganic Chemistry, A.G. Sharpe, ELBS.
- Inorganic Chemistry, W.W. Porterfield Addison-Wesley.
- J.D. Lee, Concise Inorganic Chemistry, 4th Ed.
- J.E. Huheey, Inorganic Chemistry, Harper & Row.
- Jolly, W.L., Modern Inorganic Chemistry; 2nd edition, Pubs: Tata McGraw-Hill Publishing Company Limited, 1991.
- Lee, J.D., Concise Inorganic Chemistry; 4th edition, Pubs: Chapman & Hall Ltd., 1991.
- Miessler, G.L., Tarr, D.A., Inorganic Chemistry; 3rd edition, Pubs: Pearson Education Inc. 2004,
- N.N. Greenwood and A. Earnshaw, Chemistry of Elements, Pergamon Press.
- Porterfeild, W.W., Wesky, A., Inorganic Chemistry; Pubs: Addison-Wesky Publishing Company, 1984.
- Purcell, K.F., Kotz, J.C., Inorganic Chemistry; Pubs: W.B.Saunders Company, 1977.
- Puri, B.R., Sharma, L.R., Kalia, K.K., Principles of Inorganic Chemistry; 30th edition, Pubs: Milestones Publisher, 2006-07.
- Shriver, D.E., Atkins, P.W., Inorganic Chemistry; 4th edition, Pubs: Oxford University Press, 2006.

CHEMISTRY (MAJOR)

Course Title: Physical Chemistry-I (States of Matter and Ionic Equilibria)

Course Code: BSE.156

L	T	P	Cr
3	0	0	3

Course Learning Outcomes:

At the end of the course the prospective teacher-trainees will be able to;

CLO1 To teach the fundamental concepts and their applications of basic concepts related to three states of matter.

CLO2 To make student teachers to understand different classifications of matter and various theories about this.

Units/Hours	Contents	Mapping with Course Learning Outcome
UNIT-I 11hours	a.Gaseous States: Postulates of kinetic theory of gases, deviation from ideal behavior, van der Waals equation of State. b.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	CLO1 CLO2

	of Corresponding states, reduced equation of state. c.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 (based on Joule-Thomson effect).	
UNIT-II 11hours	a.Liquid State: Qualitative treatment of the structure of the liquid state; physical properties of liquids; vapour pressure, surface tension and coefficient of viscosity. Effect of various solutes, on surface tension and viscosity. Variation of viscosity of liquids with temperature and comparison with that of gases. b.Solid State-I: Nature of the solid state, law of constancy of interfacial angles, law of rational indices, Miller indices, elementary ideas of symmetry, symmetry elements and symmetry operations, qualitative idea of point and space groups, seven crystal systems and fourteen Bravais lattices.	CLO1 CLO2
UNIT-III 11hours	a.Solid State-II: X-ray diffraction, Bragg's law, a simple account of rotating crystal method and powder pattern method. Analysis of powder diffraction patterns of NaCl, CsCl and KCl. Defects in crystals. Glasses and liquid crystals (Laue's method and powder method). classification of colloids. b.Ionic equilibria-I: Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect; dissociation constants of mono-, di-and triprotic acids (exact treatment).	CLO1 CLO2
UNIT-IV 12 hours	a.Ionic Equilibria-II: Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions; derivation of Henderson equation and its applications; buffer capacity, buffer range, buffer action and applications of buffers in analytical chemistry and biochemical processes in the human body. b.Solubility and solubility product of sparingly soluble salts – applications of solubility product principle. Qualitative treatment of acid – base titration curves (calculation of pH at various stages). Theory of acid–base indicators; selection of indicators and their limitations.	CLO1 CLO2

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Suggested Readings

- Principles of physical chemistry Author: S. H. Maron & C. F. Prutton.
- Publisher: Collier Macmillan Ltd; 4th Revised edition edition (1 December 1965) ISBN-10: 0023762306
- Physical Chemistry Author: K. J. Laidler. Publisher: Houghton Mifflin; 4th Revised ed. edition (May 1, 2002) ISBN-10: 061815292X
- Physical Chemistry Vol-1 Author: K. L. Kapoor. Publisher: Laxmi Publications; Fourth edition (2011) ISBN-10: 0230332757
- Physical chemistry Author: W. J. Moore. Publisher: Longman; 1st Revised edition edition (24 July 1972) ISBN-10: 0582442346
- Atkins, P., Paula, J.de, Atkins Physical Chemistry; 8th edition, Pubs: Oxford University Press, 2008.
- Puri, B.R., Sharma, L.R., Pathania, M.S., Principles of Physical Chemistry; 43rd edition, Pubs: Vishal Publishing Co., 2008.
- Barrow, G.M., Physical Chemistry; 6th edition, Pubs: McGraw Hill Inc, 1996.
- Rao, C.N.R., University General Chemistry; Pubs: Macmillan India, 1985
- Berry, R.S., Rice, S.A., Ross, J., Physical Chemistry; 2nd edition, Pubs: Oxford University Press, 2000.
- Albert, R.A., Silbey, R.J., Physical Chemistry; 1st edition, Pubs: John Wiley & Sons Inc.,1992.
- Dogra, S.K., Dogra, S., Physical Chemistry Through Problems; Pubs:Wiley Eastern Limited, 1991.
- Levine, I.N., Physical Chemistry; 5th edition, Pubs: Tata McGraw Hill Publishing Co. Ltd., 2002.
- Moore, W. J., Basic Physical Chemistry; Pubs: Prentice Hall of India Pvt. Ltd, 1983.
- University General Chemistry, C.N.R. Rao, Macmillan.

CHEMISTRY (MAJOR)

Course Title: Inorganic Chemistry-II (Practical-I: Qualitative Analysis)

Course Code: BSE.157

L	T	P	Cr
0	0	2	1

Course Learning Outcomes:

At the end of the course the prospective teacher-trainees will be able to;

CLO1 To provide a positive, enjoyable learning experience, soundly based on scientific principles and practice.

CLO2 To foster good laboratory practice and develop technical skills relevant to qualitative analysis.

CLO3 To provide an environment which encourages an inquiring, investigate approach, developing competence and confidence.

Course Content

Units/Hours	Content	Mapping with Course Content
30 hours	• Supplement and reinforce chemical principles taught in the theory units. • Special Tests for Mixture of Anions (do any 8) • Carbonate in the presence of sulphate. • Nitrate in the presence of nitrite • Nitrate in the presence of bromide and iodide. • Nitrate in the presence of chlorate. • Chloride in the presence of bromide and iodide. • Chloride in the presence of bromide. • Chloride in the presence of iodide. • Bromide and iodide in the presence of each other and of chloride. • Iodate and iodide in the presence of each other. • Phosphate, arsenate and arsenite in the presence of each other. • Sulphide, sulphite, thiosulphate and sulphate in the presence of each other. • Borate in the presence of copper and barium salts. • Oxalate in the presence of fluoride. • Oxalate, tartrate, acetate, citrate in the presence of each other. • Separation and Identification of Cations in Mixtures • Separation of cations in groups. • Separation and identification of Group I, Grou p II (Group IIA and IIB), Group III, Group IV, Group V and Group VI cations. • Identification of Cations including Less Familiar Elements by Spot Tests Assisted by Group Analysis (3 cations).	CLO1 CLO2 CLO3

Suggested Readings:

- Vogel's book on Inorganic Qualitative Analysis
- Experimental Organic Chemistry, Vol. I & II, P.R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.
- Laboratory Manual in Organic Chemistry, R.K. Bansal, Wiley Eastern.
- Vogel's Textbook of Practical Organic Chemistry, B.S. Furniss, A.J. Hannaford, V. Rogers, P.W.G. Smith and A.R. Tatchell, ELBS.
- Experiments in General Chemistry, C.N.R. Rao and U.C. Aggarwal, East-West Press.
- Experiments in Physical Chemistry, R.C. Das and B. Behra, Tata McGraw Hill

CHEMISTRY (MAJOR)

Course Title: Physical Chemistry-I (Practical-II)

L	T	P	Cr
0	0	2	1

Course Code: BSE.158

Course Learning Outcomes:

At the end of the course the prospective teacher-trainees will be able to;

CLO 1 The main objective of this lab learning exposure is to provide hands on experience the properties of matter and correlate with the theory learnt.

Course Content

Units/Hours	Content	Mapping with Course Content
30 hours	Preparation of solutions: Basic concepts and standardization Surface tension measurements. Determine the surface tension by Drop number (ii) drop weight method (iii) capillary rise method. Study the variation of surface tension of detergent solutions with concentration and hence the CMC value. Viscosity measurement using Ostwald's viscometer. Determination of viscosity of aqueous solutions of Polymer (ii) ethanol and (iii) sugar at room temperature. Study the variation of viscosity of sucrose solution with the concentration of solute. Study effect of temperature on viscosity of water. Indexing of a given powder diffraction pattern of a cubic crystalline system. pHmetry Study the effect on pH of addition of HCl/NaOH to solutions of acetic acid, sodium acetate and their mixtures. Preparation of buffer solutions of different pH Sodium acetate-acetic acid Ammonium chloride-ammonium hydroxide pH metric titration of (i) strong acid vs. strong base, (ii) weak acid vs. strong base. Determination of dissociation constant of a weak acid.	CLO 1

Suggested Readings:

- Khosla, B. D.; Garg, V. C. & Gulati, A. *Senior Practical Physical Chemistry,* R. Chand & Co.: New Delhi (2011).
- Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. *Experiments in Physical Chemistry 8th Ed*.; McGraw-Hill: New York (2003).
- Halpern, A. M. & McBane, G. C. *Experimental Physical Chemistry 3rd Ed.;* W.H. Freeman & Co.: New York (2003).
- Advanced Practical Physical Chemistry, J.B. Yadav, Goel Publishing House.
- Advanced Experimental Chemistry, Vol. I, Physical,J.N.Guru and R.Kapoor, S.Chand& Co.
- Selected Experiments in Physical Chemistry, N.G. Mukherjee, J.N. Ghosh & Sons.
- Experiments Physical Chemistry, J.C. Ghosh, Bharati Bhavan.

MATHEMATICS (MAJOR)

Course Title: Differential Equations

L	T	P	Cr
4	0	0	4

Course Code: BSE.159

Course Learning Outcomes:

At the end of the course the prospective teacher-trainees will be able to;

CLO1 To understand Order and degree of differential equation, Linear and non-linear differential equations.
CLO2 To comprehend Applications of differential equations of first order and first degree.
CLO3 To understand Differential equations of first order and higher degree solvable for x, y and p.
CLO4 To understand Linear differential equations with constant coefficients, Methods of variation of parameters.

Units/Hours	Contents	Mapping with CLOs
UNIT-I 15 hours	Order and degree of differential equation, Linear and non-linear differential equations, Formation of differential equation, Existence and uniqueness theorem, Differential equations of first order and first degree: separation of variables, homogeneous differential equations, Pfaffian differential equation.	CLO1
UNIT-II 15 hours	Exact differential equations, Linear differential equations, Geometric meaning of a differential equation of first order and first degree, Applications of differential equations of first order and first degree, Orthogonal trajectories.	CLO2
UNIT-III 15 hours	Differential equations of first order and higher degree solvable for x, y and p, Clairaut's forms and singular	CLO3

	solutions, Extraneous loci.	
UNIT-IV 15 hours	Linear differential equations with constant coefficients, Methods of variation of parameters, Homogeneous linear differential equations, Simultaneous differential equations.	CLO4

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Suggested Readings:

- D.A. Murray: Introductory Course in Differential Equations. Orient Longman (India), 1967.
- G.F. Simmons: Differential Equations, Tata McGraw Hill, 1972.
- E.A. Codington: An Introduction to Ordinary Differential Equations, Prentice Hall of India, 1961.
- Tom M. Apostol: Calculus: An Indian Adaptation, Wiley India, 2023
- Erwin Kreyszig: Advanced Engineering Mathematics, John Wiley and Sons, 1999. 52
- Narayan, S. and P.K. Mittal: Integral Calculus. Sultan Chand & Sons.
- Narayan S. and P.K. Mittal: Differential Calculus, Sultan Chand & Sons.

MATHEMATICS (MAJOR)

Course Title: Calculus-II

L	T	P	Cr
4	0	0	4

Course Code: BSE.160

Course Learning Outcomes:

At the end of the course the prospective teacher-trainees will be able to;

CLO1 understand Limit and continuity of functions of two variables, partial differentiation, change of variables.
CLO2 enhance their knowledge related to Integration of trigonometric and hyperbolic functions.
CLO3 solve Quadrature and Rectification related problems.
CLO4 comprehend applications to evaluate area, volume surface of solid of revolution

Units/Hours	Contents	Mapping with CLOs
UNIT-I 15 hours	Limit and continuity of functions of two variables, partial differentiation, change of variables, Differentiability of real-valued functions of two variables, Euler's theorem on homogeneous functions, Taylor's theorem for functions of two variables, Jacobians, Maxima and Minima.	CLO1

UNIT-II 15 hours	Integration of trigonometric and hyperbolic functions, Reduction formula, Definite integrals, Fundamental theorem of integral calculus, Beta and Gamma functions.	CLO2
UNIT-III 15 hours	Quadrature and Rectification, Double and Triple integrals, change of variables, Change of order of Integration.	CLO3
UNIT-IV 15 hours	Applications to evaluate area, volume surface of solid of revolution, Centre of Gravity, Moment of Inertia	CLO4

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Suggested Readings:

- Narayan, S. and P.K. Mittal: Integral Calculus. Sultan Chand & Sons.
- Narayan S. and P.K. Mittal: Differential Calculus, Sultan Chand & Sons.
- Tom M. Apostol: Calculus: An Indian Adaptation, Wiley India, 2023

BOTANY (MAJOR)

Course Title: Plant Anatomy

Course Code: BSE.161

L	T	P	Cr
3	0	0	3

Course Learning Outcomes:

At the end of the course the prospective teacher-trainees will be able to;

CLO1: understand tissue, classification of tissues

CLO2: analyze endodermis, exodermis and origin of lateral root. vascular cambial Structure

CLO3: explain wood: types of rays and axial parenchyma; cyclic aspects and reaction wood

CLO4: reflect on adaptive and protective systems: epidermal tissue system

Units/Hours	Contents	Mapping with CLOs
Unit-I 07 hrs	Tissue: Classification of tissues; simple and complex tissues (no phylogeny); pits and plasmodesmata; wall ingrowths and transfer cells; ergastic substances. stem and leaf: Organization of shoot apex (apical cell theory, histogen theory, tunica corpus theory, continuing meristematic residue, cyto-histological zonation); types of vascular bundles; Structure of dicot and monocot stem;	CLO1

	shoot chimeras; structure of dicot and monocot leaf, kranz anatomy; development of Leaf.	
Unit-II 10 hrs	Root: organization of root apex (Apical cell theory, histogen theory, korper- kappe theory); quiescent centre; Root cap; Structure of dicot and monocot root; Endodermis, exodermis and origin of lateral root. vascular cambial Structure (axially and radially oriented elements); function and seasonal activity of cambium; secondary growth in root and stem, anomalies in secondary growth in stem: included phloem and phloem wedges.	CLO2
Unit-III 15 hrs	Wood: types of rays and axial parenchyma; cyclic aspects and reaction wood; sapwood and heartwood; ring and diffuse porous wood; Early and late wood, tyloses; dendrochronology. periderm, development and composition of periderm; rhytidome and lenticels.	CLO3
Unit-IV 13 hrs	Adaptive and protective systems: epidermal tissue system; cuticle; epicuticular waxes;trichomes (uni-and multicellular, glandular and non-glandular, two examples of each); stomata (classification); adcrustation and incrustation; anatomical adaptations of xerophytes and hydrophytes. Secretory system, hydathodes, cavities, lithocysts and laticifers. scope of plant Anatomy, applications in systematics, forensics and pharmacognosy.	CLO4

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Suggested Readings

1. Dickison, W.C. (2000).Integrative Plant Anatomy.Cambridge, U.K.:Harcourt Academic Press.

2. Esau, K. (1977).Anatomy of Seed Plants. New Delhi, Delhi: John Wiley & Sons, Inc.

3. Evert, R.F., Eichhorn, S. E. (2006). Esau's Plant anatomy: Mersitems, Cells, and tissues of the Plant Body: their structure, function and development. New Jersey, U.S.: Wiley- Liss.

Course Title: Plant Systematics

Course Code: BSE.162

L	T	P	Cr
3	0	0	3

Course Learning Outcomes:

At the end of the course the prospective teacher-trainees will be able to;

CLO1: understand tissue, classification of tissues

CLO2: analyze endodermis, exodermis and origin of lateral root. vascular cambial Structure

CLO3: explain wood: types of rays and axial parenchyma; cyclic aspects and reaction wood

CLO4: reflect on adaptive and protective systems: epidermal tissue system

Units/Hours	Contents	Mapping with CLOs
Unit-I 07 hrs	Plant identification, classification, nomenclature, biosystematics, field inventory; herbarium techniques; functions of herbarium; important herbaria and botanical gardens of the world and India; virtual herbarium; E-flora: flora, monographs, journals; keys: single access and multi-access.	CLO1
Unit-II 10 hrs	Systematics-an interdisciplinary science, evidence from palynology, cytology, phytochemistry [alkaloids, phenolics, glucosides, terpenes and semantides (in brief)] and molecular data (cp.DNA, mt-DNA, nuclear DNA, PCR amplification, sequence data analysis), taxonomic hierarchy: concept of taxa (family, genus, species); categories and taxonomic hierarchy; species concept (taxonomic, biological, evolutionary)	CLO2
Unit-III 15 hrs	Botanical nomenclature: principles and rules (ICN); ranks and names; typification, author citation, valid publication, rejection of names, principle of priority and its limitations; names of hybrids and cultivated plants. system of classification: major contributions of Theophrastus, Bauhin, Tournefort, Linnaeus, Adanson, de Candolle, Bessey, Hutchinson, Takhtajan and Cronquist; Classification systems of Benthan and Hooker (up to series) and Engler and Prantl (up to series); Brief references of Angiosperm Phylogeny Group (APG IV) classification.	CLO3
Unit-IV 13 hrs	Biometrics and numerical taxonomy: characters; variations; OTUs, character weighing and coding; cluster analysis; phenograms phylogeny of angiosperms: Terms and concepts (primitive and advanced, homology and analogy, parallelism and convergence, monophyly, paraphyly, polyphyly and clades). Origin and evolution of angiosperms; cladistics; methods of illustrating evolutionary relationships (phylogenetic tree, cladogram)	CLO4

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Suggested Readings:

Reven, F.H., Evert, R. F., Eichhorn, S.E. (1992). Biology of Plants. New York, NY: W.H. Freeman andCompany.

2. Singh, G. (2012). Plant Systematics: Theory and Practice, 3rd edition. New Delhi, Delhi: Oxform and IBH Pvt. Ltd.

Course Title: Plant Anatomy (Practical-I)

Course Code: BSE.163

L	T	P	Cr
0	0	2	1

Contents:

Study of anatomical details through permanent slides/temporary stain mounts/ macerations/ museum specimens with the help of suitable examples.

1. Apical meristem of root, shoot and vascular cambium.
2. Distribution and types of parenchyma, collenchyma and sclerenchyma.
3. Xylem: Tracheary elements-tracheids, vessel elements; thickenings; perforation plates; xylem fibres.
4. Wood: ring porous; diffuse porous; tyloses; heartwood and sapwood.
5. Phloem: Sieve tubes-sieve plates; companion cells; phloem fibres.
6. Epidermal system: cell types, stomata types; trichomes: non-glandular and glandular.
7. Root: monocot, dicot, secondary growth.
8. Stem: monocot, dicot - primary and secondary growth; phloem wedges in Bignonia, included phloem in Leptadenia/Salvadora; periderm; lenticels.
9. Leaf: isobilateral, dorsiventral, C4 leaves (Kranz anatomy).
10. Adaptive Anatomy: xerophytes, hydrophytes.
11. Secretory tissues: cavities, lithocysts and laticifers.

Course Title: Plant Systematics (Practical-II)

L	T	P	Cr
0	0	2	1

Course Code: BSE.164

Contents:

Study of vegetative and floral characters of angiosperms families (Description, V.S. flower, section of ovary, floral diagram/s, floral formula/e and systematic position) as per availability of seasonal flowering plants.

1. Represented families:

- Ranunculaceae- Ranunculus, Delphinium
- Brassicaceae- Brassica, Alyssum/ Iberis
- Myrtaceae- Eucalyptus, Callistemon
- Umbelliferae-Coriandrum/ Anethum/ Foeniculum
- Asteraceae- Sonchus/ Launaea, Veronia/ Ageratum, Elipta/ Tridax S
- olanaceae- Solanum nigrum/ Withania
- Lamiaceae- Salvia/Ocimum
- Euphorbiaceae-Euphorbia hirta/ E.milli, Jatropha
- Liliaceae- Asphodelus/ Lilium/ Allium
  Poaceae- Triticum/ Hordeum/ Avena
- Malvaceae-Abutilon/ Hibiscus/ sida
- Caryophyllaceae-Stellaria/ Dianthus
- Apocyanaceae- Vinca rosea
- Asclepediaceae- Calotropis procera
- Moraceae- Morus alba Chenopodiaceae- Chenopodium alba
- Cannaceae- Canna indica

2. Field visit (local)- Subject to grant funds from the University
3. Mounting of a properly dried and pressed specimen of any wild plant with herbarium label (to be submitted in the record book).

ZOOLOGY (MAJOR)

Course Title: BIOLOGY OF CHORDATES

L	**T**	**P**	**Cr**
3	**0**	**0**	**3**

Course Code: BSE.165

Course Learning Outcomes (CLO)

At the end of the course the prospective teacher-trainees will be able to;

CLO1: Explain chordate characteristics and classification of protochordates.

CLO2: Differentiate between Agnatha and Gnathostomata and classify fishes and analyze their adaptations.

CLO3: Explain structural and functional diversity of chordates.

CLO4: Analyze evolutionary relationship amongst vertebrates.

CLO5: Understand evolution of organ systems in vertebrates.

Unit/ Hours	Contents	Mapping with CLOs
Unit 1 **10 hours**	**Unit I: Introduction to Chordates** • General features of chordates and Classification up to classes. • General organization of Hemichordate: Balanoglossus. • General organization of Urochordata (e.g., *Herdmania*), Retrogressive metamorphosis. • General organization of Cephalochordata (e.g., *Branchiostoma*) • Affinities of protochordates.	**CLO 1**
Unit 2 **10 hours**	**Introduction to Agnatha and Gnathostomata** • Characteristics of Agnatha. • Classification and features of Cyclostomes (e.g., *Petromyzon* and *Myxine*). • General characteristics and classification of fishes. • Locomotion and swimming adaptations. • Respiratory system: gills and accessory respiratory structures. • Economic importance of fishes. • Scales and fins of fishes	**CLO 2**
Unit 3 **12 hours**	**Diversity and Structural Organization of Chordates** • General characteristics and classification of amphibians. • Metamorphosis and neoteny • Parental care in amphibians • General characteristics and classification of reptiles • Biting mechanism in snake. • General characteristics and classification of birds • Flight adaptations in birds (skeletal, muscular, and respiratory modifications) • General characteristics and classification of mammals. • Adaptive radiation in mammals.	**CLO 3**
Unit 4 **13 hours**	**Comparative Anatomy of Vertebrates** • Comparative study of digestive system in vertebrates • Comparative study of the heart in vertebrates • Evolution of the urogenital system in vertebrates • Comparative study of the vertebrate brain.	**CLO 4 & 5**

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method.

Suggested readings:

1. Harvey et al (2006). The Vertebrate Life.

2. Colbert et al (2002). Colbert's Evolution of the Vertebrates: A history of the backboned animals through time (5th ed,Wiley - Liss)
3. Hildebrand (1995). Analysis of Vertebrate Structure (4th edition, 1995, John Wiley)
4. Kenneth V. Kardong (2015). Vertebrates: Comparative Anatomy, Function, Evolution McGrawHill
5. McFarland et al. (1979). Vertebrate Life (Macmillan Publishing)
6. Parker and Haswell (1978). Textbook of Zoology, Vol. II (ELBS)
7. Romer and Parsons (1986). The Vertebrate Body (6th edition, CBS Publishing Japan)
8. Young (2006). The Life of vertebrates (3rd edition, ELBS/Oxford)
9. Weichert C.K and William Presch (1980). Elements of Chordate Anatomy, Tata McGraw Hills.

Course Title: Biochemistry and Physiology

L	T	P	Credit
3	0	0	3

Course Code -BSE.166

Course Learning Outcomes (CLO)

At the end of the course the prospective teacher-trainees will be able to;

CLO1: Develop a deep understanding of structure of biomolecules like proteins, lipids and carbohydrate

CLO2: understand the thermodynamics of enzyme catalyzed reactions.

CLO3: Analyze mechanisms of energy production at cellular and molecular levels.

CLO4: understand systems biology and various functional components of an organism.

CLO5: explore the complex network of these functional components.

Units/Hours	Contents	Mapping with CLOs
UNIT I 12 hours	Structure and Function of Biomolecules • Structure and Biological importance of carbohydrates (Monosaccharides, Disaccharides, Polysaccharides and Glycoconjugates) • Classification and Biological importance of Lipids (saturated and unsaturated fatty acids; simple, conjugated and derived lipids) • Peptide bond formation and Overview of Protein Structure. Carbohydrates: Nomenclature and classification; Monosaccharides; Disaccharides; Oligosaccharides and polysaccharides. Lipids: Definition and major classes of storage and structural lipids; Fatty acids structure and functions; Essential fatty acids; Triacyl glycerol's structure, functions and properties; Phosphoglycerides, lipid functions.	CLO1
UNIT II 12 hours	Nomenclature and classification of enzymes • Mechanism of enzyme action, Enzyme kinetics; Factors affecting rate of enzyme-catalysed reactions; Derivation of Michaelis-Menten equation, Concept of Km and Vmax, Lineweaver-Burk plot; Enzyme inhibition; Regulation of enzyme action, inhibition and allosteric Isozymes; Cofactors	CLO2

UNIT III 12 hours	Metabolism of Carbohydrates • Glycolysis • Citric acid cycle • Gluconeogenesis • Phosphate pentose pathway • Glycogenesis and Glycogenolysis • Metabolism of Amino acids • Catabolism of amino acids: Transamination, Deamination, Urea cycle • Metabolism of Lipids • Biosynthesis of Palmitic acid • β-oxidation of saturated fatty acids • Ketogenesis	CLO3
UNIT IV 12 hours	Circulation and Excretion • Components of blood and their functions • Structure of mammalian heart, Cardiac cycle and its regulation; Cardiac output, Electrocardiogram, Blood pressure • Structure of kidney and its functional unit; Mechanism of urine formation • Nervous System: Structure of neuron, resting membrane potential, Origin of action potential and its propagation across the myelinated and • unmyelinated nerve fibers, Synaptic transmission Muscular System • Ultra structure of skeletal muscle; Motor unit, • Molecular and chemical basis of muscle contraction	CLO4 CLO5

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

References

1. Nelson & Cox(2000). Lehninger's Principles of Biochemistry: McMillan
2. Zubayet al(1995). Principles of Biochemistry: WCB
3. Voet & Voet (2004). Biochemistry Vols 1 & 2: Wiley
4. Murray et al (2003): Harper's Illustrated Biochemistry: McGraw Hill Elliott and Elliott: Biochemistry and Molecular Biology: Oxford University Press.
5. Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. W.B.Saunders Company.
6. Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI Edition. John Wiley & sons.
7. Christopher D. Moyes, Patricia M. Schulte. (2016). Principles of Animal Physiology. 3rd Edition, Pearson Education
8. Hill, Richard W., et al. (2004). Animal physiology. Vol. 2. Sunderland, MA: Sinauer Associates.
9. Chatterjee C. C. (2016). Human Physiology. Volume 1 & 2. 11th edition. CBS Publishers.

Course Title: Biology of Chordates (Practical-I)

L	T	P	Credit
0	0	2	1

Course Code: BSE.167

Course Learning Outcomes (CLO)

At the end of the course the prospective teacher-trainees will be able to;

CLO1: Develop the skills of staining and mounting of materials (temporary and permanent) and of dissection, display and labeling.

CLO2: Acquire the skills of collection, preservation, mounting, identification and labeling of specimens.

Course Content

1. Study of Museum specimen with respect to levels and patterns of organization, biosystematics, biodiversity, adaptations, development stages, population dynamics, ecological implication sets.
a) Hemichordata: Balanoglossus.
b) Urochordata : Herdmania,Pyrosoma
c) Cephalochordata : Petromyzon,Myxine
d) Cyclostomata : Petromyzon, Myxine
e) Pisces:Scoliodon,Sphyrna,Torpedo,Pristis,Trygon Lepidosteus,Clarias, Ophiocephalus, Anabas. Exocoetus, Hippocampus, Tetradon, Protopterus
f) Amphibia: Icthyophis, Necturus, Proteus, Ambystoma, Axolotl larva, Triturus. Amphiuma, Alytes Bufo.
g) Reptilia : Testudo, Trionyx, Sphenodon , Hemidactylus, Draco, Calotes, Chamaeleon, Varanus, Heloderma, Typhlops , Eryx, Hydrophis, Viper , Bungarus , Naja Alligator,
h) Aves: Pavo, Columba, Psitacula, Passer, Corvus, Archaeopteryx.
i) Mammals: Ornithorhynchus, Echidna, Macropus, Loris, Manis, Rattus.
2. Study of Permanent Sildes:
a) Balanoglossus: T.S. of proboscis , collgar region and trunk
b) Amphioxus: T.S. or oral hood, pharynx.
c) Mammals: T.S., skin Stomach, Duodenum, IIeum, liver, Pancreas, spleen lung, kindney Testis, Ovary.
3. Osteology:
a) Study of skull bone of Frog, Varanus, Bird and Rabbits.
b) Study of vertebral of Frog. Varanus, Bird and Rabbit.
c) Stud of girdles, forelimb and hind limb bones of Frog, Varanus, Bird and Rabbit.
4. Dissections and/or its demonstration through Charts/ Models/Video/CD/digital alternatives etc and/or preparation of working models of the different system of the following animals.
a) Scoliodon: Afferent brachial systems, efferent branchial system, cranial nerves and internalear.
b) Frog : Anatomy, digestive, system , Urino-genital system
5. Permanent /Temporary preparation of the following-:
a) Scales: Placoid, Cycloid
b) Blood film of any vertebrate
c) Filoplumes of birds
d) Thigh muscles of frog
6. Estimation of Hemoglobin.
7. Enumeration of RBC in blood samples.
8. Enumeration of WBC in blood samples.
9. Preparation of Haemin Crystals.
10. Effect of different concentrations of NaCI on RBC.
11. Measurement of blood pressure, Heart beat and Pulse rate.

12. Study of bleeding time, Coagulation time of blood.
13. Study of Histological slides of the following endocrine gland of mammal testis, ovary, thyroid, adrenal, pituitary, Islets of Langerhans.

Course Code: Biochemistry and Physiology (Practical-II)

L	T	P	Credit
0	0	2	1

Course Code: BSE.168

Course learning Outcomes:

At the end of the course the prospective teacher-trainees will be able to;

- Understand the structure of biomolecules like proteins, lipids and carbohydrates
- Perform basic hematological laboratory testing,
- Distinguish normal and abnormal hematological laboratory findings to predict the diagnosis of hematological disorders and diseases.

1. Estimation of haemoglobin using Sahli's haemoglobinometer
2. Preparation of haemin and haemochromogen crystals
3. Counting of RBCs and WBCs using Haemocytometer
4. To study different mammalian blood cell types using Leishman stain.
5. Recording of blood pressure using a sphygmomanometer
6. Recording of blood glucose level by using glucometer
7.Study of permanent slides of Mammalian skin, trachea, lungs, Cartilage, Bone, Spinal cord, Nerve cell, Pituitary, Pancreas, Testis, Ovary, Adrenal, Thyroid and Parathyroid.
8. Preparation of temporary stained mount of nerve and striated muscle.
9. Recording of simple muscle twitch with electrical stimulation (or Virtual)
10. Demonstration of the unconditioned reflex action (Deep tendon reflex such as knee jerk reflex)
11. Ninhydrin test for □-amino acids.
12. Molisch Test for Carbohydrate
13. Benedict's test for reducing sugar and iodine test for starch.
14. Test for sugar and acetone in urine.
15. Qualitative tests of functional groups in carbohydrates, proteins and lipids.
16. Action of salivary amylase under optimum conditions.

PHYSICS (MINOR)

Course Title: Electricity and Magnetism
Course Code: BSE.169

L	T	P	Cr
3	0	0	3

Course Learning Outcomes;
At the end of the course the prospective teacher-trainees will be able to;
CLO1 develop the skills on the electrostatics techniques for calculating potential
CLO2 enrich their theoretical knowledge on the electric field in the matter
CLO3 comprehend the knowledge on the magnetostatics

CLO4 develop the understanding on the magnetostatics field in matter

Unit/Hours	Contents	Mapping

		with CLOs
UNIT-I 13 hours	1. Electrostatics Electrostatic field – Coulomb's law, Electric field, Continuous charge distributions -Divergence and curl of electrostatic field, Field lines and Gauss law, The divergence of E, Applications of Gauss law, Curl of E - Electric potential – Comments on potential, Poisson's equation and Laplace's equation, The potential of a localized charge distribution, Electrostatic boundary conditions – Work and energy in electrostatics, The work done in moving a charge, The energy of point charge distribution, The Energy of a continuous charge distribution, Comments on Electrostatic energy – Conductors, Basic properties of conductors, Induced charges, The Surface charge on a conductor, The force on surface charge, Capacitors. (Sections 2.1 to 2.5 of Introduction to Electrodynamics by David J Griffiths) 2. Special Techniques for Calculating Potentials Laplace's equation in One Dimension, Two Dimensions and Three Dimensions, Uniqueness theorems - Method of images, The classic image problem, induced surface charge, force and energy. (Sections 3.1 to 3.2.3 of Introduction to Electrodynamics by David J Griffiths)	CLO1
UNIT-II 12 hours	3 . Electric fields in matter Polarization – Dielectrics, Induced dipoles, Alignment of polar molecules, Polarization – The field of a polarized object , Bound charges, Physical interpretation of bound charges, The field inside a dielectric – The electric displacement – Gauss's law in presence of 13 dielectrics, Boundary conditions for D – Linear dielectrics, Susceptibility, Permittivity, Dielectric constant, Energy in dielectric systems, Forces on dielectrics, Polarizability and susceptibility. (Sections 4.1 to 4.4.1, 4.4.3, 4.4.4 of Introduction to Electrodynamics by David J Griffiths)	CLO2
UNIT-III 10 hours	4 . Magnetostatics The Lorentz force law – Magnetic fields, Magnetic forces, cyclotron motion, cycloid motion, Currents, Linear, Surface and Volume current	CLO3

	density – Biot -Savart law, The magnetic field of steady current – Divergence and curl of B, Straight line currents, Applications of Ampere's law, Magnetic field of a toroidal coil, Comparison of magnetostatics and electrostatics – Magnetic vector potential , Vector potential, Magnetostatic boundary conditions. (Sections 5.1 to 5.4.2 of Introduction to Electrodynamics by David J Griffiths)	
UNIT-IV 10 hours	5. Magnetostatic fields in matter Magnetisation – Diamagnets, Paramagnets and Ferromagnets, Torques and forces on magnetic dipoles, Effect of a magnetic field on atomic orbits, Magnetization – Field of a magnetised object, Bound Currents, Physical interpretation, Magnetic field inside matter – Auxiliary field H, Ampere's law in magnetised materials, Boundary conditions – Linear and nonlinear media, Magnetic susceptibility and permeability, Ferromagnetism. (Sections 6.1 to 6.4 of Introduction to Electrodynamics by David J Griffiths)	CLO4

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Textbook for study

Introduction to Electrodynamics by David J Griffiths, 3rd Ed.

Books for reference

1. Electricity and magnetism by Arthur F Kip
2. Physics Vol. II by Resnick and Halliday

Course Title Physics Practical-I

Course Code: BSE.170

L	T	P	Cr
0	0	2	1

Contents

1.Deflection magnetometer-TAN A, Tan B positions

2. Deflection magnetometer -Tan C Position-moment of moments

3. Searle's vibration magnetometer-moment & ratio of moments

4. Box type vibration magnetometer-m & Bh

5. Melde's string arrangement-Frequency, relative density of solid (both modes)

6. Mirror galvanometer-figure of merit

CHEMISTRY (MINOR)

Course Title: Inorganic Chemistry-II (Chemistry of S, P, D & F Block Elements)

Course Code: BSE.171

L	T	P	Cr
3	0	0	3

Course Learning Outcomes:

At the end of the course the prospective teacher-trainees will be able to;

CLO1 To develop understanding for the concepts of periodic table.

CLO2 To develop understanding of periodic properties and their variation in groups and periods.

CLO3 To enrich their factual knowledge of chemistry related to inorganic compounds.

Units/Hours	Contents	Mapping with Course Learning Outcome
UNIT-I 11hours	a..Periodicity of Elements: Introduction of s, p, d, f block elements, the long form of periodic table.Detailed discussion of periodic properties of the elements b.Comparative Study of s and p Block Elements: IA-VII A and Zero Groups: General remarks about each group, trends in electronic configuration, structure of elements, atomic and ionic, Radii, ionization potential, electron affinity, electronegativity, oxidation states, inert pair effect, catenation and heterocatenation, first and second row amomalies, the use of d orbitals by non-metals, the use of p orbitals in bonding. Important classes of Compounds of s and p block.	CLO1 CLO3
UNIT-II 11hours	a.Alkali Metals: Oxides, hydroxides, peroxides and super oxides, halides, hydrides, solutions of metals in liquid ammonia, complexes crowns and cryptands and podands. b.Alkaline Earth Metals: Solutions of the metals in liquid ammonia, hydroxides, oxides, sulfates, hydrides, halides, carbides, structures of calcium carbide, structures of basic beryllium acetate Be4O(CH3COO)6, beryllium oxalate complexes Be(OX)2. Structure of chlorophyll `a'.	CLO2 CLO3
UNIT-III	a.Group III (Boron Group): Oxides, halides and hydrides of group	

11hours	III elements, boron sesquioxide and borates structure of borates, trihalides and lower halides of boron, preparation of boron hydrides reactions and structures of boranes. (b) Group IV (Carbon Group): Structure and allotropy of the elements, types and structure of carbides, oxides of carbon and silicon, types and structures of silicates, Organo-silicon compounds and the silicones, halides of IV group elements. b.Group V (Nitrogen Group): Hydrides, properties and structure of ammonia, hydrazine, hydroxylamine, trihalides and Pentahalides of V groups elements, oxides of nitrogen, structure of N2O, NO, N2O3, N2O4 and N2O5, oxo acids of nitrogen and phosphorous, phosphazenes and cyclophosphazenes	CLO2 CLO3
UNIT-IV 12 hours	a.Group VI (Oxygen Group): Structure and allotropy of the elements. Oxides of sulfur (structure of SO2 and SO3) oxoacids of sulfur halides of sulfur, selenium and tellurium, compounds of Sulfur and nitrogen (S4N4). b.Group VII: Oxides of halogens (OF2, O2F2, Cl2O, ClO2, Cl2O6, BrO2, I2O5) (structures), Preparation, reaction and structure interhalogen compounds. (ClF3, BrF3, I2, Cl5, IF5, IF7) Polyhalides, basic properties of halogens. c.Zero Group: Clatharate compounds, preparation, structure and bonding of noble gas compounds (XeF2, XeF4, XeF6, XeO3, XeO2F2, XeO4).	CLO 2 CLO3

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Suggested Readings

- J.D. Lee, Concise Inorganic Chemistry, 4th Ed.
- J.E. Huheey, Inorganic Chemistry, Harper & Row.
- F.A. Cotton and G. Wilinson, Advanced Inorganic Chemistry, Interscience Publishers.
- N.N. Greenwood and A. Earnshaw, Chemistry of Elements, Pergamon Press.
- Cotton, F.A., Wilkinson, G., Gaus, P.L., Basic Inorganic Chemistry; 2nd edition, Pubs: John Wiley and Sons, 1995.
- Lee, J.D., Concise Inorganic Chemistry; 4th edition, Pubs: Chapman & Hall Ltd., 1991.
- Shriver, D.E., Atkins, P.W., Inorganic Chemistry; 4th edition, Pubs: Oxford University Press, 2006.
- Douglas, B., Medaniel, D., Atenander, J., Concepts and Models of Inorganic Chemistry, 3rd edition, Pubs: John Wiley and Sons Inc., 1994,
- Porterfeild, W.W., Wesky, A., Inorganic Chemistry; Pubs: Addison-Wesky Publishing

Company, 1984.
- Miessler, G.L., Tarr, D.A., Inorganic Chemistry; 3rd edition, Pubs: Pearson Education Inc. 2004,
- Jolly, W.L., Modern Inorganic Chemistry; 2nd edition, Pubs: Tata McGraw-Hill Publishing Company Limited, 1991.
- Purcell, K.F., Kotz, J.C., Inorganic Chemistry; Pubs: W.B.Saunders Company, 1977.
- Puri, B.R., Sharma, L.R., Kalia, K.K., Principles of Inorganic Chemistry; 30th edition, Pubs: Milestones Publisher, 2006-07.
- Inorganic Chemistry, W.W. Porterfield Addison-Wesley.
- Inorganic Chemistry, A.G. Sharpe, ELBS.

Course Title: Inorganic Chemistry-II (Practical-I: Qualitative Analysis)

Course Code: BSE.172

L	T	P	Cr
0	0	2	1

Course Learning Outcomes:

At the end of the course the prospective teacher-trainees will be able to;

CLO1 provide a positive, enjoyable learning experience, soundly based on scientific principles and practice

CLO2 foster good laboratory practice and develop technical skills relevant to qualitative analysis

CLO3 provide an environment which encourage an inquiring, investigate approach, developing competence and confidence

Course Content

Units/Hours	Content	Mapping with the Course Content
30 hours	• Supplement and reinforce chemical principles taught in the theory units • Special Tests for Mixture of Anions (do any 8) • Carbonate in the presence of sulphate. • Nitrate in the presence of nitrite • Nitrate in the presence of bromide and iodide. • Nitrate in the presence of chlorate. • Chloride in the presence of bromide and iodide. • Chloride in the presence of bromide. • Chloride in the presence of iodide. • Bromide and iodide in the presence of each other and of chloride. • Iodate and iodide in the presence of each other. • Phosphate, arsenate and arsenite in the presence of each other. • Sulphide, sulphite, thiosulphate and sulphate in the presence of each other.	CLO1 CLO2 CLO 3

	• Borate in the presence of copper and barium salts. • Oxalate in the presence of fluoride. • Oxalate, tartrate, acetate, citrate in the presence of each other. • Separation and Identification of Cations in Mixtures • Separation of cations in groups. • Separation and identification of Group I, Grou p II (Group IIA and IIB), Group III, Group IV, Group V and Group VI cations. • Identification of Cations including Less Familiar Elements by Spot Tests Assisted by Group Analysis (3 cations).	

Suggested Readings

- Vogel's book on Inorganic Qualitative Analysis
- Experimental Organic Chemistry, Vol. I & II, P.R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.
- Laboratory Manual in Organic Chemistry, R.K. Bansal, Wiley Eastern.
- Vogel's Textbook of Practical Organic Chemistry, B.S. Furniss, A.J. Hannaford, V. Rogers, P.W.G. Smith and A.R. Tatchell, ELBS.
- Experiments in General Chemistry, C.N.R. Rao and U.C. Aggarwal, East-West Press.
- Experiments in Physical Chemistry, R.C. Das and B. Behra, Tata McGraw Hill

MATHEMATICS (MINOR)

Course Title: Differential Equations

L	T	P	Cr
4	0	0	4

Course Code: BSE.173

Course Learning Outcomes:

At the end of the course the prospective teacher-trainees will be able to;

CLO1 understand Order and degree of differential equation, Linear and non-linear differential equations.
CLO2 solve problems on applications of differential equations of first order and first degree.
CLO3 solve Differential equations of first order and higher degree solvable for x, y and p.
CLO4 apply Linear differential equations with constant coefficients, Methods of variation of parameters.

Units/Hours	Contents	Mapping with CLOs
UNIT-I	Order and degree of differential equation, Linear and non-linear differential equations, Formation of differential equation, Existence and uniqueness theorem, Differential equations of first order and first degree: separation of variables, homogeneous differential equations,	CLO1

	Pfaffian differential equation.	
UNIT-II	Exact differential equations, Linear differential equations, Geometric meaning of a differential equation of first order and first degree, Applications of differential equations of first order and first degree, Orthogonal trajectories.	CLO2
UNIT-III	Differential equations of first order and higher degree solvable for x, y and p, Clairaut's forms and singular solutions, Extraneous loci.	CLO3
UNIT-IV	Linear differential equations with constant coefficients, Methods of variation of parameters, Homogeneous linear differential equations, Simultaneous differential equations.	CLO4

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Suggested Readings:

- D.A. Murray: Introductory Course in Differential Equations. Orient Longman (India), 1967.
- G.F. Simmons: Differential Equations, Tata McGraw Hill, 1972.
- E.A. Codington: An Introduction to Ordinary Differential Equations, Prentice Hall of India, 1961.
- Tom M. Apostol: Calculus: An Indian Adaptation, Wiley India, 2023
- Erwin Kreyszig: Advanced Engineering Mathematics, John Wiley and Sons, 1999. 52
- Narayan, S. and P.K. Mittal: Integral Calculus. Sultan Chand & Sons.
- Narayan S. and P.K. Mittal: Differential Calculus, Sultan Chand & Sons.

BOTANY (MINOR)

Course Title: Plant Systematics

Course Code: BSE.174

L	T	P	Cr
3	0	0	3

Course Learning Outcomes:

At the end of the course the prospective teacher-trainees will be able to;

CLO1: understand tissue, classification of tissues

CLO2: analyze endodermis, exodermis and origin of lateral root. vascular cambial Structure

CLO3: explain wood: types of rays and axial parenchyma; cyclic aspects and reaction wood

CLO4: reflect on adaptive and protective systems: epidermal tissue system

Units/Hours	Contents	Mapping with CLOs
Unit-I 07 hrs	Plant identification, classification, nomenclature, biosystematics, field inventory; herbarium techniques; functions of herbarium; important herbaria and botanical gardens of the world and India; virtual herbarium; E-flora: flora, monographs, journals; keys: single access and multi-access.	CLO1
Unit-II 10 hrs	Systematics-an interdisciplinary science, evidence from palynology, cytology, phytochemistry [alkaloids, phenolics, glucosides, terpenes and semantides (in brief)] and molecular data (cp.DNA, mt-DNA, nuclear DNA, PCR amplification, sequence data analysis), taxonomic hierarchy: concept of taxa (family, genus, species); categories and taxonomic hierarchy; species concept (taxonomic, biological, evolutionary)	CLO2
Unit-III 15 hrs	Botanical nomenclature: principles and rules (ICN); ranks and names; typification, author citation, valid publication, rejection of names, principle of priority and its limitations; names of hybrids and cultivated plants. system of classification: major contributions of Theophrastus, Bauhin, Tournefort, Linnaeus, Adanson, de Candolle, Bessey, Hutchinson, Takhtajan and Cronquist; Classification systems of Benthan and Hooker (up to series) and Engler and Prantl (up to series); Brief references of Angiosperm Phylogeny Group (APG IV) classification.	CLO3
Unit-IV 13 hrs	Biometrics and numerical taxonomy: characters; variations; OTUs, character weighing and coding; cluster analysis; phenograms phylogeny of angiosperms: Terms and concepts (primitive and advanced, homology and analogy, parallelism and convergence, monophyly, paraphyly, polyphyly and clades). Origin and evolution of angiosperms; cladistics; methods of illustrating evolutionary relationships (phylogenetic tree, cladogram)	CLO4

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Suggested Readings:

1. Reven, F.H., Evert, R. F., Eichhorn, S.E. (1992). Biology of Plants. New York, NY: W.H. Freeman and Company.
2. Singh, G. (2012). Plant Systematics: Theory and Practice, 3rd edition. New Delhi, Delhi: Oxform and IBH Pvt. Ltd.

Course Title: Plant Systematics (Practical-II)

L	T	P	Cr
0	0	2	1

Course Code: BSE.175

Contents:

Study of vegetative and floral characters of angiosperms families (Description, V.S. flower, section of ovary, floral diagram/s, floral formula/e and systematic position) as per availability of seasonal flowering plants.

1. Represented families:

- Ranunculaceae- Ranunculus, Delphinium
- Brassicaceae- Brassica, Alyssum/ Iberis
- Myrtaceae- Eucalyptus, Callistemon
- Umbelliferae-Coriandrum/ Anethum/ Foeniculum
- Asteraceae- Sonchus/ Launaea, Veronia/ Ageratum, Elipta/ Tridax S
- Olanaceae- Solanum nigrum/ Withania
- Lamiaceae- Salvia/Ocimum
- Euphorbiaceae-Euphorbia hirta/ E.milli, Jatropha
- Liliaceae- Asphodelus/ Lilium/ Allium
  Poaceae- Triticum/ Hordeum/ Avena
- Malvaceae-Abutilon/ Hibiscus/ sida
- Caryophyllaceae-Stellaria/ Dianthus
- Apocyanaceae- Vinca rosea
- Asclepediaceae- Calotropis procera
- Moraceae- Morus alba Chenopodiaceae- Chenopodium alba
- Cannaceae- Canna indica

2. Field visit (local)- Subject to grant funds from the University

3. Mounting of a properly dried and pressed specimen of any wild plant with herbarium label (to be submitted in the record book).

ZOOLOGY (MINOR)

Course Title: Biology of Chordates

L	T	P	Cr
3	0	0	3

Course Code: BSE.176

Course Learning Outcomes (CLO)

At the end of the course the prospective teacher-trainees will be able to;

CLO1: Demonstrate comprehensive identification abilities of chordate diversity

CLO2: Explain structural and functional diversity of chordates

CLO3: Analyze evolutionary relationship amongst chordates.

CLO4: Elaborate the digestive, nervous and circulatory system of aves and mammilia.

Course Content

Units/Hours	Contents	Mapping with CLOs
UNIT I 12 hours	• An outline classification of chordates up to orders but up to sub classes only in case of protochordate groups and mammals. • Comparative anatomy of vertebrates from an evolutionary point of view of the following: - • Integument including structure and development of placoid scales, feathers and hair. • Heart and aorticarches. • Kidney and associated urogenital ducts	CLO1
Unit- II 10 hours	• Habit and habitat, structure, reproduction (excluding development) and affinities to following types: - • Hemichordate: Banlanoglossus • Urocohordata: Herdmania, ascidian tadpole larva and its metamorphosis. • Cephalochordata: Amphioxus	CLO2
Unit-III 12 hours	• Habit, habitat, structure (morphology, digestive system, respiratory system, blood vascular system, urogenital system nervous system (central and peripheral) of the following types: - • Agnatha: Petromyzon (including its affinities) • Pisces: Scoliodon (including sense organs) • Scales and fins of fishes.	CLO3
Unit- IV 11 hours	• Habit, habitat, structure (morphology, digestive system, respiratory system, blood vascular system, nervous system (central and peripheral) and urogenital system of the following types:- • Amphibia • Reptilia • Habit, habitat, structure, morphology, digestive system, respiratory system, blood vascular system, system nervous system (central and peripheral) and urogenital system of the following types: - • Aves: Columba • Mammalia: Rabbit.	CLO4

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Suggested Readings:

1. Harvey et al (2006). The Vertebrate Life.

2. Colbert et al (2002). Colbert's Evolution of the Vertebrates: A history of the backboned animals through time (5th ed,Wiley - Liss)

3. Hildebrand (1995). Analysis of Vertebrate Structure (4th edition, 1995, John Wiley)

4. Kenneth V. Kardong (2015). Vertebrates: Comparative Anatomy, Function, Evolution McGrawHill

5. McFarland et al. (1979). Vertebrate Life (Macmillan Publishing)

6. Parker and Haswell (1978). Textbook of Zoology, Vol. II (ELBS)

7. Romer and Parsons (1986). The Vertebrate Body (6th edition, CBS Publishing Japan)

8. Young (2006). The Life of vertebrates (3rd edition, ELBS/Oxford)

9. Weichert C.K and William Presch (1980). Elements of Chordate Anatomy, Tata McGraw Hills.

Course Title: Biology of Chordates (Practical-I)

Course Code: BSE.177

L	T	P	Credit
0	0	2	1

Course Learning Outcomes (CLO)

At the end of the course the prospective teacher-trainees will be able to;

CLO1: Develop the skills of staining and mounting of materials (temporary and permanent) and of dissection, display and labeling.

CLO2: Acquire the skills of collection, preservation, mounting, identification and labeling of specimens.

Course Content

1. Study of Museum specimen with respect to levels and patterns of organization, biosystematics, biodiversity, adaptations, development stages, population dynamics, ecological implication sets.

a) Hemichordata: Balanoglossus.

b) Urochordata : Herdmania,Pyrosoma

c) Cephalochordata : Petromyzon,Myxine

d) Cyclostomata : Petromyzon, Myxine

e) Pisces:Scoliodon,Sphyrna,Torpedo,Pristis,Trygon Lepidosteus,Clarias, Ophiocephalus, Anabas. Exocoetus, Hippocampus, Tetradon, Protopterus

f) Amphibia: Icthyophis, Necturus, Proteus, Ambystoma, Axolotl larva, Triturus. Amphiuma, Alytes Bufo.

g) Reptilia : Testudo, Trionyx, Sphenodon , Hemidactylus, Draco, Calotes, Chamaeleon, Varanus, Heloderma, Typhlops , Eryx, Hydrophis, Viper , Bungarus , Naja Alligator,

h) Aves: Pavo, Columba, Psitacula, Passer, Corvus, Archaeopteryx.

i) Mammals: Ornithorhynchus, Echidna, Macropus, Loris, Manis, Rattus.

2. Study of Permanent Sildes:

a) Balanoglossus: T.S. of proboscis , collgar region and trunk

b) Amphioxus: T.S. or oral hood, pharynx.

c) Mammals: T.S., skin Stomach, Duodenum, IIeum, liver, Pancreas, spleen lung, kindney Testis, Ovary.

3. Osteology:

a) Study of skull bone of Frog, Varanus, Bird and Rabbits.

b) Study of vertebral of Frog. Varanus, Bird and Rabbit.

c) Stud of girdles, forelimb and hind limb bones of Frog, Varanus, Bird and Rabbit.

4. Dissections and/or its demonstration through Charts/ Models/Video/CD/digital alternatives etc and/or preparation of working models of the different system of the following animals.

a) Scoliodon: Afferent brachial systems, efferent branchial system, cranial nerves and internalear.

b) Frog : Anatomy, digestive, system , Urino-genital system

5. Permanent /Temporary preparation of the following-:

a) Scales: Placoid, Cycloid

b) Blood film of any vertebrate

c) Filoplumes of birds

d) Thigh muscles of frog

6. Estimation of Hemoglobin.

7. Enumeration of RBC in blood samples.

8. Enumeration of WBC in blood samples.

9. Preparation of Haemin Crystals.

10. Effect of different concentrations of NaCI on RBC.

11. Measurement of blood pressure, Heart beat and Pulse rate.

12. Study of bleeding time, Coagulation time of blood.

13. Study of Histological slides of the following endocrine gland of mammal testis, ovary, thyroid, adrenal, pituitary, Islets of Langerhans.

(Language 2)
English

Course Title: Communicative English
Course Code: BSE.178
Course Learning Outcomes:
At the end of the course the prospective teacher-trainees will be able to;

L	T	P	Cr
4	0	0	4

CLO1 To define the basics of language to develop listening, speaking, reading and writing skills.
CLO2 To apply the combination of language and cognition for effective communication skills.
CLO3 To improve pronunciation of individual sounds and sound combinations and write sentences with clarity and grammatically correct.
CLO4 To demonstrate the ability to interpret texts and explain their understanding in both verbal and written communication.

Units/Hours	Contents	Mapping with CLOs
Unit 1 **15 hours**	**Understanding Language** Language: Definitions, principles and functions, Language, culture and society, language variation, language and dialect, language policy and language planning, language standardization; Multilingualism in Indian context, Language skills (listening, speaking, reading, & writing) and the new-age technologies. ***Learning Activities:*** *Task-Based Learning, Flow Chart, Quizzes.*	**CLO1**
Unit 2 **15 hours**	**Language and Communication and Cognition** Communication: nature, types and process, barriers to communication, story of human communication from early times to new age. Language as a means of communication and language as a medium of cognition. The 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. ***Learning Activities:*** *Role Play, Key Words Arrangement, Word Bank.*	**CLO2**
Unit 3 **15 hours**	**Understanding Speech Sound and Grammar** Classification of speech sounds, identification of morphemes, word formation processes, Sentence formation, vocabulary formation and stress, pitch, tone, intonation and juncture. Parts of speech, sentences-simple, complex, and compound, semantics and pragmatics, lexical semantics, Coining new words, speech acts. ***Learning Activities: -*** *Timeline Activity, Teams Race, Story Writing, Jumbled Words.*	**CLO3**
Unit 4 **15 hours**	**Reading Writing and Speaking Skills** 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. Writing and Speaking Skills Speech versus writing; Types of writing; writing for specific purposes (essays, letters, and	**CLO4**

Unit/Hours	Content	Mapping with CLOs
	reports). Dealing with New Words (Academic Vocabulary Building) Speaking to learn and learning to speak; situational conversations and role plays; tasks/activities for developing speaking (speech, elocution, discussion, debate, storytelling, illustrations). Presentation and speaking skills; Practicing narrative skills; Body language, voice, and pronunciation; Creating interest and establishing a relationship with the audience. ***Learning Activities:*** *Simulation, Group Writing, Group Presentation.*	

Suggestive Mode of Transaction

The course content transaction will include the following:
Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, focus group discussion, surveys, short term project work, etc.

Recommended Books:

- Anderson, M. (2010). *Critical thinking, academic writing and presentation skills*. Pearson.
- Bansal, R. K. (2024). *Spoken English: A manual of speech and phonetics*. Orient Blackswan.
- Chaturvedi, P. D., & Chaturvedi, M. (2011). *Communication skills*. Pearson Education.
- Sethi, J., & Dhamija, P. V. (1999). *A course in phonetics and spoken English (2th ed).* PHI Learning.
- Sinha, R. P. (2001). *Current English grammar and usage with composition*. Oxford University Press.
- Taylor, G. (2001). *English conversation practice*. McGraw-Hill.
- Thakur, K. P. (2018). *A practical guide to English grammar*. Bharati Bhawan.
- Wood, F. T. (2013). *A remedial English grammar for foreign students*. Macmillan.
- Wren, P. C., & Martin, H. (2023). *High school English grammar and composition*. S Chand Publishing.

(Language 2)
Punjabi

L	T	P	Credits
4	0	0	4

Course Title: ਪੰਜਾਬੀ ਭਾਸ਼ਾ, ਵਿਹਾਰਕ ਵਿਆਕਰਣ ਅਤੇ ਸਭਿਆਚਾਰ

Course Code: BSE.179

Course Learning Outcomes:

ਇਸ ਕੋਰਸ ਨੂੰ ਪੂਰਾ ਕਰਨ ਉਪਰੰਤ ਵਿਦਿਆਰਥੀ:

CLO1: ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਦੀ ਬਣਤਰ ਅਤੇ ਵਿਕਾਸ ਪ੍ਰਕਿਰਿਆ ਉਲੀਕ ਸਕਣਗੇ।

CLO 2: ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਅਤੇ ਵਿਆਕਰਨ ਦੇ ਬੁਨਿਆਦੀ ਸੰਕਲਪਾਂ ਤੋਂ ਜਾਣੂ ਹੋਣਗੇ।

CLO 3: ਪੰਜਾਬੀ ਸਭਿਆਚਾਰ ਅਤੇ ਲੋਕਧਾਰਾ ਦੇ ਬੁਨਿਆਦੀ ਪੱਖਾਂ ਤੋਂ ਜਾਣੂ ਹੋਣਗੇ।

CLO4: ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਦੇ ਵਿਆਕਰਨ ਦੀ ਵਰਤੋਂ ਵਿਹਾਰਕ ਹੁਨਰ ਵਿੱਚ ਕਰਣਗੇ

ਯੂਨਿਟ – 1 **14 ਘੰਟੇ**	**ਭਾਸ਼ਾ ਦੀ ਪਰਿਭਾਸ਼ਾ ਅਤੇ** ਪ੍ਰਕ੍ਰਿਤੀ • **ਧੁਨੀਆਂ, ਅੱਖਰ ਅਤੇ ਵਿਆਕਰਨ** • ਪੰਜਾਬੀ **ਧੁਨੀਆਂ ਦਾ ਵਰਗੀਕਰਨ (ਸਵਰ ਅਤੇ ਵਿਅੰਜਨ)**	**CLO 1** **CLO 2**
ਯੂਨਿਟ – **2** **16** ਘੰਟੇ	ਸ਼ਬਦ **ਦੀ** ਪਰਿਭਾਸ਼ਾ ਅਤੇ ਕਿਸਮਾਂ **(**ਰਚਨਾ ਅਤੇ ਸਰੋਤ ਦੇ ਆਧਾਰ 'ਤੇ**)** • ਵਾਕਾਂ ਦੀ ਪਰਿਭਾਸ਼ਾ ਅਤੇ ਕਿਸਮਾਂ **(**ਬਣਤਰ ਦੇ ਆਧਾਰ 'ਤੇ**)** ਸ਼ਬਦਾਂ ਦੀਆਂ ਵਿਆਕਰਨਿਕ ਸ਼੍ਰੇਣੀਆਂ **(**ਨਾਂਵ, ਪੜਨਾਂਵ, ਵਿਸ਼ੇਸ਼ਣ, ਕਿਰਿਆ**)** • ਸ਼ਬਦ ਬਣਤਰ **(**ਸੰਯੋਜਕ, ਮਿਸ਼ਰਿਤ, ਅਗੇਤਰ, ਪਿਛੇਤਰ**)** • ਕਹਾਵਤਾਂ ਅਤੇ ਮੁਹਾਵਰੇ	**CLO 1** **CLO 2**
ਯੂਨਿਟ – 3 **16 ਘੰਟੇ**	ਪੰਜਾਬੀ ਸਭਿਆਚਾਰ ਮੁੱਢਲੀ ਜਾਣਕਾਰੀ**:** ਡਾ. ਜਸਵਿੰਦਰ ਸਿੰਘ ਲੋਕਧਾਰਾ ਅਤੇ ਸਾਹਿਤ**:** ਵਣਜਾਰਾ ਬੇਦੀ ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਦੀ ਬਣਤਰ**:** ਡਾ. ਬਲਦੇਵ ਸਿੰਘ ਚੀਮਾ	**CLO 1** **CLO 3**
ਯੂਨਿਟ – 4 **14 ਘੰਟੇ**	ਅਸ਼ੁੱਧਤਾ ਸੁਧਾਈ **(**ਸ਼ਬਦਾਂ ਅਤੇ ਵਾਕਾਂ ਦੇ ਪੱਧਰ 'ਤੇ**)** • ਪੱਤਰ ਲਿਖਣਾ **(**ਰਸਮੀ ਅਤੇ ਗੈਰ ਰਸਮੀ**)**	**CLO 4**

ਸਹਾਇਕ ਪੁਸਤਕ ਸੂਚੀ

9. ਬਰਾੜ, ਬੂਟਾ ਸਿੰਘ. ***ਪੰਜਾਬੀ ਵਿਆਕਰਣ: ਸਿਧਾਂਤ ਤੇ ਵਿਹਾਰ.*** **ਚੇਤਨਾ ਪ੍ਰਕਾਸ਼ਨ, ਲੁਧਿਆਣਾ, 2008.**

10. ਪੁਆਰ, ਜੋਗਿੰਦਰ ਸਿੰਘ ਅਤੇ ਹੋਰ. ***ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਦਾ ਵਿਆਕਰਨ: ਭਾਗ I.*** **1992. ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਅਕਾਦਮੀ, ਜਲੰਧਰ, 2016.**

11. ਹਰਕੀਰਤ ਸਿੰਘ ਅਤੇ ਉੱਜਲ ਸਿੰਘ ਬਾਹਰੀ, *ਭਾਸ਼ਾ ਵਿਗਿਆਨ ਅਤੇ ਪੰਜਾਬੀ ਭਾਸ਼ਾ*, ਬਾਹਰੀ ਪਬਲਿਸ਼ਰਜ਼, ਦਿੱਲੀ, **1973.**

12. ਕਸੇਲ, ਕਿਰਪਾਲ ਸਿੰਘ ਅਤੇ ਪਰਮਿੰਦਰ ਸਿੰਘ, ***ਪੰਜਾਬੀ ਸਾਹਿਤ ਦੀ ਉਤਪਤੀ ਤੇ ਵਿਕਾਸ,*** **15ਵਾਂ ਸੋਧਿਆ ਐਡੀਸ਼ਨ, ਲਾਹੌਰ ਬੁਕ ਸ਼ਾਪ, ਲੁਧਿਆਣਾ, 2013.**

13. ਖਹਿਰਾ, ਭੁਪਿੰਦਰ ਸਿੰਘ, *ਲੋਕਯਾਨ, ਭਾਸ਼ਾ ਅਤੇ ਸਭਿਆਚਾਰ*, ਪੈਪਸੂ ਬੁੱਕ ਡਿਪੂ, ਪਟਿਆਲਾ

14. ਗਿੱਲ, ਹਰਜੀਤ ਸਿੰਘ, ***ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਅਤੇ ਸਭਿਆਚਾਰ ਦਾ ਵਿਸ਼ਵਕੋਸ਼,*** **ਪੰਜਾਬੀ ਯੂਨੀਵਰਸਿਟੀ, ਪਟਿਆਲਾ.**

15. ਬਰਾੜ, ਬੂਟਾ ਸਿੰਘ, *ਪੰਜਾਬੀ ਭਾਸ਼ਾ: ਸ੍ਰੋਤ ਤੇ ਸਰੂਪ*, ਵਾਰਿਸ ਸ਼ਾਹ ਫਾਊਂਡੇਸ਼ਨ, ਅੰਮ੍ਰਿਤਸਰ, **2004.**

16. ਰੰਧਾਵਾ, ਮਹਿੰਦਰ ਸਿੰਘ, ***ਪੰਜਾਬ,*** **ਭਾਸ਼ਾ ਵਿਭਾਗ, ਪਟਿਆਲਾ, 1960.**

Hindi (Language 2)

Course Title: हिंदी भाषा का व्यावहारिक व्याकरण एवं लेखन

Course Code: BSE.180

L	T	P	Cr
4	0	0	4

पाठ्यक्रम अधिगम परिणाम(CLO):

इस पाठ्यक्रम को पढ़ने के उपरांत विद्यार्थी -

CLO-1 **हिंदी भाषा के ध्वनि और वर्ण के मूल नियमों का विश्लेषण करेंगे**

CLO-2 **हिंदी भाषा के शब्द भंडार एवं वाक्य-संरचना का तुलनात्मक मूल्यांकन करेंगे**

CLO-3 **हिंदी भाषा की शब्द निर्माण प्रक्रिया एवं व्याकरणिक कोटियों का विश्लेषण करेंगे**

CLO-4 **हिंदी भाषा के व्याकरण का व्यावहारिक कौशल में प्रयोग करेंगे**

Unit/Hours	Content	Mapping with CLOs
UNIT I Hours: 15	• भाषा की परिभाषा एवं प्रकृति • ध्वनि, वर्ण और व्याकरण • हिंदी की ध्वनियों का वर्गीकरण (स्वर और व्यंजन) अभ्यास : भाषा की परिभाषा , भाषा के ध्वनि एवं वर्ण के मूल नियमों का विश्लेषण करेंगे।	CLO-1
UNIT II Hours: 15	• शब्द की परिभाषा और भेद (रचना एवं स्रोत के आधार पर) • वाक्य की परिभाषा और भेद (संरचना के आधार पर) अभ्यास :शब्द की परिभाषा, उसकी उत्पत्ति एवं भेद का मूल्यांकन करेंगे।	CLO-2
UNIT III Hours: 15	• शब्दों की व्याकरणिक कोटियाँ (संज्ञा, सर्वनाम, विशेषण, क्रिया) • शब्द निर्माण (संधि, समास, उपसर्ग, प्रत्यय) • लोकोक्ति एवं मुहावरे अभ्यास : व्याकरणिक कोटियों का अध्ययन करेंगे।	CLO-3
UNIT IV Hours: 15	• अशुद्धि शोधन (शब्द एवं वाक्य के स्तर पर) • पत्र लेखन (औपचारिक एवं अनौपचारिक) अभ्यास : संधि, समास, उपसर्ग एवं प्रत्यय से परिचिति होंगे।	CLO-4

Transaction Mode: Lecture; Viedo, Recitation, PPT, Group Discussion; Seminar, Self-learning, Text book analysis

अध्ययन के लिए पुस्तकें

- **किशोरीदास वाजपेयी: हिंदी व्याकरण, लोक भारती प्रकाशन, इलाहाबाद**.2012
- **कामता प्रसाद गुरु: हिंदी व्याकरण, नयी किताब प्रकाशन, नयी दिल्ली**. 2019
- **वासुदेवनंदन: आधुनिक हिंदी व्याकरण और रचना, भारती भवन पब्लिशिर्स एंड वितरक, पटना**, 2014

Course Title: Teacher and Society

L	T	P	Cr
2	0	0	2

Course Code: BSE.181

Course Learning Outcomes:

At the end of the course the prospective teacher-trainees will be able to;

CLO1 Gain insight and reflect on concept of teacher education and professional teacher.
CLO2 comprehend different way of nurturing a teacher.
CLO3 Develop professional attitudes, values and interests needed to function as a teacher educator.
CLO4 Develop understanding of the role of values in teacher's professional development.
CLO5 Reflect on the historical development process of teacher education.
CLO6 Understand the role of ICT and role of different agencies in teacher education.

Unit/Hours	Contents	Mapping with CLOs
Unit-I 5 hours	Understanding the Teacher a. Teacher education; Concept and Objectives of teacher education at secondary level b. Exploring the professional Teacher: Qualifications,	CLO1 CLO2

	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	
Unit-II 5 hours	Nurturing the Teacher a. Teaching: One profession, many roles b. Teaching character: nurturing teacher for human flourishing c. Holistic teacher development: nurturing the Panchakoshas d. Teacher values, beliefs, and current philosophy of teaching: A reflective dialogue	CLO1 CLO2 CLO3
Unit-III 12 hours	Development of Teacher Education: a. Vedic Period, Buddhist Period, Muslim Period, British Period b. Teacher Education in Independent India: University Education Commission (1948-49), Secondary Education Commission (1952-53), Education Commission (1964-66), NPE-1986, NEP 2020	CLO5
Unit-IV 8 hours	Structure and Management of Teacher Education: a. Structure of teacher education at foundational, preparatory, middle and secondary stage, Role of NCTE and NCERT in teacher education. b. Role of teacher for social change, School, community and teacher: Linkages	CLO5 CLO6

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Sessional Work

- Visit to teacher education institutions and make a report on the actual implementation of defined objectives of teacher education at various levels of school education (primary, secondary and higher).
- Make a presentation on recommendations of various educational commissions (University Education Commission (1948-49), Secondary Education Commission (1952-53), Education Commission (1964-66) NEP:2020) for teacher education in India (Any two).

Suggested Readings:

- Balsare Maitraya (2005) Administration and Reorganization of teacher education. Kanishka Publishers, New Delhi India.
- Beck, Clive & Clark Kosnik Albany (2006): Innovations in Teacher Education: A Social

Constructivist approach. State University of York.
- Caggart, G.L. (2005): Promoting Reflective Thinking in Teachers. Crowin Press.
- Cohen Louis, Minion Lawrence & Morrison, Keith (2004).A Guide to Teaching Practice (5^{th} edition). Rout ledge Falmer. London and New York.
- Day, C. & J. Sachs, J. (Ed.) (2004): International Handbook on the Continuing Professional Development of Teachers. Maidenhead, Brinks Open University Press.
- Herne Steve, Jessel John & Griffith, Jenny (2000). Study to Teach: A Guide to Studying in Teacher Education. Rout ledge Falmer. London and NewYork.
- Irvine, J.J. (2003): Educating teachers for diversity: Seeing with a cultural eye. New York: Teachers College Press.
- Joyce, B., and Weal, M. (2003). Modals of Teaching (7th Ed.). Boston: Allyn & Bacon.

Course Title: Understanding India (Indian Ethos and Knowledge Systems)-II

L	T	P	Cr
2	0	0	2

Course Code: BSE.182

Course Learning Outcomes:

At the end of the course the prospective teacher-trainees will be able to;

CLO1: Interpret and conceive the concept of Indian Knowledge System (IKS) alongwith the concept of Panchakosha.

CLO2: Analyze investigate Philosophy, Ethics & Values of various schools of ancient Indian philosophy and their relevance in modern day India.

CLO3: Summarize, recapitulate and theorize Indian culture in context of its food and sports tradition

CLO4: Explore and Investigate Indian contribution to the World in the fields of arithmetic, logic and astronomy.

Units/ Hours	Contents	Mapping with CLOs
UNIT I 6 Hours	**Introduction to IKS (Indian Knowledge System):** Meaning, scope, objectives, vision, mission, related subjects. Concept of Panchakosha in Vedic literature.	**CLO1**
UNIT II 10 Hours	**Philosophy, Ethics & Values: Schools of Orthodox Philosophy:** Vaishesika, Nyaya, Samkhya, Yoga, Purva Mimansa and Vedanta or Uttara Mimansa- Educational Implications, and their relevance in today's time.	**CLO2**
UNIT III 8 Hours	**Food:** (regional cuisines, food and festival, vegetarianism, food and hospitality, and globalization). **Clothes:** (traditional Indian clothing, regional costumes, clothing status, globalization in clothing). **Sports** (traditional Indian sports, martial arts, sports and gender, sports & globalization).	**CLO3**
UNIT IV 6 Hours	**Arithmetic and logic:** Natural sciences: math, physics, metallurgy, and chemistry. Astronomy: India's contributions to the world. Indian notions of time and space.	**CLO4**

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion,

panel interactions, small theme-based seminars, cooperative teaching, and team teaching, focus group discussion, surveys, short term project work, etc.

Sessional Work:

- Make an assignment and draw a comparative and critical analysis of various schools of Indian Philosophy (Any three).
- Visit to a community and make a report on various food habits of different communities and its impact on other communities' cultures.
- Organize an awareness program on the topic of `Relevance of Yoga for modern day lifestyle' in the schools and make a report on this.

Suggested Readings:

- Aziz, K. K. (2007). Indian knowledge systems: A multidisciplinary approach. New Dawn Press.
- Chakrabarti, A. (2006). Indian Philosophy: An Introduction to Hindu and Buddhist Thought. Routledge.
- Chauhan, S. (2015). Indian Educational Philosophy and Its Relevance Today. Prentice Hall.
- Chaturvedi, B. K. (2009). The Indian knowledge system. National Publishing House.
- Kulkarni, P. (2010). Cosmos and Culture: India's Contributions to Astronomy. Kunal Books.
- Nanda, M. (2014). Ethics in Indian Philosophy (2nd ed.). Routledge.
- Singh, R. (2004). The Concept of Space and Time in Ancient Indian Thought. Rajkamal Prakashan
- Yadav, S. K. S. (2015). Science and technology in ancient India. Discovery Publishing House.

SEMESTER-III

Course Title: Child Development and Educational Psychology

Course Code: BSE.201

L	T	P	Credits
4	0	0	4

Course Learning Outcomes (CLOs)

At the end of the course the prospective teacher-trainees will be able to;

CLO1: Describe the concept, characteristics, and factors affecting growth and development
CLO2: Analyze the nature and significance of physical, cognitive, socio-emotional, and moral development of the child
CLO3: Interpret and apply the various mechanisms of the process of learning
CLO4: Apply various problem solving and learning strategies in real classroom settings
CLO5: Explain group dynamics and apply strategies to facilitate group learning

Units/ Hours	Contents	Mapping with CLOs
UNIT I 17 hours	Child Development A. Educational Psychology: Concept, meaning and scope. B. Growth and Development of the child: Meaning, and characteristics and difference C. Developmental Characteristics: Infancy, Early Childhood, Middle to Late Childhood and Adolescence stage D. Development across domains: Physical, cognitive, language, socio-emotional, and moral E. Factors affecting development. Learning Activities: Dialogue on different concepts, Discussion	CLO 1 CLO 2
UNIT II 15 hours	Developmental Process A. Piaget's theory of cognitive development and its educational implications. B. Individual differences: • Children with special needs including developmental disorders. • Tools and Techniques for Identifying Learner with different abilities. C. Teachers' role and strategies to address the needs of learners with different learning abilities Learning Activities: conduction and interpretation if results of diagnostic tools, case-study, seminar, group discussion	CLO 1 CLO 2
UNIT III 14 hours	Process of Learning A. Learning: Concept, characteristics, nature and significance. B. Theories of Learning: Behaviorist, Cognitivist, and Constructivist	CLO 3 CLO 4

	C. Problem Solving and Learning Strategies: Inquiry and problem-based learning, Steps and Strategies in problem solving, Factors hindering problem solving. Learning Activities: Group discussion, Individual presentation and preparation of report	
UNIT IV 14 hours	Motivation and Classroom Management A. Motivation: Conceptual clarity, nature, and significance • Intrinsic and Extrinsic Motivation • Strategies for enhancing Motivation B. Classroom management • Creating a positive learning environment • Managing behavioral problems C. Group dynamics: • Classroom as a social group • Characteristics of group • Strategies to facilitate group learning. Learning Activities: hand-on experiences of classroom management through the presentation of seminar	CLO 5

Transaction Mode

Lecture, Seminar, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning, Cooperative Learning and Role Play

Suggested Readings

- Attri, A.K. (2015). Psychology of development and learning. New Delhi: APH Publishing Corporation.
- Chauhan, S.S. (1978). Advanced educational psychology. New Delhi: Vikas Publishing House.
- Dash, M. (2009). Educational psychology. New Delhi: Deep & Deep publications.
- Jha, A.K. (2009). Constructivist epistemology and pedagogy- insight into teaching learning and knowing. Atlantic publishers & distributors.
- Mangal, S.K. (2014). Advanced educational psychology. Delhi: PHI Learning Limited. McGraw Hill, New York, 1990.
- Robinson, S. K. (2009). Foundation of educational psychology. Ane books Pvt. Ltd. Publication.

PHYSICS (MAJOR-I)

Course Title: Electrodynamics

L	T	P	Cr
4	0	0	4

Course Code: BSE.202

Course learning Outcomes;

At the end of the course the prospective teacher-trainees will be able to;

CLO1 comprehend the boundary value problems in electrodynamics.

CLO2 understand the covariant formulation of electrodynamics

CLO3 apply the relativistic transformation to electromagnetic fields and comprehend the advanced concepts of charge particle acceleration techniques.

CLO4 recognize the postulates of special theory of relativity, relativistic kinematics and dynamics.

Unit/Hours	Contents	Mapping with CLOs
UNIT-I **14 hours**	**REVIEW OF ELECTROSTSTICS AND MAGNETOSTATICS** Poisson and Laplace equations and formal solution for scalar potential, boundary value problems, multipole expansion, Dielectrics, polarization of a medium, Clausius-Mossotti Relation, Electrostatic energy in dielectrics and Maxwell stress tensor, Magnetic multipole expansion of vector potential, Magnetostatic energy densities and Magnetic stress tensor	**CLO1**
UNIT-II **14 hours**	**COVARIANT FORMULATION OF ELECTRODYNAMICS** Vector and Scalar potentials in electrodynamics, gauge invariance and gauge fixing, Coulomb and Lorenz gauges, The Electromagnetic field tensor and its transformation under Lorentz transformations: relation to known transformation properties of E and B, Covariant formulation of Maxwell's equations, Equation of motion of charged particle, Motion of charged particles in external electric and magnetic fields.	**CLO2**
UNIT-III **16 hours**	**ELECTROMAGNETIC RADIATIONS** Introduction to retarded potentials, Potentials due to a moving charge: Lienard Wiechert potentials, E and B due to a uniformly moving charge, E and B due to an accelerating charge particle, Larmor's formula and its relativistic generalization. **INTERATION OF MATTER WITH CHARGED PARTICLES** Radiation Bremsstrahlung and transition radiation, Thomson scattering, Synchrotron radiation and Undulator radiation, Coherent emission from multiple particles, Coherence and Form factor, Radiation from relativistic particle traveling through matter: Cherenkov radiations.	**CLO3**
UNIT-IV **16 hours**	**ELECTRODYNAMICS ANS SPECIAL THEORY OF RELATIVITY** Einstein's postulates, Geometry of relativity, The Lorentz transformations, The Structure of space time, Proper time and proper velocity, Relativistic energy and momentum, Relativistic kinematics, Relativistic dynamics, Relativistic Electrodynamics: Magnetism as a relativistic phenomenon, How the fields transform, The field tensor, Electrodynamics in tensor notation. Relativistic potentials, Lagrangian and Hamiltonian for a relativistic charged particle in external electromagnetic fields. Applications of electrodynamics in particle accelerators.	**CLO4**

Suggestive Mode of Transaction

The course content transaction will include the following:

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, selections from theoretical readings, flipped learning, blended learning, demonstration, laboratory method

Books for Study

1. Introduction to Electrodynamics, D.J. Griffiths, 2018, Fourth Edition, Pearson Education
2. Classical Electrodynamics, J D Jackson, Wiley; Third edition, 2003
3. Classical Electrodynamics, S P Puri, Narosa Publishing; 2011

Books for Reference

1. The Classical Theory of Fields, L.D Landau, E.M Lifshitz, 4th Edn., 2003, Elsevier
2. Classical Electricity and Magnetism, W. K. H. Panofsky and M. Philips, Dover Publication, 2nd Edn, 2012
3. Modern Problems in Classical Electrodynamics, Chales A Brau, OUP USA, 2003
4. Feynman Lectures, Vol. II, R.P.Feynman, R.B.Leighton, M.Sands, 2008, Pearson Education
5. X-Rays and Extreme Ultraviolet Radiation: Principles and Applications, David Attwood, Cambridge University Press; 2nd edition, 2017

PHYSICS (MAJOR-II)

Course Title: Fundamental of Optics and Laser

Course Code: BSE.203

L	T	P	Cr
4	0	0	4

Course Learning Outcomes;

At the end of the course the prospective teacher-trainees will be able to;

CLO1 understand and examine the wave characteristics of light and the phenomenon of interference and diffraction.
CLO2 comprehend the fundamental concept of polarisation and its applications.
CLO3 apply the principles of optics in the application of Lasers.
CLO4 apply the principles of optics in Fiber optics, Fourier optics and Holography

Unit/Hours	Contents	Mapping with CLOs
UNIT-I **16 hours**	**INTERFERENCE AND DIFFRACTION** Division of wavefront and division of amplitude, Young's Double Slit experiment, Lloyd's Mirror and Fresnel's Biprism, Phase change on reflection: Stokes' treatment, Interference in Thin Films: parallel and wedge-shaped films, Fringes of equal inclination (Haidinger Fringes), Fringes of equal thickness (Fizeau Fringes), Newton's Rings: measurement of wavelength and refractive index, Michelson's Interferometer. Fraunhofer diffraction: Single slit; Double Slit, Multiple slits & Diffraction grating, Dispersive power of diffraction grating, Fresnel Diffraction: Half-period zones, Zone plate, Fresnel Diffraction pattern of a straight edge, a slit and a wire using half-period zone analysis.	**CLO1**
UNIT-II **14 hours**	**POLARIZATION** Transverse nature of light waves, Unpolarized and plane polarized light, production of polarized light, Wire grid polarizer, Polaroid, Effect of intensity of light passing through Polaroid, Malus' law, double refraction, ordinary ray and extraordinary ray, positive and negative crystals, birefringence, Nicol Prism, quarter wave plate and half wave plate, Polarization by reflection (Brewster law), polarization by scattering, Circular and elliptical polarization, production of elliptically polarized and circularly polarized light.	**CLO2**

UNIT-III **14 hours**	**LASER** Introduction to laser, Spontaneous and stimulated emission of radiations, Thermal equilibrium, Condition for Light amplification, Population inversion, Pumping (Three level and four level pumping), Optical resonator, Laser beam characteristics, Ruby laser, Nd-YAG Laser, He-Ne Laser, Semiconductor Laser.	**CLO3**
UNIT-IV **16 hours**	**FIBER OPTICS, FOURIER OPTICS AND HOLLOGRAPHY** Light propagation in optical fibers, Optical fiber communication, Attenuation and dispersion; Pulse dispersion in multimode fibers; Single-mode fibers, material dispersion; Fiber amplifiers and lasers, Fiber optic sensors. Basics of Fourier transformation, definition of spatial frequency, FT by diffraction and by lens, Spatial filtering, Phase contrast microscope, some applications; Holographic principles, on-axis and off-axis hologram recording and reconstruction, Types of holograms, some applications.	**CLO4**

Suggestive Mode of Transaction

The course content transaction will include the following:

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, selections from theoretical readings, flipped learning, blended learning, demonstration, laboratory method

Books for Study

1. A textbook of Optics, N. Subramaniam, Brij Lal & M. N. Avadhanulu, S. Chand & company Ltd.
2. Optics, A K Ghatak, Tata McGraw-Hill Education, 2009.
3. LASERS Theory and Applications, K. Thyagarajan, A. K. Ghatak; Macmillan India Ltd.

Books for Reference

1. Optics, F A Jenkins and H E White, McGraw-Hill, 3rd Edition, (1957)
2. Optics and Spectroscopy, R Murugeshan, Kiruthiga ivaprasath, S Chand 7. Optical Physics, Ariel Lipson,Stephen G. Lipson, Henry Lipson, Cambridge University Press.
3. Fundamentals of Optics: Geometrical Physical and Quantum, D. R. Khanna, H. R. Gulati R. Chand Publication.

PHYSICS (MAJOR)

L	T	P	Cr
0	0	4	2

Course Title: Physics Practical-I
Course Code: BSE.204

1. Study of Biot-Savart's law
2. Measurement of field strength B and its variation in a Solenoid (Determine dB/dx).
3. To study a series LCR circuit and determine its (a) Resonant Frequency, (b) Quality Factor
4. To study a parallel LCR circuit and determine its (a) Anti-resonant frequency and (b) Quality factor Q
5. To determine a Low Resistance by Carey Foster's Bridge.
6. To find frequency of ac supply using an electrical vibrator.
7. To determine the self-inductance of a coil by Anderson's bridge.
8. Study of a RC Transmission line at 60 Hz.
9. Study of a LC transmission line.
10. Study of magnetic field due to a current.

Course Title: Physics Practical-II
Course Code: BSE.205

L	T	P	Cr
0	0	4	2

1. To determine the value of Cauchy Constants of a material of a prism.
2. Newton's Rings- wavelength of sodium light
3. Micheleson's interferometer
4. Fabry-Perot interferometer
5. To measure the intensity using photo sensor and laser in diffraction patterns of single and double slits.
6. To determine the wavelengths of light of a given source using diffraction grating
7. To study the characteristics of Diode laser.
8. Optical fiber Characterization.
9. To study the V-I and P-I characteristics of different optical LED sources operating at different wavelength.
10. To study the V-I and P-I characteristics of different LASER optical sources operating at different wavelength.

CHEMISTRY (MAJOR)

Course Title: Organic Chemistry-II (Chemistry of Oxygen and Nitrogen Containing Functional Groups)
Course Code: BSE.206

L	T	P	Cr
4	0	0	4

Course Learning Outcomes

At the end of the course the prospective teacher-trainees will be able to;

CLO1 recognize and classify the structures of alcohols, phenols, and ethers, identify key functional groups and understanding their chemical properties and reactivity.
CLO2 understand the structure and chemical reactivity of carbonyl compounds.
CLO3 develop proficiency in the methods of synthesizing carboxylic acids and their derivatives , structure and their reactivity.
CLO4 identify, synthesize, and analyze nitrogen-containing functional groups.

Units/Hours	Contents	Mapping with CLOs
UNIT-I **14 Hours**	**Alcohols, Phenols, Ethers and Epoxides** Alcohols: Preparation, properties and relative reactivity of 1°, 2°, 3° alcohols, Bouvaelt–Blanc Reduction; Preparation and properties of glycols: Oxidation by periodic acid and lead tetraacetate, Pinacol–Pinacolone rearrangement; Phenols: Preparation and properties; Acidity and factors effecting it, Ring substitution reactions, Reimer–Tiemann and Kolbe's–Schmidt Reactions, Fries and Claisen rearrangements with mechanism; Ethers and Epoxides: Preparation and reactions with acids. Reactions of epoxides with alcohols, ammonia derivatives and LiAlH	**CLO1**

UNIT-II **15 hours**	**Carbonyl Compounds** Structure, reactivity and preparation; Nucleophilic additions, Nucleophilic addition–elimination reactions with ammonia derivatives with mechanism; Mechanisms of Aldol and Benzoin condensation, Knoevenagel condensation, Claisen–Schmidt, Perkin, Cannizzaro and Wittig reaction, Beckmann and Benzil–Benzilic acid rearrangements, haloform reaction and Baeyer Villiger oxidation, α–substitution reactions, oxidations and reductions (Clemmensen, Wolff–Kishner, LiAlH4, NaBH4, MPV, PDC and PCC); Addition reactions of unsaturated carbonyl compounds: Michael addition. Active methylene compounds: Keto–enol tautomerism. Preparation and synthetic applications of diethyl malonate and ethyl acetoacetate	**CLO2**
UNIT-III **15 hours**	**Carboxylic Acids and their Derivatives** Preparation, physical properties and reactions of monocarboxylic acids: Typical reactions of dicarboxylic acids, hydroxy acids and unsaturated acids: succinic/phthalic, lactic, malic, tartaric, citric, maleic and fumaric acids; Preparation and reactions of acid chlorides, anhydrides, esters and amides; Comparative study of nucleophilic sustitution at acyl group –Mechanism of acidic and alkaline hydrolysis of esters, Claisen condensation, Dieckmann and Reformatsky reactions, Arndt-Eistert synthesis, Neber, Shapiro reaction ,Hofmann–bromamide degradation, Favorskii, Scmidt and Curtius rearrangement. Sulphur containing compounds: Preparation and reactions of thiols, thioethers and sulphonic acids.	**CLO3**
UNIT-IV **14 hours**	**Nitrogen Containing Functional Groups** Preparation and important reactions of nitro and compounds, nitriles and isonitriles Amines: Effect of substituent and solvent on basicity; Preparation and properties: Gabriel phthalimide synthesis, Carbylamine reaction, Mannich reaction, Hoffmann's exhaustive methylation, Hofmann–elimination reaction; Distinction between 1°, 2° and 3° amines with Hinsberg reagent and nitrous acid. Diazonium Salts: Preparation and their synthetic applications.	**CLO4**

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Suggested Readings

● Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

● Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

● Graham Solomons, T.W. Organic Chemistry, John Wiley & Sons, Inc.

● McMurry, J.E. (2013). Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition.

● Atkins, P., Paula, J.de, (2008). Atkins Physical Chemistry; 8th edition, Pubs: Oxford

University Press.
● Puri, B.R., Sharma, L.R., Pathania, M.S., (2008). Principles of Physical Chemistry; 43rd edition, Pubs: Vishal Publishing Co.
● Barrow, G.M., (1996). Physical Chemistry; 6th edition, Pubs: McGraw Hill Inc.
● Rao, C.N.R., (1985). University General Chemistry; Pubs: Macmillan India.
● Berry, R.S., Rice, S.A., Ross, J., (2000) Physical Chemistry; 2nd edition, Pubs: Oxford University Press.
● Albert, R.A., Silbey, R.J., (1992). Physical Chemistry; 1st edition, Pubs: John Wiley & Sons Inc.
● Dogra, S.K., Dogra, S. (1991). Physical Chemistry Through Problems; Pubs: Wiley Eastern Limited.
● Levine, I.N., (2002). Physical Chemistry; 5th edition, Pubs: Tata McGraw Hill Publishing Co. Ltd.

CHEMISTRY (MAJOR)

Course Title: Course Title: Physical Chemistry-II (Chemical thermodynamics and its Applications, , Surface chemistry, colloids and polymers)

Course Code: BSE.207

L	T	P	Cr
4	0	0	4

Course Learning Outcomes

At the end of the course the prospective teacher-trainees will be able to;
CLO1 Comprehend and apply the First Law of Thermodynamics to analyze energy conservation
CLO2 apply the second laws of thermodynamics, comprehend the concept of entropy, and analyze chemical equilibrium processes.
CLO3 Understand and apply Hess's Law and thermochemical principles to calculate reaction enthalpies, bond dissociation energies, and analyze temperature dependence of enthalpy using Kirchhoff's equation.
CLO4 apply concepts of entropy production and irreversible thermodynamics to various systems.

Units/Hours	Contents	Mapping with CLOs
UNIT-I **17 hours**	**a) Thermodynamics–I** Definition of Thermodynamic Terms: System, surroundings etc. Types of systems, intensive and extensive properties, state and path functions and their differentials, thermodynamics process, concept of heat and work. **b) First Law of Thermodynamics** Statement, definition of internal energy and enthalpy, heat capacities at constant volume and pressure and their relationship. Joule's law, Joule Thomson coefficient and inversion temperature. Calculation of w, q, ΔU& ΔH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process. **c) Thermochemistry**	**CLO1**

	Standard state, standard enthalpy of formation – Hess's Law of heat summation and its applications. Heat of a reaction at constant pressure and at constant volume, enthalpy of neutralization, bond dissociation energy and its calculation from thermo–chemical data, temperature dependence of enthalpy and Kirchhoff's equation.	
UNIT-II **17 hours**	**a) Thermodynamics–II**: Second law of thermodynamics: need for the law, different statements of the law. Carnot cycle and its efficiency, Carnot theorem. Thermodynamic scale of temperature. **Concept of Entropy**: Entropy as a state function, entropy as a function of V & T, entropy as a function of P & T, entropy change in physical change. Clausius inequality, entropy as a criterion of spontaneity and equilibrium. Entropy changes in ideal gases and mixing of gases.	**CLO2**
UNIT-III **13 hours**	**a) Third Law of Thermodynamics**: Nernst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data. Gibbs and Helmholtz functions; Gibb's function (G) and Helmholtz function (A) as thermodynamic quantities. A & G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change. Variation of G and A with P, V and T. **b) Non–Equilibrium Thermodynamics**: Introduction, conservation of mass and energy, concept of entropy production due to heat flow and chemical reactions, Onsager equation and its reciprocal relations,.	**CLO3**
UNIT-IV **13 hours**	**a) Surface Chemistry:** Types of adsorptions, adsorption isotherms, Freundlich, Langmuir and Gibbs adsorption isotherms: Limitations and applications. Difference between multilayered and mono layered, Concept of catalysis and types (homogeneous vs. heterogeneous). Characteristics of catalytic reactions. Haber-Bosch Process. **b) Colloids:** Definition, classification (lyophilic vs. lyophobic, multimolecular/macromolecular/associated colloids). Distinction between true solutions, colloids, and suspensions. Optical properties: Tyndall effect, Brownian motion. Kinetic properties: diffusion, sedimentation, viscosity. Electrical properties: electrophoresis, electro-osmosis, streaming potential, sedimentation potential. **Polymer Chemistry:** Introduction to polymers; classification of polymers based on origin, structure, and applications. Concept of average molar masses of polymers – number average, weight average, viscosity average, and polydispersity index.	**CLO4**

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Suggested Readings:

● Glasstone, B. (2003) Thermodynamics for Chemists, East West Press, New Delhi. ISBN– 10: 8176710148.

● Rock, P.A. (1983) Chemical Thermodynamics, University Science Books, Sausalito, CA. ISBN 10: 1891389327

● Maron S.H., Prutton C.F. (1965) Principles of Physical Chemistry, 4th Edition, Mac Millan Publishing Company, New York. ISBN–10: 0023762306

● Atkin, P., Paula J, (2002) Atkin's Physical Chemistry, 7th Edition, Oxford University Press, London. ISBN: 9780199697403

● Kapoor, K.L (2006) A Text Book of Physical Chemistry, 6th Volume, Macmillan Publishers India Ltd., New Delhi. ISBN10: 0230332765

● Laidler, K.J. (1995) The world of Physical Chemistry, 3rd Volume, Oxford University Press, London. ISBN–10: 0198559194

● Jou D., Llebot J.E. (1990) Introduction to the Thermodynamics of Biological Processes, Prentice Hall. ISBN: 9780135028810

● Rajaram J., Kuriacose J. C. (1986) Thermodynamics for Students of Chemistry, Shoban Lal Nagin Chand & Co. Delhi ISBN–13

• Negi, A. S.; S. C. Chand, A textbook of Physical Chemistry, 2nd edition, 2014 print.

● Thermodynamics for Chemists, Author: Samuel Glasstone, Publisher: East–West Press Pvt Ltd. (2008), ISBN–13: 8176710148.

Puri, B.R., Sharma, L.R., Pathania, M.S., Principles of Physical Chemistry; 46th edition, Pubs: Milestones Publisher, 2012–13

CHEMISTRY (MAJOR)

Course Name: Organic Chemistry-II (Practical-I Qualitative Analysis)

Course Code: BSE.208

L	T	P	Cr
0	0	4	2

Course Learning Outcomes

At the end of the course the prospective teacher-trainees will be able to;

CLO1 experience a positive and enjoyable learning based on sound scientific principles and practice.

CLO2 foster good laboratory practice and develop technical skills relevant to quantitative analysis.

CLO3 accurately identify and analyze the presence of various functional groups.

CLO4 supplement and reinforce chemical principles taught in the theory units.

Units/Hours	Contents	Mapping with Course Learning Outcome

60 hours	Qualitative analysis of unknown organic compounds containing simple functional groups: Alcohols carboxylic acids phenols and carbonyl compounds Amines Amides halo and nitro hydrocarbons Carbohydrates	CLO1 CLO2 CLO3 CLO4

Suggested Readings:-

● Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009)

● Furniss, B.S., Hannaford, A.J., Smith, P.W.G. & Organic Chemistry, 5th Ed. Pearson. Tatchell, A.R. Practical

● Ahluwalia, V.K. & Aggarwal, R.(2000).Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press.

● Ahluwalia, V.K. & Dhingra, S. (2000).Comprehensive Practical Organic Chemistry: Qualitative Analysis, University Press.

● Atkins, P., Paula, J.de,(2000). Atkins Physical Chemistry; 8th edition, Pubs: Oxford University Press.

● Puri, B.R., Sharma, L.R., Pathania, M.S. (2008). Principles of Physical Chemistry; 43rd edition, Pubs: Vishal Publishing Co.

● Barrow, G.M. (1996). Physical Chemistry; 6th edition, Pubs: McGraw Hill Inc.

● Rao, C.N.R., (1985). University General Chemistry; Pubs: Macmillan India.

● Berry, R.S., Rice, S.A., Ross, J.,(2000). Physical Chemistry; 2nd edition, Pubs: Oxford University Press

● Albert, R.A., Silbey, R.J.(1992). Physical Chemistry; 1st edition, Pubs: John Wiley & Sons Inc.

● Dogra, S.K., Dogra, S., (1991). Physical Chemistry Through Problems; Pubs: Wiley Eastern Limited.

● Levine, I.N., (2002).Physical Chemistry; 5th edition, Pubs: Tata McGraw Hill Publishing Co. Ltd.

● Moore, W. J., (1983). Basic Physical Chemistry; Pubs: Prentice Hall of India Pvt. Ltd.

CHEMISTRY (MAJOR)

Course Name: Physical Chemistry-II (Practical-II Thermochemistry)

Course Code: BSE.209

L	T	P	Cr
0	0	4	2

Course Learning Outcomes

At the end of the course the prospective teacher-trainees will be able to;

CLO1 demonstrate proficiency in conducting thermochemical experiments, including the proper handling of calorimeters.

CLO2 foster good laboratory practice and develop technical skills relevant to quanlitative analysis.

CLO3 accurately measure and calculate the enthalpy changes for various chemical reactions.

CLO4 apply thermodynamic principles to real-world chemical processes.

Units/Hours	Contents	Mapping with Course Learning Outcome
60 hours	Determination of heat capacity of a calorimeter for different volumes using change of enthalpy data of a known system (method of back calculation of heat capacity of calorimeter from known enthalpy of solution or enthalpy of neutralization). Determination of heat capacity of the calorimeter and enthalpy of neutralization of hydrochloric acid with sodium hydroxide. Calculation of the enthalpy of ionization of a weak acid. Determination of heat of solution of Na2SO4. Determination of Lattice energy of NaCl (using Born–Haber cycle). Determination of enthalpy of hydration of copper sulphate Study of the solubility of benzoic acid in water and determination of ΔH. To determine excess partial molar enthalpy of benzoic acid and find out ΔHfusion of the acid. To determine the enthalpy of fusion of napthalene. To determine the dissociation constant of picric acid by studying its distribution between benzene and water To find out the partition coefficient of benzoic acid in toluene and water. To determine the molecular weight of naphthalene by Rast method. To determine the molecular weight of diphenylamine by depression in freezing point in naphthalene. To find out the equilibrium constant of aluminiumxylenol orange complex.	CLO1 CLO2 CLO3 CLO4

Suggested Readings:-

● Khosla, B. D.; Garg, V. C. & Gulati, A., Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011).

● Athawale, V.D. & Mathur, P. Experimental Physical Chemistry New Age International: New Delhi (2001)

● Morrison, R.T., Boyd, R.N., Organic Chemistry; 6th edition, Pubs: Prentice–Hall, 1992.

● Wade Jr., L.G., Singh, M.S., Organic Chemistry; 6th edition, Pubs: Pearson Education, 2008.

● Mukherji, S.M., Singh, S.P., Kapoor, R.P., Organic Chemistry; Pubs: Wiley Eastern Limited, 1985, Vol. I, II, III.

● Solomons, T.W., Fryhle, C.B., Organic Chemistry; 9th edition, Pubs: Wiley India, 2007.

● Carey, F.A., Organic Chemistry; 4th edition, Pubs: McGraw–Hill, 2000.

● Streitwieser, A., Clayton, Jr., Heathcock, H., Introduction to Organic Chemistry; 3rd edition, Pubs: Macmillan Publishing Company, 1989. University General Chemistry, C.N.R. Rao, Macmillan

Mathematics (Major-I)

Course Title: Analysis and Vector Calculus

L	T	P	Cr
4	0	0	4

Course Code: BSE.210

Course Learning Outcomes:

At the end of the course the prospective teacher-trainees will be able to;

CLO1 Understand and apply the theorems on limits of sequences, and analyze the convergence of bounded and monotonic sequences using Cauchy's convergence criterion.

CLO2 Understand and apply various convergence tests for series of non-negative terms, including the comparison test, ratio test, root test, logarithmic test, and Leibnitz's test, to determine absolute and conditional convergence.

CLO3 Understand the concept of Riemann integrability, and apply conditions for the existence of Riemann integrals for continuous functions and monotone functions, including the algebra of integrable functions.

CLO4 Understand and apply vector differentiation and integral calculus by utilizing gradient, divergence, and curl operators, as well as performing line integrals and vector integration.

Units/Hours	**Content**	**Mapping with CLOs**
Unit-1 15 hours	Definition of a sequence. Theorems on limits of sequences. Bounded and monotonic sequences. Cauchy's convergence criterion.	CLO1
Unit-2 15 hours	Series of non-negative terms. Comparison tests. Cauchy's integral test. Ratio test. Cauchy's root test. Logarithmic test. Cauchy condensation test, Gauss test, Alternating series. Leibnitz's test. Absolute and conditional convergence.	CLO2
Unit-3 15 hours	Partitions, Upper and lower sums. Upper and lower integrals, Riemann integrability. Conditions of existence of Riemann integrability of continuous functions and of monotone functions. Algebra of integrable functions. Improper integrals and statements of their conditions of existence. Test of the convergence of improper integral, Beta and Gamma functions.	CLO3
Unit-4 15 hours	Vector differentiation, Gradient, divergence and curl operators, line integrals, Vector identity, Vector integration. Theorems of Gauss, Green, Stokes and problems based on these.	CLO4

Suggestive Mode of Transaction:

The course content transaction will include the following:

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussions, panel interactions, small theme-based seminars, cooperative teaching, team teaching, flipped learning, blended learning, and demonstration.

Suggestive Mode of Assessment: Assignments, Class tests, Problem-solving, Semester examinations.

Suggestive Readings:

- Malik, S.C. and Savita Arora: *Mathematical Analysis*, Wiley Eastern Ltd. (1991).
- Apostal, T.M.: *Mathematical Analysis*, Addison Wesley Series in Mathematics (1974).
- Narayan, S. and P.K. Mittal: *Integral Calculus*, Sultan Chand & Sons.
- Spiegal, M.R.: *Introduction to Vector Calculus and Tensor*.
- Spiegal, M.R.: *Vector Analysis*.

Mathematics (Major-II)

Course Title: Partial Differential Equations

L	T	P	Cr
4	0	0	4

Course Code: BSE.211

Course Learning Outcomes:

At the end of the course the prospective teacher-trainees will be able to;

CLO1 Understand the concept of first-order partial differential equations and apply the method of characteristics to solve Cauchy's problem, determine integral surfaces, and study orthogonal surfaces.

CLO2 Understand the concept of non-linear first-order partial differential equations and apply methods such as the Cauchy method of characteristics, Charpit's method, and Jacobi's method to solve them.

CLO3 Understand the concept of second-order partial differential equations and apply methods such as separation of variables and the use of canonical forms to solve linear PDEs with constant coefficients.

CLO4 Understand the concept of the one-dimensional wave equation, heat equation, and Laplace equation, and solve simple problems related to these equations.

Units/Hours	Content	Mapping with CLOs
Unit-1 15 hours	Partial differential equations of the first order-Partial differential equations, Origins of first order partial differential equations, Cauchy's problem for first order equations, linear equation of first order, Integral surface passing through a given curve, Surfaces orthogonal to a given system of surfaces.	CLO1

Unit-2 15 hours	Non-linear partial differential equation of the first order, Cauchy method of characteristics, Compatible system of first order equations, Charpit's method, Special types of first order equations, Solutions satisfying given conditions, Jacobi's method, Applications of first order equations.	CLO2
Unit-3 15 hours	PDEs of second order- origin of second order equations, linear PDEs with constant coefficients, separation of variables. Canonical forms.	CLO3
Unit-4 15 hours	One dimensional wave equation, heat equation, Laplace equation- Simple problems.	CLO4

Suggestive Mode of Transaction:

The course content transaction will include the following:

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussions, panel interactions, small theme-based seminars, cooperative teaching, team teaching, flipped learning, blended learning, and demonstration.

Suggestive Mode of Assessment: Assignments, Class tests, Problem-solving, Semester examinations.

Suggestive Readings:

- Ravi P. Agarwal, Donal O'Regan: *Ordinary and Partial Differential Equations with Special Functions, Fourier Series, and Boundary Value Problems*, Springer, 2009.
- I. N. Sneddon: *Elements of Partial Differential Equations*, Dover Publications, Inc. New York, 2006.
- Tyn Myint-U and Lokenath Debnath: *Linear Partial Differential Equations for Scientists and Engineers*, 4th edition, Springer, Indian reprint, 2006.

Mathematics (Major-III)

Course Title: Numerical Methods

L	T	P	Cr
4	0	0	4

Course Code: BSE.230

Course Learning Outcomes: At the end of the course, the students will be able to:

CLO1 Understand the different types of numerical errors and apply numerical methods to solve nonlinear algebraic and transcendental equations.
CLO2 Apply direct and iterative techniques to solve systems of linear equations and find eigenvalues and eigenvectors numerically.
CLO3 Use finite differences and interpolation methods effectively for data approximation and numerical differentiation.
CLO4 Employ numerical integration methods and solve ordinary differential equations using standard numerical techniques.

Units/Hours	Content	Mapping with CLOs
Unit-1 **15 hours**	Errors in numerical computations: sources, types, and error propagation. Numerical solution of algebraic and transcendental equations: Bisection method, Regula-Falsi, Newton-Raphson, Secant, and Iterative methods.	**CLO1**
Unit-2 **15 hours**	Solution of systems of linear equations: Gauss elimination, Gauss-Jordan, Crout's method, LU decomposition. Iterative methods: Jacobi, Gauss-Seidel, and Relaxation methods. Eigenvalues and eigenvectors: Power method, Jacobi method.	**CLO2**
Unit-3 **15 hours**	Finite differences and finite difference operators. Interpolation: Newton's forward and backward interpolation, divided differences, Lagrange interpolation, inverse interpolation. Numerical differentiation using finite differences.	**CLO3**
Unit-4 **15 hours**	Numerical integration: Trapezoidal rule, Simpson's rules, Newton-Cotes formulas. Numerical solution of ordinary differential equations: Euler's method, Modified Euler's method, Runge-Kutta methods, Predictor-Corrector methods (Milne-Simpson).	**CLO4**

Suggestive Mode of Transaction:

The course content transaction will include the following:

- Planned lectures infused with multimedia/PowerPoint presentations. Small group discussions, panel interactions, small theme-based seminars, cooperative teaching, team teaching, flipped learning, blended learning, demonstrations of algorithms' implementation and use of calculators/software for practical understanding.

Suggestive Mode of Assessment: Assignments, Class tests, Problem-solving, Semester examinations.

Suggestive Readings:

- S.S. Sastry, Introductory Methods of Numerical Analysis (PHI)
- M.K.Jain, S.R.K.Iyengar, R.K.Jain, Numerical methods for Scientific and Engineering Computation (New Age International)
- B.S. Grewa, Numerical Methods: For Engineering and Science (Khana Publishers)

BOTANY (MAJOR)

Course Title: Plant Physiology

L	T	P	Cr
4	0	0	4

Course Code: BSE.212

Course Learning Outcomes:

At the end of the course the prospective teacher-trainees will be able to;

CLO1 understand water potential, absorption, their movement in plants.

CLO2 learn the role of minerals and their deficiency symptoms in plants.

CLO3 understand the mechanism of phloem translocation and associated models to supports source-sink dynamics and roles of phytohormones

CLO4 analyze the physiological mechanisms of flowering.

Units/Hours	Contents	Mapping with CLOs
UNIT-I 10 hrs	**Plant-water relations**: Water Potential and its components, water absorption by roots, aquaporins, pathway of water movement, symplast, apoplast, transmembrane pathways, root pressure, guttation. Ascent of sap–cohesion-tension theory. Transpiration and factors affecting transpiration, antitranspirants, mechanism of stomatal movement.	**CLO1**
UNIT-II 12hrs	**Mineral nutrition**; Essential and beneficial elements, macro and micronutrients, criteria for essentiality, mineral deficiency symptoms, roles of essential elements, chelating agents. **Nutrient Uptake:** Soil as a nutrient reservoir, transport of ions across cell membrane, passive absorption, electrochemical gradient, facilitated diffusion, active absorption, role of ATP, carrier systems, proton ATPase pump and ion flux, uniport, co-transport, symport, antiport.	**CLO2**
UNIT-III 12hrs	**Translocation in the phloem**. Experimental evidence in support of phloem as the site of sugar translocation. Pressure–Flow Model; Phloem loading and unloading; Source–sink relationship. **Plant growth regulators:** Discovery, chemical nature (basic structure), bioassay and physiological roles of Auxin, Gibberellins, Cytokinin, Abscisic acid, Ethylene.	**CLO3**
UNIT-IV 11hrs	**Physiology of flowering**; Photoperiodism, flowering stimulus, florigen concept, vernalization, seed dormancy. **Phytochrome, crytochromes and phototropins**: Discovery, chemical nature, role in photomorphogenesis, low energy responses (LER) and high irradiance responses (HIR), mode of action.	**CLO4**

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions,

small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Suggested Readings:

1. Dennis, D.T., Turpin, D.H., Lefevre, D.D. and Layzell, D.B.(eds.) 1997, *Plant Metabolism* (2nd Edition). Longman, Essex, England.
2. Galston, A.W. 1989. *Life Processes in Plants*. Scientific American Library, Springer, Verlag, New York, USA.
3. Heldt, H.2003. *Plant Biochemistry*, Academic Press, Indian Edition, Reed Elsevier India Pvt. Ltd., New Delhi.
4. HopkinS, W.G. 1999, *Introduction to Plant Physiology* (2nd Edition). John Wiley & Sons, Inc., New York, USA.
5. Lea, P.J. and Leegood, R.C. 1999, *Plant Biochemistry and Molecular Biology*. John Wiley & Sons, Chickester, England.
6. Mohr, H. and Schopfer, P. 1995. *Plant Physiology*. Springer Verlag, Berlin, Germany.
7. Salisbury, F.B. and Ross, C.W. 2005, *Plant Physiology* (4th Edition). Eastern Press Bangalore, Pvt. Ltd.

8. Tiaz, I and Zeiger, E. 2006. *Plant Physiology* (4th Edition) Sinauer Associates, Inc., Publishers, Massachusetts, USA.

Course Title: Plant Ecology

L	T	P	Cr
4	0	0	4

Course Code: BSE.213

Course Learning Outcomes:

At the end of the course the prospective teacher-trainees will be able to;

CLO1 understand interactions between living organisms and their environment such as soil, light, temperature etc.

CLO2 learn how ecosystem functioning and the interactions of species, population dynamics and also will help to understand the sustainable environmental practices.

CLO3 analyze ecological relationships, ecological principles of biodiversity conservation and management.

CLO4 analyze the different models of energy flow and their principles, ecological efficiencies, and different biogeochemical processes.

Units/Hours	Contents	Mapping with CLOs
UNIT-I **12 hrs**	**Basic concepts:** Levels of organization. Inter-relationships between the living world and the environment, the components and dynamism, homeostasis. **Soil:** Importance; Origin; Formation; Composition; Physical; Chemical and Biological components; Soil profile; Role of climate in soil development. **Water:** Importance: States of water in the environment; Atmospheric moisture; Precipitation types (rain, fog, snow, hail, dew); Hydrological Cycle; Water in soil; Water table. **Light, temperature, wind and fire:** Variations; adaptations of plants to their variation.	**CLO1**
UNIT-II **12hrs**	**Biotic interactions:** Trophic organization, basic source of energy, autotrophy, heterotrophy; symbiosis, commensalism, parasitism; food chains and webs; ecological pyramids; biomass, standing crop. **Population ecology:** Characteristics and Dynamics. Ecological Speciation.	**CLO2**
UNIT-III **10hrs**	**Plant communities:** Concept of ecological amplitude; Habitat and niche; Characters: analytical and synthetic; Ecotone and edge effect; Dynamics: succession – processes, types; climax concepts. **Ecosystems:** Structure; Processes; Trophic organisation; Food chains and Food webs; Ecological pyramids.	**CLO3**
UNIT-IV **11hrs**	**Functional aspects of ecosystem:** Principles and models of energy flow; Production and productivity; Ecological efficiencies; Biogeochemical cycles; Cycling of Carbon, Nitrogen and Phosphorus.	**CLO4**

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions,

small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Suggested Readings:

1. Odum, E.P. (2005). Fundamentals of ecology. Cengage Learning India Pvt. Ltd., New Delhi. 5th edition.
2. Singh, J.S., Singh, S.P., Gupta, S. (2006). Ecology Environment and Resource Conservation. Anamaya Publications, New Delhi, India.
3. Sharma, P.D. (2010). Ecology and Environment. Rastogi Publications, Meerut, India. 8th edition.
4. Wilkinson, D.M. (2007). Fundamental Processes in Ecology: An Earth Systems Approach. Oxford University Press. U.S.A.
5. Kormondy, E.J. (1996). Concepts of ecology. PHI Learning Pvt. Ltd., Delhi, India. 4th edition.

Course Title: Plant Physiology (Practical-I)

Course Code: BSE.214

L	T	P	Cr
0	0	4	2

Course Contents

1. Determination of osmotic potential of plant cell sap by plasmolytic method.
2. Determination of water potential of given tissue (potato tuber) by weight method.
3. Study of the effect of wind velocity and light on the rate of transpiration in excised twig/leaf.
4. Calculation of stomatal index and stomatal frequency from the two surfaces of leaves of a mesophyte and xerophyte.
5. To calculate the area of an open stoma and percentage of leaf area open through stomata in a mesophyte and xerophyte (both surfaces).
6. To study the phenomenon of seed germination (effect of light).
7. To study the effect of different concentrations of IAA on *Avena* coleoptile elongation (IAA Bioassay).
8. To study the induction of amylase activity in germinating barley grains.

Course Title: Plant Ecology (Practical-II)

Course Code: BSE.215

L	T	P	Cr
0	0	4	2

Course Contents

1. Study of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, anemometer, psychrometer/hygrometer, rain gauge and lux meter.

2. Determination of pH of various soil and water samples (pH meter, universal indicator/Lovi bond comparator and pH paper)
3. Analysis for carbonates, chlorides, nitrates, sulphates, organic matter and base deficiency from two soil samples by rapid field tests.
4. Determination of organic matter of different soil samples by Walkley & Black rapid titration method.
5. Comparison of bulk density, porosity and rate of infiltration of water in soils of three habitats.
6. Determination of dissolved oxygen of water samples from polluted and unpolluted sources.
   (a). Study of morphological adaptations of hydrophytes and xerophytes (four each).
   (b). Study of biotic interactions of the following: Stem parasite (*Cuscuta*), Root parasite (*Orobanche*) Epiphytes, Predation (Insectivorous plants).
7. Determination of minimal quadrat size for the study of herbaceous vegetation in the college campus, by species area curve method (species to be listed).
8. Quantitative analysis of herbaceous vegetation in the institute campus for frequency and comparison with Raunkiaer's frequency distribution law.
9. Quantitative analysis of herbaceous vegetation for density and abundance in the college campus.
10. Field visit to familiarise students with ecology of different sites.

ZOOLOGY (MAJOR)

Course Title: Immunology

L	T	P	Cr
4	0	0	4

Course Code: BSE.216

Course Learning Outcomes (CLO)

At the end of the course the prospective teacher-trainees will be able to;

CLO1: Explain the structure, components, and functions of the immune system.
CLO2: Identify and describe the roles of immune cells and lymphoid organs in maintaining immune function.
CLO3: Analyze the processes of antigen recognition, presentation, and activation of immune responses, including the roles of antibodies and cytokines.
CLO4: Identify the causes, mechanisms, and consequences of immune system disorders.
CLO5: Critically evaluate the role of immunology in medical advancements, such as Immunotherapy.

Unit/ Hours	Contents	Mapping with CLOs
Unit 1 **14 hours**	**Introduction to Immune system** Historical perspectives and milestones in immunology Overview of immune responses: innate vs adaptive immunity Components of the immune system: Organs: Thymus, bone marrow, spleen, lymph nodes. Cells: T cells, B cells, macrophages, dendritic cells, natural killer (NK) cells. Applications of immunology in medicine, biotechnology and research	**CLO 1**

	Immune surveillance and homeostasis	
Unit 2 **15 hours**	**Types of Immunity and lymphoid organs** Innate Immunity: First line of defense: Physical barriers (skin, mucous membranes). Second line of defense: Phagocytosis, inflammation, fever. Adaptive Immunity: Specificity and memory. Humoral immunity (B cells and antibodies). Cell-mediated immunity (T cells). Primary lymphoid organs: Thymus and bone marrow. Secondary lymphoid organs: Spleen, lymph nodes, mucosa-associated lymphoid tissue (MALT). Role of pattern recognition receptors (PRRs) in innate immunity Role of antigen-presenting cells (APCs)	**CLO 2**
Unit 3 **15 hours**	**Antigens, Antibodies, immune cells and molecules** Antigen: properties of antigens, Haptens and adjuvants. Antigen-antibody specificity. Origin and differentiation of immune cells. Introduction to antibodies (structure and function). Cytokines and chemokines. Major Histocompatibility Complex (MHC) Isotypes and classes of immunoglobulins Affinity and avidity of antigen-antibody interactions	**CLO 3**
Unit 4 **14 hours**	**Immune disorders, Immunotherapy and Cancer Immunology** A brief overview of autoimmunity, hypersensitivity, and immunodeficiency. Cancer as an immunological challenge. Tumor Immunology: Types of tumor antigen Tumor-specific antigens (TSA) and Tumor-associated antigens (TAA). Overview of immunotherapy approaches. The immune system's role in tumor surveillance. Monoclonal antibodies in immunotherapy	**CLO 4 & 5**

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Suggested Readings

1. Janeway's Immunobiology (2022): 10th Edition, Published by: Garland Science.
2. Kuby Immunology (2023): 9th Edition, Published by: W. H. Freeman and Company
3. Roitt's Essential Immunology (2022): 14th Edition, Published by: Wiley-Blackwell
4. Cellular and Molecular Immunology (2021): 10th Edition, Published by: Elsevier

Course Title: Biomolecules

L	T	P	Cr
4	0	0	4

Course Code: BSE.217

Course Learning Outcomes (CLO)

At the end of the course the prospective teacher-trainees will be able to;

CLO1: Define the structured approach to understanding the fundamentals of biomolecules.
CLO2: Explains the structure, function, and importance of carbohydrates and lipids.
CLO3: Understand protein structure, protein function and protein denaturation.
CLO4: Explains structure and function of nucleic acids.

Unit/Hours	Contents	Mapping with course learning outcome
I/ 14 hours	**Introduction to Biomolecules-Definition and Importance** What are biomolecules? Their role in biological systems. The chemistry of life: Carbon-based molecules. Chemical Bonds in Biomolecules Covalent, ionic, hydrogen bonds, and van der Waals interactions. Polarity and solubility. Water: The Universal Solvent Properties of water relevant to biomolecules. Hydrogen bonding and its role in biomolecular interactions. pH, buffers, and their significance in biological systems	CLO1
II/16 hours	**Carbohydrates and lipids-Monosaccharides** Structure and classification (aldoses, ketoses, hexoses, etc.). Isomerism (e.g., stereoisomers, epimers, anomers). Disaccharides Common examples: Sucrose, lactose, maltose. Glycosidic bonds. Polysaccharides Storage polysaccharides (starch, glycogen). Structural polysaccharides (cellulose, chitin). Biological Roles of Carbohydrates Energy storage. Structural components. Classification and Structure Fatty acids: Saturated vs. unsaturated. Triglycerides. Phospholipids. Steroids. Functions of Lipids Energy storage. Membrane structure. Lipid Metabolism Beta-oxidation. Lipoproteins and their role in lipid transport, Eicosanoids: Prostaglandins, leukotrienes and their functions	CLO2
III/14 hours	**Proteins-Amino Acids** Structure and classification (polar, nonpolar, acidic, basic). Essential vs. non-essential amino acids. **Protein Structure** Primary, secondary (α-helix, β-sheet), tertiary, and quaternary structures. Bonds and interactions in protein folding. **Protein Function** Enzymes: Structure and mechanism of action. Structural proteins, transport proteins, and signaling proteins. Protein Denaturation Causes and consequences of denaturation. Enzyme kinetics (Michaelis-Menten basics)	CLO3
IV/16 hours	**Nucleic Acids -Structure of Nucleotides** Components: Sugar, phosphate, nitrogenous base. DNA vs. RNA. DNA and RNA Structure Double helix model. Chargaff's rule and base pairing	CLO4

	specificity, Secondary structures of RNA. RNA types: mRNA, tRNA, rRNA, miRNA – structure and function Functions of Nucleic Acids Genetic information storage and transfer. Role in protein synthesis (transcription, translation). Ribozymes and regulatory RNA. DNA Replication and Repair Mechanisms and enzymes involved. Mutation and repair mechanisms.	

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Suggested Readings

1. Berg, J.M., Tymoczko, J.L., Gatto, G.J., & Stryer, L. (2023). *Biochemistry* (9th ed.). W.H. Freeman.
2. Lehninger, A.L., Nelson, D.L., & Cox, M.M. (2021). *Lehninger Principles of Biochemistry* (8th ed.). W.H. Freeman.
3. Voet, D., Voet, J.G., & Pratt, C.W. (2022). *Fundamentals of Biochemistry: Life at the Molecular Level* (6th ed.). Wiley.
4. Mathews, C.K., Van Holde, K.E., Appling, D.R., & Anthony-Cahill, S.J. (2020). *Biochemistry* (5th ed.). Pearson.
5. Garrett, R.H., & Grisham, C.M. (2016). *Biochemistry* (6th ed.). Cengage Learning.
6. Berg, J.M., Tymoczko, J.L., & Stryer, L. (2015). *Biochemistry: A Short Course* (3rd ed.). W.H. Freeman.

Course Title: Immunology (Practical-I)

Course Code: BSE.218

L	T	P	Cr
0	0	4	2

Course Learning Outcomes (CLO)

At the end of the course the prospective teacher-trainees will be able to;

CLO1: Accurately identify and differentiate various immune cells through blood smear staining.
CLO2: Interpret antigen-antibody agglutination and precipitation tests to detect specific pathogens or antibodies in biological samples.
CLO3: Conduct blood typing using agglutination reactions and explain the immunological basis of ABO and Rh blood group systems.
CLO4: Use radial immunodiffusion and agar gel diffusion assays to quantify and analyze antigen-antibody reactions in serum samples

Course Content

1. Perform total and differential leukocyte count using a hemocytometer. Identify immune cells in stained blood smears.
2. Determine ABO and Rh blood groups using antigen-antibody agglutination reactions.
3. Perform slide agglutination tests to demonstrate antigen-antibody interactions (e.g., Widal test for typhoid diagnosis).
4. Perform ring precipitation and agar gel diffusion tests to observe antigen-antibody

precipitation.

5. Separate serum proteins via electrophoresis, then use antibodies for detection in a gel medium.
6. Quantify antigen or antibody concentration by observing precipitation rings in agar gels.
7. Dissect lymphoid organs (thymus, spleen) in laboratory animals to study their structure and function.

Course Title: BIOMOLECULES (Practical-II)

Course Code: BSE.219

L	T	P	Cr
0	0	4	2

Course Learning Outcomes (CLO)

At the end of the course the prospective teacher-trainees will be able to;

1. **Carbohydrates**

a. **Qualitative Tests for Carbohydrates**

- **Benedict's Test**: Detection of reducing sugars (glucose, fructose).
- **Barfoed's Test**: Distinguishing between monosaccharides and disaccharides.
- **Iodine Test**: Detection of starch.

b. **Quantitative Estimation of Glucose**

- **Procedure**: Perform a colorimetric assay and determine glucose concentration using a standard curve.

2. Lipids

a. **Extraction and Identification of Lipids**

- **Procedure**: Lipid extraction using a solvent (chloroform-methanol mixture).
- Perform the Sudan III or Sudan IV test for lipid detection.

b. **Saponification Reaction**

- **Procedure**: Heat a lipid sample with sodium hydroxide and observe soap formation.

3. Proteins

a. **Qualitative Tests for Proteins**

- **Biuret Test**: Detection of peptide bonds.
- **Xanthoproteic Test**: Detection of aromatic amino acids.
- **Ninhydrin Test**: Detection of free amino groups.

b. **Protein Estimation Using Lowry Method**

- **Procedure**: Perform the Lowry assay and generate a standard curve using bovine serum albumin (BSA).

c. **Protein Denaturation and Precipitation**

- **Procedure**: Expose proteins to heat, acidic/basic conditions, or ethanol, and observe precipitation.

4. Nucleic Acids

a. **Isolation of DNA from Plant or Animal Tissue**

- **Procedure**: Use a buffer containing detergent and salt to lyse cells.
- Precipitate DNA using ethanol or isopropanol.
- Visualize DNA as a pellet or threads.

b. **Qualitative Test for Nucleic Acids**

- **Dische Test**: Detection of DNA.
- **Orcinol Test**: Detection of RNA.

3. **Agarose Gel Electrophoresis of DNA**

- **Procedure**: Load DNA samples mixed with dye onto an agarose gel.

- Perform electrophoresis and visualize DNA using ethidium bromide or SYBR Green under UV light.

Course Title: Basics of Pedagogy at Secondary Stage
Course Code: BSE.229

L	T	P	Cr
4	0	0	4

Course Learning Outcomes

At the end of the course the prospective teacher-trainees will be able to;

CLO1 build comprehensive understanding of secondary stage learners.
CLO2 assess the physical, mental, social, and emotional growth of secondary stage learners.
CLO3 create enriching and inclusive learning environments to foster values-based education after implementing effective teaching and learning strategies.
CLO4 identify various pedagogical approaches and their impact on learners.
CLO5 outline knowledge and skills necessary for continuous professional development.

Units/Hours	Contents	Mapping with CLOs
Unit 1 15 hours	Understanding Secondary Stage Learners: *A. Understanding the learners and learner background:* • Physical, mental, social, and psychological growth of learners. • Cognitive skills of learners. • Conflicts and challenges of secondary learners. • Characteristics of secondary stage learners. *B. Observing the unique capabilities of a child.* *Learning Activities: Discussion, Quizzes, Extempore.*	**CLO1** **CLO2**
Unit 2 15 hours	Strategies of Teaching and Learning *A. Understanding teaching and learning strategies:* • Concept, characteristics and functions of teaching. • Relating abstract concepts with real-life situations by enjoyable activities. • Promoting multidisciplinary learning through integration of different disciplines. • Promoting learner participation and engagement in learning • Inculcating values through art integrated activities, community engagement etc. • Promoting health and social sensitivities. • Developing respect toward Cross-Cultural Heritage. • Making classrooms inclusive and joyful learning spaces *B. Relationship between Aims and Values of Education, Curriculum and Pedagogy.* *Learning Activities: Discussion, Quizzes, Essay Writing.*	**CLO3**
Unit 3 15 hours	Pedagogical Approaches *A. Pedagogical Approaches*: Constructivist approach; collaborative approach; reflective approach; integrative approach, inquiry- based approach; art-integrated learning, sports- integrated learning. *B. Types of Pedagogy:* Social pedagogy; critical pedagogy; culturally	**CLO4**

	responsive pedagogy; Socratic pedagogy in inclusive set up. *C. Role of pedagogy in effective learning:* How does pedagogy impact the learner? *Learning Activities: Discussion, Quizzes, Extempore.*	
Unit 4 15 hours	Continuous Professional Development of Teacher *A. Concept, Meaning and Need:* Professional and ethical competencies and need for updating content and pedagogical competencies to develop their professional competencies. *B. Professional Development Activities:* Seminars, conferences, orientation programmes, workshops, online and offline courses, , publications, , capacity building programmes, and teacher exchange programmes. *C. Development of professional competencies*: To deal with gender issues, equity and inclusion, ethical issues, environmental issues *Learning Activities: Discussion, Quizzes, Extempore.*	**CLO5**

Suggestive Practicum (Any Three)

1. Analyse NEP 2020 with reference to pedagogical aspects of the concerned subject.
2. Analyse and reflect on the qualities of an 'Innovative Teacher' in Context of National Professional Standards for Teachers (NPST) and National Mentoring Mission (NMM).
3. Explore different platforms such as National Teacher's Portal, NISHTHA, DIKSHA, and SWAYAM for an online course and prepare a report.
4. Participate in a workshop or seminar to explore the concept of Continuous Professional Development (CPD), its significance in lifelong learning and prepare a write up on the findings.
5. Develop teaching learning strategies to address the needs of diverse learners in context of gender, equity and inclusion and prepare a PowerPoint presentation.
6. Raise awareness on the ethical and social challenges in education through field trip and create an e-portfolio.
7. Any other project assigned by HEI.

Suggestive Mode of Transaction

The course content transaction will include the following:
Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, focus group discussion, surveys, short term project work, etc.

Suggestive Mode of Assessment

Portfolio creation, written tests, classroom presentations, seminars, assignments, practicum, sessional, terminal semester examinations (As per UGC norms).

Suggestive Readings

- National Council of Educational Research and Training. (April 2022). Mandate documents Guidelines for the development of National Curriculum Frameworks.
- National Education Policy 2020, MoE, Government of India (English and Hindi)
- National Steering Committee for National Curriculum Frameworks, (2023). Draft
- National Curriculum Framework for School Education.
- National Policy on Education 1968, 1986 and 2020.
- Nunn, L. M. (2018). *33 simple strategies for faculty: A week-by-week resource for teaching first-year and first-generation students*. Rutgers University Press.

SEMESTER-IV

SEMESTER-IV

Course Title: Philosophical & Sociological Perspectives of Education – I
Course Code: BSE.251

L	T	P	Credits
4	0	0	4

Course Learning Outcomes (CLOs)

At the end of the course the prospective teacher-trainees will be able to;

CLO1 Students to know the basic concepts of philosophy and education.

CLO2 Demonstrate a foundational understanding of key philosophical concepts relevant to education

CLO3 Critically analyze the contributions of major philosophical schools to educational thought, identifying their key assumptions and implications for teaching and learning.

CLO4 To examining the philosophical basis of education in a social context.

CLO5 Engage in in-depth readings and critical analyses of the educational visions of prominent Indian and global educators and reflecting on their respective visions, educational processes, and contemporary relevance.

CLO6 Articulate the meaning of values and significance of value education within the context of contemporary society.

Units/ Hours	Contents	Mapping with CLOs
Unit I 12 Hours	Education and Philosophy • Meaning, nature and scope of Philosophy • Branches of Philosophy • Functions of Philosophy of Education • Difference between Philosophy of Education and Educational Philosophy • Relationship between Philosophy and Education Learning Activities: Group discussion and Seminar	CLO1 CLO2
Unit II **16** hours	Philosophical Schools and Education • Educational Implications of Indian Schools of thoughts: Samakhya, Yoga, Nyaya, Vaisheshika, Mimamsa, and Vedanta. • Western Schools of thoughts and their educational implications: Idealism, Naturalism, and Pragmatism Learning Activities: Individual presentation and panel discussion	CLO3
Unit III 16 Hours	Examining the Philosophical basis of Education in a Social Context • Activity theory of learning: Mahatma Gandhi and Rabindranath Tagore • Discovery theory of learning: John Dewey • Dialogue and theory of learning: Plato • Context of universalism, nationalism, and secularism with respect to Ambedkar, Jyotirao Phule Learning Activities: Dialogue on different concepts	CLO4 CLO5
Unit IV 16 Hours	Value Education • Values: Meaning, classification of values, sources of values. • Values enshrined in Indian Constitution. • Values with special reference to 21st Century (NEP 2020). Learning Activities: Group discussion and Seminar	CLO6

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- Bhattacharya, S. (2006). *Sociological foundations of education*. New Delhi: Atlantic
- Bhattacharya, S. (2008*). Foundation of education*. New Delhi: Atlantic Publishers and Distributors.
- Brubacher, John. S. (1939). *Modern philosophies of education*. New York, USA: McGraw Hill Book Company. Inc.
- Butler J. Donald (1957). F*our philosophies and their practice in education and religion*. New York, USA: Harper & Row.
- Dearden R. F. (1984). *Theory and practice in education*. Routledge K Kegan& Paul.
- Deshpande, S. (2004). *Contemporary India: A Sociological View*. New Delhi: Penguin Education Commission 1964-66. New Delhi: MHRD.
- Dewey, J. (1977): *Democracy and education: An introduction to the philosophy of education*. New York: Macmillan.
- Dwivedi, K. (2014). *Education thoughts and thinkers*. New Delhi: Shree Publishers and Distributors.
- Kneller, G. F. (1964). *Introduction to philosophy of education*. New York, USA: John Wiley and Sons, Inc.
- Kumar, A. (2015*). Philosophical perspective of education*. New Delhi: A.P.H. Publishing Corporation.
- Nayak, B.K. (2003), *Text book of foundation of education.* Cuttack, Odisha: Kitab Mahal.
- NCERT (2014). Basics in Education. New Delhi: National Council of Educational Research and Training.
- Ozman, H. A., & Craver, S. M. (2011). *Philosophical foundations of education*. Boston, USA: Allyn& Bacon.
- Sharma, Y.S. (2004). *Foundations in Sociology of Education*, New Delhi: Anushka Publications.
- Siddiqui, M. H. (2014). *Philosophical & sociological foundations of education*. New Delhi: APH Publishing Corporation.
- Taneja, V. R. (2000). *Educational thought and practice*. New Delhi: Sterling.

PHYSICS (MAJOR-I)

Course Title: Quantum Mechanics

Course Code: BSE.252

L	T	P	Cr
4	0	0	4

Course Learning Outcomes;

At the end of the course the prospective teacher-trainees will be able to;

CLO1 understand the historical development of quantum mechanics and interpret experiments that reveal the dual nature of matter.
CLO2 review the classical operator in quantum mechanics.
CLO3 develop understanding about the theory of Hydrogen atom though the study of influence of electric and magnetic fields on atoms

CLO4 utilize the concepts of quantum mechanics for the purpose of problem solving.

Unit/Hours	Contents	Mapping with CLOs
UNIT-I **16 hours**	**BASIS OF QUANTUM THEORY AND SCHRODINGER EQUATION** Drawback of Classical Mechanics, Origin of Quantum theory, Black body Radiations, Photoelectric effect, Compton effect, Wave particle dualism for light and matter, De-Broglie's Wave, Davisson and Germer experiment, Heisenberg uncertainty Principle, Wave packets: phase and group velocity, Commutation relations. Physical significance of wave function. Schrödinger's time dependent and time independent equations, Operators, Eigen values and Eigen functions, Expectation values, Applications of Schrödinger's equation: Motion of a free particle; Electron in an infinite deep potential well (rigid box); Particle in one dimensional box; Finite potential well and Tunneling.	**CLO1**
UNIT-II **14 hours**	**REVIEW OF THE CLASSICAL OSCILLATOR** Quantization of the Oscillator (Coordinate Basis), The Oscillator in the Energy Basis, Passage from the Energy Basis to the position Basis. Matrix Representation of Various Opera-tors, Expectation Values of Various Operators. General expression for uncertainty relations	**CLO2**
UNIT-III **14 hours**	**ATOMIC SPECTRA AND HYDROGEN ATOM** Atomic Spectra: Electron orbits, Energy levels and Spectra, Spectral Notations for Atomic States, Atomic excitation, Hydrogen Atom: Schrodinger's equation for the Hydrogen atom, Separation of variables, Quantum numbers: Principal quantum number; Orbital quantum number; Magnetic quantum number, Electron probability density, Radiative transitions.	**CLO3**
UNIT-IV **16 hours**	**SPIN ANGULAR MOMENTUM** General Formalism of Angular Momentum, Space quantization, Electron Spin and Spin Angular Momentum, Larmor's Theorem, Spin Magnetic Moment, Stern- Gerlach Experiment, Zeeman Effect, Pauli Matrices and Spinors, Atomic structure, Spin-Orbit coupling. **ROTATION IN QUANTUM MECHANICS** Infinitesimal and Finite Rotations, Properties of the Rotation Operator, Euler Rotations, Rotation Matrices. Addition of Angular Momenta: Addition of two Angular Momenta: General formalism, Calculation of the Clebsch-Gordan Coefficients, Addition of more than two angular	**CLO4**

	momenta, Coupling of Orbital and Spin Angular Momenta, Rotation matrices for coupling two angular momenta, Scalar, Vector, and Tensor Operators.	

Suggestive Mode of Transaction

The course content transaction will include the following:

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, selections from theoretical readings, flipped learning, blended learning, demonstration, laboratory method

Books for Study

1. Perspectives of Modern Physics, Arthur Beiser, McGraw-Hill Inc.,US; International edition.
2. Introduction to Quantum Mechanics, David J. Griffiths, 2017, Cambridge University Press (CUP).
3. A Text book of Quantum Mechanics, P.M. Mathews & K. Venkatesan, 2nd Ed., 2010, McGraw Hill

Books for Reference

1. Basic Quantum Mechanics, A.Ghatak (Mc Millan India) 2012.
2. Quantum Mechanics, Eugen Merzbacher, 2004, John Wiley and Sons, Inc.
3. Quantum Mechanics, G. Aruldhas, 2nd Edn. 2002, PHI Learning of India.
4. Quantum Mechanics, Bruce Cameron Reed, 2008, Jones and Bartlett Learning.

PHYSICS (MAJOR-II)

Course Title: Computational Physics

Course Code: BSE.253

L	T	P	Cr
4	0	0	4

Course Learning Outcomes;

At the end of the course the prospective teacher-trainees will be able to;

CLO1 comprehend the basic Linux commands, algorithms and flowchart for simple problems.
CLO2 interpret the fundamental FORTRAN syntax and semantics.
CLO3 develop understanding about the numerical methods to analysis the simple problem of physics.
CLO4 utilize the graphical analysis and visualization in simple physics problems.

Unit/Hours	Contents	Mapping with CLOs
UNIT-I **14 hours**	**INTRODUCTION** Importance of computers in Physics, the paradigm for solving physics problems for solution, Usage of Linux as an Editor, Algorithms: definition; properties and development, Flowchart: concept; symbols; guidelines and types, Examples: Cartesian to Spherical Polar Coordinates; Roots of Quadratic Equation; Sum of two matrices; Sum and Product of a finite series; calculation of sin(x) as a series, Algorithm for plotting (i)	**CLO1**

	Lissajous figures and (2) trajectory of a projectile thrown at an angle with the horizontal.	
UNIT-II **14 hours**	**SCIENTIFIC PROGRAMMING** Some fundamental Linux Commands, Development of FORTRAN, Basic elements of FORTRAN, Variables and their types, Keywords, Variable Declaration and concept of instruction and program, Operators, Expressions, Fortran I/O Statements, Executable and Non-Executable Statements, Layout of Fortran Program, Format of writing Program and concept of coding, Initialization and Replacement Logic, Examples from physics problems. Types of Logic, Branching Statements, Looping Statements, Jumping Statements, Arrays, Functions and Subroutines (Arithmetic Statement, Function Subprogram and Subroutine), Structure, Disk I/O Statements, open a file, writing in a file, reading from a file. Examples from physics problems.	**CLO2**
UNIT-III **16 hours**	**NUMERICAL METHODS OF ANYLASIS** Solution of algebraic and transcendental equations: Iterative, bisection and Newton-Raphson methods, Solution of simultaneous linear equations: Matrix inversion method, Interpolation: Newton and Lagrange formulas, Numerical differentiation, Numerical Integration, Trapezoidal, Simpson and Gaussian quadrature methods, Least-square curve fitting, Straight line and polynomial fits, Numerical solution of ordinary differential equations: Euler and Runge-Kutta methods.	**CLO3**
UNIT-IV **16 hours**	**VISUALIZATION** Introduction to graphical analysis and its limitations, Introduction to Gnuplot, importance of visualization for computational data, basic Gnuplot commands: simple plots, plotting data from a file, saving and exporting, multiple data sets per file, physics with Gnuplot (equations, building functions, user-defined variables and functions), Understanding data with Gnuplot.	**CLO4**

Suggestive Mode of Transaction

The course content transaction will include the following:

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, selections from theoretical readings, flipped learning, blended learning, demonstration, laboratory method

Books for Study

1. Introduction to Numerical Analysis, S.S. Sastry, 5th Edn., 2012, PHI Learning Pvt. Ltd.
2. Computer Programming in Fortran 77". V. Rajaraman (Publisher: PHI).
3. Computational Physics: An Introduction, R. C. Verma and P. K. Ahluwalia. New Age International Publishers, New Delhi(1999)

Books for Reference

1. Gnuplot in action: understanding data with graphs, Philip K Janert, (Manning 2010)
2. Schaum's Outline of Theory and Problems of Programming with Fortran, S Lipsdutz and A Poe, 1986Mc-Graw Hill Book Co. Quantum Mechanics, Bruce Cameron Reed, 2008, Jones and Bartlett Learning.
3. A first course in Numerical Methods, U.M. Ascher and C. Greif, 2012, PHI Learning Elementary Numerical Analysis, K.E. Atkinson, 3rd Ed., 2007, Wiley India Edition.

PHYSICS (MAJOR)

Course Title: Physics Practical-I

L	T	P	Cr
0	0	4	2

Course Code: BSE.254

1. Frank-Hertz Experiment.
2. Planck's Constant Measurement.
3. Verification of the inverse square law for light intensity using a phototransistor.
4. Study of Electron spin resonance- determine magnetic field as a function of the resonance frequency
5. Study of Zeeman effect with external magnetic field.
6. To study the quantum tunneling effect with solid state device (tunneling current in backward diode or tunnel diode).
7. To construct a Colpitt oscillator and use it to measure the dielectric constants of liquid.
8. To study the magnetic field dependence of the transverse magnetoresistance of a given semiconductor sample.
9. To determine the magnetic susceptibility of the given paramagnetic liquid using Quincke's method.
10. To determine the Landé g-factor in a free radical using an electron spin resonance spectrometer.

Course Title: Physics Practical-II

L	T	P	Cr
0	0	4	2

Course Code: BSE.255

1. To write a program to open a file and generate data for plotting using Gnuplot.
2. To evaluate sum of finite series and the area under a curve.
3. To find the product of two matrices.
4. To find a set of prime numbers and Fibonacci series.
5. To find the roots of a quadratic equation.
6. Numerical solution of the equation of motion of simple harmonic oscillator and plot the outputs for visualization.
7. To solve numerical integration using the Simpson's method.
8. To evaluate Lagrange interpolation based on given input data.
9. To find solution of first order differential equations using the Rung-Kutta method.
10. Linear curve fitting and calculation of linear correlation coefficient.

CHEMISTRY (MAJOR-I)

Course Title: Inorganic Chemistry-III (transition and inner transition elements, Coordination Chemistry and Acid-Base Concept)

Course Code: BSE.256

L	T	P	Cr
4	0	0	4

Course Learning Outcomes
At the end of the course the prospective teacher-trainees will be able to;

CLO1: understand structure, bonding and nomenclature of various coordination complexes.

CLO2: understand and explain general properties and magnetic characteristics of various transition elements.
CLO3: analyze and describe the structure of complexes of first transition series.
CLO4 : analyze acid-base reactions to identify conjugate acid-base pairs.

Units/Hours	Contents	Mapping with CLOs
Unit-I **16 hrs**	**a) Basic Coordination Chemistry:** Werner's theory, nomenclature of coordination complexes, isomerism in coordination complexes, chelating agents, metal chelates and chelate effect, names and abbreviations of important ligands, polydentate ligands, polypyrazolyborates, macrocyclic ligands, macrocyclic effect, ketoenolates, troplonates, tripod ligands, conformation of chelate rings, stereochemistry of coordination numbers 2–12 factors determining kinetic and thermodynamic stability. **b) Nature of Bonding on Coordination Compounds:** Application of the valence bond theory to coordination complexes, the electroneutrality principal, the qualitative picture of the crystal field effects in tetrahedral, square planar, octahedral, tetragonal, square pyramidal cases, pairing energy, factors affecting the CFSE, the use of crystal field theory in explaining magnetic properties of transition metal complexes, the thermodynamic effects of the crystal field splitting, the structural consequences of CFSE.	**CLO1**
Unit-II **18hrs**	**a)** The nephalauxetic effect of the spectrochemical series, the limitation of the crystal field theory, the ligand field theory, the Jahn–Teller theorem and its uses in explaining the distortions in the structures of electrically degenerate system, the molecular orbital treatment of the octahedral, tetrahedral and square planar complexes (qualitative picture only), the comparison of the VBT, CFT and MOT picture of bonding in case of transition metal complexes, the angular overlap model. **b) General Properties and Magnetism:** Definition, general characteristics and positions of transition elements in the periodic table, division into d and f block elements and electronic configurations of the atoms and ions, origin of paramagnetism, diamagnetism, magnetic susceptibility and magnetic moment from magnetic susceptibility, Guoy method to determine the magnetic susceptibility, ferromagnetism, antiferromagnetism. **c)** Electronic configuration of first transition series elements, comparative study of the first transition series elements with reference to atomic and ionic radii, ionization potential, redox potential, oxidation state diagram on the basis of redox potentials, Chemistry of scandium to copper with reference to relative stability of their oxidation states, magnetic and spectral properties	**CLO2**

Unit-III **16 hrs**	**a) Structures of Important Complexes:** Structure of some important complexes of the first transition series (to be discussed in terms of coordination number, shape or oxidation states or nature of bonding), $Ti(NO_3)_4$, TiCl4$(diars)_2$, $[Ti(Oet)_4]_4$, VF_5, $VO(acac)_2$ and nature of VO^{2+} bond, $[VOCl_3(NMe_3)_2]$, CrO_4^{2-}, $Cr_2O_7^{2-}$ $[CrO(O_2)_2Py]$, $[Cr(O_2)_2(bipy)]$, nature of metal, peroxo bond, Cr_2 (η2–acetate)$_4$ and **b)** The nature of Cr–Cr bond in this complex, tetrameric $[Co(acac)_2]_4$, tetrahedral complexes being more common in case of cobalt, oxidation of Co(II), complexes by molecular O2, $[Ni(acac)_2]_3$, $Ni(DMGH)_2$, $[Ni(Me_6 – acac)_2]$, $[Ni(MeSal)_2]$,$[Ni(CN)_5]^{3-}$, anomalous behaviour of nickel(II) complexes, copper(II) acetate dihydrate, $[Cu(CN)_2]^{2-}$, cubane complexes $[CuXL]_4$ where X=halide and L=phosphine or arsine .	**CLO3**
Unit-IV **10 hrs**	**(a) Inner-transition elements:** Chemistry of Lanthanide elements, their isolation from one another, their coordination chemistry. Chemistry of actinide elements, Their electronic configurations. Chemistry of Thorium and Uranium. **(b) Acids and Bases** : Arrhenius concept of acid -base, Brönsted-Lowry concept of acid-base reactions, solvated proton, relative strength of acids, types of acid-base reactions, Lewis acid-base concept, Classification of Lewis acids, Hard and Soft Acids and Bases (HSAB), Application of HSAB principle.	**CLO4**

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Suggested Readings:-

● F. A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry, John Wiley and Sons.

● Cotton, F.A., Wilkinson, G., Gaus, P.L., Basic Inorganic Chemistry; 3rd edition, Pubs: John Wiley Sons. 1995.

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

● Shriver, D.E., Atkins, P.W., Langford, C.H., Inorganic Chemistry; 4th edition, Oxford Publisher: Oxford University Press, 2006.

• Swami, K. N. S., Chemistry of f-block elements.

• Puri, B.R.; Sharma, L. R.; Kalia, K. C.; Principles of Inorganic Chemistry,31st edition, 2013-14.

CHEMISTRY (MAJOR)

Course Title: Organic Chemistry-III (Chemistry of Heterocyclic compounds, Natural products and Biomolecules)

Course Code: BSE.257

L	T	P	Cr
4	0	0	4

Course Learning Outcomes

At the end of the course the prospective teacher-trainees will be able to;

CLO1: describe the structure, function, and properties of amino acids, peptides, and proteins.

CLO2: explain the structure, function and role of enzymes.

CLO3: describe the structure, classification, and biological significance of carbohydrates and explain the structure, function, and metabolic roles of lipids, and their importance in energy storage.

CLO4 : analyze the composition of oils and fats and illustrate the cleansing action of soaps and the role of surfactants in synthetic detergents.

Units/Hours	Contents	Mapping with CLOs
UNIT-I ours	**a) Heterocyclic Compounds:** Classification and nomenclature (Hantzsch – Widman System) for monocyclic fused and bridged heterocycles. Structure, aromaticity in 5 numbered and 6 membered rings containing one heteroatom. **b) Heterocycles:** Furan, Pyrrole (Paal–Knorr synthesis, Knorr pyrrole synthesis, Hantzsch synthesis), Thiophene, Derivatives of furan: Furfural and furoic acid. Synthesis and reactions of Benzo–Fused Five–Membered Heterocycles with one–heteroatom. Strain-bond angle and torsional strains and their consequences in small ring heterocycles. Conformation of six-membered heterocycles with reference to molecular Geometry, barrier to ring inversion, pyramidal inversion and 1,3-diaxial interaction. Stereo electronic effects, anomeric and related effects Attractive interactions-hydrogen bonding and intermolecular nucleophilic-electrophilic interactions. **c)** Synthesis and reactions of Five–Membered Heterocycles with Two–heteroatom. Synthesis and reactions of Pyridine (Hantzsch synthesis), Pyrimidine, pyrylium salts and their comparison with pyridinium & thiopyrylium salts. Structure elucidation of quinoline and isoquinoline, Knorr quinoline synthesis, Bischler–Napieralski reaction, Pictet–Spengler reaction, Introduction of quinolizinium and benzopyrylium salts, coumarins, chromones diazines, triazines, oxadiazoles and thiadiazoles.	**CLO1**
UNIT-II 18 hours	**a) Alkaloids:** Natural occurrence, General structural features, Isolation and their physiological action Hoffmann's exhaustive methylation, Emde's modification, Structure elucidation and synthesis of Hygrine and Nicotine. Medicinal importance of Nicotine, Hygrine, Quinine, Morphine, Cocaine, and Reserpine. **b) Terpenes:** Occurrence, classification, isoprene rule; Elucidation of stucture and synthesis of Citral, Camphor and Abietic acid. **c) Steroids:** Occurrence, nomenclature, Diel's hydrocarbon and	**CLO2**

	stereochemistry. Isolation, structure determination and synthesis of Cholesterol, bile acids, Androsterone, testosterone, estrone, progesterone.	
UNIT-III hours	**a) Enzymes:** Introduction, classification and characteristics of enzymes. Salient features of active site of enzymes. Mechanism of enzyme action, factors affecting enzyme action, coenzymes and cofactors and their role in biological reactions, Lock and key mechanism, Michelson-Menton equation. **b) Carbohydrates:** Occurrence, classification and their biological importance. Monosaccharides: Constitution and absolute configuration of glucose and fructose, epimers and anomers, mutarotation, determination of ring size of glucose and fructose, Haworth projections and conformational structures; Interconversions of aldoses and ketoses; Killiani–Fischer synthesis and Ruff degradation. **Disaccharides:** Structure elucidation of maltose, lactose and sucrose. Polysaccharides – Elementary treatment of starch, cellulose and glycogen.	**CLO4**

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Suggested Readings:-

- Berg, J.M., Tymoczko, J.L. &Stryer, L. (2006) Biochemistry. 6th Ed. W.H. Freeman and Co.
- Nelson, D.L., Cox, M.M. &Lehninger, A.L. (2009) Principles of Biochemistry. IV Edition. W.H. Freeman and Co.
- Murray, R.K., Granner, D.K., Mayes, P.A. & Rodwell, V.W. (2009) Harper's Illustrated
- Biochemistry. XXVIII edition. Lange Medical Books/ McGraw–Hill
. • Miessler, G.L., Larr, D.A., Inorganic Chemistry; 3rd edition, Pubs: Pearson Education Inc., 2004.
- Jolly, W.L., Modern Inorganic Chemistry; 2nd edition, Pubs: McGraw–Hill Publishing Company Limited, 1991.
- Purcell, K.F., Kotz, J.C., Inorganic Chemistry; Pubs: W.B. Saunders Company, 1977.
- Puri, B.R., Sharma, L.R., Kalia, K.C., Principles of Inorganic Chemistry; 30th edition, Pubs: Milestones Publisher, 2006–07.
- University General Chemistry, C.N.R. Rao, Macmillaad.

CHEMISTRY (MAJOR)

Course Name: Inorganic Chemistry-III (Practical-I Volumetric Analysis-II)

Course Code: BSE.258

L	T	P	Cr
0	0	4	2

Course Learning Outcomes

At the end of the course the prospective teacher-trainees will be able to;

CLO1: perform and analyze complexometric titrations.

CLO2: conduct and interpret precipitation titrations, effectively determining the concentration of ions in a solution

using appropriate indicators.

CLO3: perform and interpret ceric sulfate titrations, accurately determining the concentration of analytes in a solution by utilizing oxidation-reduction reactions and analyzing the results effectively.

CLO4: conduct various titration techniques, accurately determine analyte concentrations in solutions, and effectively interpret and analyze the results obtained.

Units/Hours	Contents	Mapping with Course Learning Outcome
UNIT-I	• **Complexometric Titrations (EDTA)** a. Standardisation of EDTA with Pb $(NO_3)_2$ / $ZnSO_4$. $7H_2O$ b. Determination of Mg^{2+} c. Determination of Ca^{2+} (by substitution method). d. Determination of total hardness of water (permanent and temporary e. Determination of Cu^{2+} and Ni^{2+} by using masking reagent.	**CLO1** **CLO4**
UNIT-II	• **Precipitation Titrations** f. AgNO3 standardisation by Mohr's method / by using absorption indicator. g. Determination of chloride. h. Volhard's method for chloride determination	**CLO2** **CLO4**
UNIT-III	• **Ceric Sulphate Titrations** i. Standardisation with Mohr's salt. j. Determination of Cu(II) k. Determination of oxalates.	**CLO3** **CLO4**

Suggested Readings:-

● Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson, 2009.

● Vogel's Textbook of Quantitative Inorganic Analysis (revised), J. Bassett, R.C. Denney, G.H. Jeffery and J. Mandham, ELBS.

● Standard Methods of Chemical. Analysis, W.W. Scott: The Technical Press.

● Experimental Inorganic Chemistry, W.G. Palmer, Cambridge.

● Laboratory Manual in Organic Chemistry, R.K. Bansal, Wiley Eastern.

● Vogel's Textbook of Practical Organic Chemistry, B.S. Furniss, A.J. Hannaford, V. Rogers P.W.G. Smith and A.R. Tatchell, ELBS.

● Experiments in General Chemistry, C.N.R. Rao and U.C. Aggarwal, East–West Press.

● Experimental Organic Chemistry, Vol. I & II, P.R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.

CHEMISTRY (MAJOR)

Course Name: Organic Chemistry III (Practical-II Quantitative Analysis)
Course Code: BSE.259
Course Learning Outcomes

L	T	P	Cr
0	0	4	2

At the end of the course the prospective teacher-trainees will be able to;
CLO1: perform quantitative estimations of amino acids, proteins, and other organic compounds.
CLO2: analyze and interpret the effects of different conditions on enzyme activity, particularly focusing on salivary amylase.
CLO3: determine the saponification and iodine values of oils and fats, assessing their chemical properties and composition.
CLO4: isolate and characterize biomolecules such as DNA from plant tissues and caffeine from tea leaves, applying relevant extraction and purification techniques.

Units/ Hours	Contents	Mapping with Course Learning Outcome
30 hours	Quantitative Analysis of Organic Compounds 1. Estimation of glycine by Sorenson's formalin method. 2. Study of the titration curve of glycine. 3. Estimation of proteins by Lowry's method. 4. Study of the action of salivary amylase on starch at optimum conditions. 5. Effect of temperature on the action of salivary amylase. 6. Saponification value of an oil or a fat. 7. Determination of Iodine number of an oil/ fat. 8. Isolation and characterization of DNA from onion/ cauliflower/peas. 9. Extraction of caffeine from tea leaves.	CLO1 CLO2 CLO3 CLO4

Suggested Readings:-

- Manual of Biochemistry Workshop, 2012, Department of Chemistry, University of Delhi.
- Arthur, I. V. Quantitative Organic Analysis, Pearson.
- Experimental Organic Chemistry, Vol. I & II, P.R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.
- Laboratory Manual in Organic Chemistry, R.K. Bansal, Wiley Eastern.
- Vogel's Textbook of Practical Organic Chemistry, B.S. Furniss, A.J. Hannaford, V. Rogers, P.W.G. Smith and A.R. Tatchell, ELBS.
- Experiments in General Chemistry, C.N.R. Rao and U.C. Aggarwal, East–West Press.

Mathematics (Major-I)

Course Title: Abstract Algebra

Course Code: BSE.260

Course Learning Outcomes:

L	T	P	Cr
4	0	0	4

At the end of the course the prospective teacher-trainees will be able to;

CLO1 Understand the concepts of groups, and subgroups, and the properties of permutation groups and alternating groups.

CLO2 Understand the concepts of cyclic groups, and generators, and apply Lagrange's Theorem and the properties of normal subgroups and quotient groups.

CLO3 Understand homomorphisms, isomorphism theorems, and Automorphism, inner Automorphism.

CLO4 Understand External and internal direct products.

Units/Hours	Content	Mapping with CLOs
Unit-1 **15 hours**	Binary operations, Semigroup, groups, groups of integers modulo n, Matrix groups, Groups of Quaternions, Symmetric groups, cyclic representation of permutations, even and odd permutations. Elementary properties of groups, Subgroups, Examples of subgroups, Order of group elements, Centralizer, Normalizer of a group.	**CLO1**
Unit-2 **15 hours**	Cyclic groups, Classification of subgroups of cyclic groups, Subgroups generated by a subset, Generators and relations, Generators of Sn and An, Cosets and Lagrange's theorem , Normal subgroups, Quotient groups.	**CLO2**
Unit-3 **15 hours**	Homomorphisms, Isomorphism Theorems, Cayley's Theorem, Automorphism, Inner automorphism, Automorphism group.	**CLO3**
Unit-4 **15 hours**	External and internal direct products and their properties. Cauchy's theorem for finite abelian groups, Fundamental theorem for finite Abelian group.	**CLO4**

Suggestive Mode of Transaction:

The course content transaction will include the following:

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussions, panel interactions, small theme-based seminars, cooperative teaching, team teaching, flipped learning, blended learning, and demonstration.

Suggestive Mode of Assessment: Assignments, Class tests, Problem-solving, Semester examinations.

Suggestive Readings:

- I.N. Herstein: *Topics in Algebra* (Second Edition), John Wiley & Sons (2003).
- J. B. Fraleigh: *A First Course in Algebra*, Addison Wesley.
- M.L. Santiago: *Modern Algebra*, (TMG).
- Joseph A. Gallian: *Contemporary Abstract Algebra*.

Mathematics (Major-II)

Course Title: Analytical and Solid Geometry
Course Code: BSE.261

L	T	P	Cr
4	0	0	4

Course Learning Outcomes:
At the end of the course the prospective teacher-trainees will be able to;

CLO1 Understand and apply the concepts of transformation of axes, shifting of origin, and rotation of axes. Solve problems involving joint equations of pairs of straight lines and equations of bisectors.

CLO2 Understand and apply the properties of ellipse, hyperbola, and sphere. Solve problems involving tangents, normals, and chord of contact for conic sections.

CLO3 Understand and apply the concepts of cylinders and cones, including the classification of different types (right circular, elliptic, hyperbolic, parabolic) and the equation of a cone with a vertex at the origin.

CLO4 Comprehend the equations of surfaces of revolution such as ellipsoids, hyperboloids, and paraboloids, and apply the concepts of tangent lines, tangent planes, and normal planes for general second-degree surfaces.

Units/Hours	Content	Mapping with CLOs
Unit-1 15 hours	Transformation of axes, shifting of origin, Rotation of axes in two dimension and three dimension, The invariants, Joint equation of pair of straight lines, and equations of bisectors. Parabola and its properties.	CLO1
Unit-2 15 hours	Ellipse and hyperbola with their properties. Intersection of three planes, condition for three planes to intersect in a point or along a line or to form a prism, Sphere: Section of a sphere by a plane, spheres of a given circle. Intersection of a line and a sphere. Tangent line, tangent plane, power of a point w.r.t. a sphere, radical planes.	CLO2
Unit-3 15 hours	Cylinder as surface generated by a line moving parallel to a fixed line and through fixed curve. Different kinds of cylinders such as right circular, elliptic, hyperbolic and parabolic in standard forms. Cone with a vertex at the origin as the graph of homogeneous equation of second degree in x, y, z. Cone as a surface generated by a line passing through a fixed curve and fixed point outside the plane of the curve, right circular and elliptic cones.	CLO3
Unit-4 15 hours	Equation of surface of revolution obtained by rotating the curve $f(x, y) = 0$ about the z-axis in the form of $f(x^2 + y^2, z) = 0$. Equation of ellipsoid, hyperboloid, and paraboloid in standard forms. Surfaces represented by general equation of 2^{nd} degree S = 0. Tangent lines, tangent planes and Normal plane.	CLO4

Suggestive Mode of Transaction:
The course content transaction will include the following:

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussions, panel interactions, small theme-based seminars, cooperative teaching, team teaching, flipped learning, blended learning, and demonstration.

Suggestive Mode of Assessment: Assignments, Class tests, Problem-solving, Semester examinations.

Suggestive Readings:

- Gorakh Prasad and H.C. Gupta: *Text Book on Coordinate Geometry*.
- S.L. Loney: *The Elements of Coordinate Geometry*, Macmillan and Company, London.
- Narayan, S.: *Analytical Solid Geometry*, Sultan Chand & Sons (2005).
- Kreyszig, E.: *Advanced Engineering Mathematics*.
- Thomas, G.B. and Finney, R.L.: *Calculus and Analytic Geometry*.

Mathematics (Major-III)

Course Title: Complex Analysis

L	T	P	Cr
4	0	0	4

Course Code: BSE.262

Course Learning Outcomes: At the end of the course, the students will be able to:

CLO1 Understand and apply properties of the extended complex plane, Möbius transformations, conformal mappings, and multivalued functions including branches of logarithm and power functions.

CLO2 Demonstrate mastery of differentiability of complex functions, Cauchy-Riemann equations, analytic and harmonic functions, and compute complex line integrals and primitives.

CLO3 State, prove, and apply fundamental theorems like Cauchy-Goursat's theorem, Cauchy integral formula, and Liouville's theorem; understand the maximum modulus principle and winding number.

CLO4 Develop and use Taylor and Laurent series expansions of complex functions, analyze singularities, and grasp applications involving residue calculations.

Units/Hours	Content	Mapping with CLOs
Unit-1 **15 hours**	The extended complex plane and its spherical representation. Lines and circles in the complex plane. Bilinear (Möbius) transformations, cross ratio, images of half planes and disks by Möbius transformations. Introduction to conformal mappings and Riemann mapping theorem (overview). Multivalued functions and their branches: argument, logarithm, power functions.	**CLO1**

Unit-2 **15 hours**	Derivative of a complex function. Cauchy-Riemann equations; sufficient conditions for differentiability. Analytic functions, analyticity at infinity. Harmonic functions and their conjugates. Curves, simply closed curves, complex line integrals, primitives, and path independence.	**CLO2**
Unit-3 **15 hours**	Cauchy-Goursat's theorem for rectangles, disks, and simply connected domains. Cauchy integral formula and its applications. Liouville's theorem. Gauss's mean value theorem. Maximum modulus principle. Classification of singularities.	**CLO3**
Unit-4 **15 hours**	Taylor and Laurent series expansions of complex functions. Determination of coefficients. Applications in calculation of residues (introductory). Examples illustrating series expansions and isolated singularities.	**CLO4**

Suggestive Mode of Transaction:

The course content transaction will include the following:

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussions, panel interactions, small theme-based seminars, cooperative teaching, team teaching, flipped learning, blended learning, and demonstration.

Suggestive Mode of Assessment: Assignments, Class tests, Problem-solving, Semester examinations.

Suggestive Readings:

- H.S. Kasana, Complex Variables: Theory and Applications, 2nd Edition, PHI, 2005.
- J.W.Brown & R.V. Churchil, Complex Variables and Applications, 8th Edition, McGraw-Hill, 2009
- J.B.Conway, Functions of One Complex Variable, 2nd Edition, narosa, 2002.
- S.Ponnusamy, Foundations of Complex Analysis, 2nd Edition, Narosa, 2005.

BOTANY (MAJOR)

Course Title: Plant Metabolism

L	T	P	Cr
4	0	0	4

Course Code: BSE.263

Course Learning Outcomes:

At the end of the course the prospective teacher-trainees will be able to;

CLO1 Students will understand different metabolic pathways and factors affecting photosynthetic efficiency.

CLO2 Students will learn carbohydrate metabolism, carbon oxidation pathways and their regulation in plants.

CLO3 Students will learn the mechanisms of ATP synthesis and metabolism of lipid

CLO4 Students will understand nitrogen metabolism and signal transduction in plants.

Units/ Hours	Contents	Mapping with CLOs
UNIT-I **12 hrs**	**Concept of metabolism:** Introduction, anabolic and catabolic pathways, regulation of metabolism, role of regulatory enzymes (allosteric, covalent modulation and Isozymes). **Carbon assimilation:** Photosynthesis,	**CLO1**

	photosynthetic pigments (chlorophylls and accessory pigments), antenna molecules and reaction centres, photochemical reactions, photosynthetic electron transport, PSI, PSII, Q cycle, CO_2 reduction, photorespiration, C4 pathways; Crassulacean acid metabolism; Factors affecting CO_2 reduction.	
UNIT-II 12hrs	**Carbohydrate metabolism**; Synthesis and catabolism of sucrose and starch. **Carbon Oxidation**: Glycolysis, oxidative pentose phosphate pathway, oxidative decarboxylation of pyruvate, regulation of PDH, NADH shuttle; TCA cycle, regulation of the cycle, mitochondrial electron transport, oxidative phosphorylation, cyanide-resistant respiration, factors affecting respiration.	**CLO2**
UNIT-III 10hrs	**ATP-Synthesis:** Mechanism of ATP synthesis, substrate level phosphorylation, chemiosmotic mechanism (oxidative and photophosphorylation), ATP synthase, Boyers conformational model, Racker's experiment, Jagendorf's experiment; role of uncouplers. **Lipid metabolism:** Synthesis and breakdown of triglycerides, β-oxidation, glyoxylate cycle, gluconeogenesis and its role in mobilisation of lipids during seed germination, α oxidation.	**CLO3**
UNIT-IV 11hrs	**Nitrogen metabolism**: Nitrate assimilation, biological nitrogen fixation (examples of legumes and non-legumes); Physiology and biochemistry of nitrogen fixation; Ammonia assimilation and transamination. **Mechanisms of signal transduction**: Receptor-ligand interactions; Second messenger concept, Calcium calmodulin.	**CLO4**

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions,

small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Suggested Readings:

1. Hopkins, W.G. and Huner, A. (2008). Introduction to Plant Physiology. John Wiley and Sons. U.S.A. 4th edition.
2. Taiz, L., Zeiger, E., Moller, I.M. and Murphy, A (2015). Plant Physiology and Development. Sinauer Associates Inc. USA. 6th edition.
3. Harborne, J.B. (1973). Phytochemical Methods. John Wiley & Sons. New York

Course Title: Plant Reproductive Biology

L	T	P	Cr
4	0	0	4

Course Code: BSE.264

Course Learning Outcomes:

At the end of the course the prospective teacher-trainees will be able to;

CLO1 Students will understand the reproductive development of plants and anther biology..

CLO2 Students will learn the structure and development of ovule in plants. genetic and molecular mechanisms of flowering, anther and pollen biology, ovule development, pollination and fertilization processes, self-incompatibility systems, and the structure and development of embryos, endosperms, and seeds, including their unique features and reproductive adaptations

CLO3 Students will learn pollination, fertilization and self-incompatibility systems in plants.

CLO4 Students will understand structure and development of embryos, endosperms, and seeds.

Units/Hours	Contents	Mapping with CLOs
UNIT-I 14 hrs	**Reproductive development**: Induction of flowering; flower as a modified determinate shoot. Flower development: genetic and molecular aspects. **Anther and pollen biology:** Anther wall: Structure and functions, microsporogenesis, callose deposition and its significance. Microgametogenesis; Pollen wall structure, MGU (male germ unit) structure, NPC system; Palynology and scope (a brief account); Pollen viability, storage and germination; Abnormal features: Pseudomonads, polyads, massulae, pollinia.	**CLO1**
UNIT-II 10 hrs	**Ovule**: Structure; Types; Special structures–endothelium, obturator, aril, caruncle and hypostase; Female gametophyte– megasporogenesis (monosporic, bisporic and tetrasporic) and megagametogenesis (details of Polygonum type); Organization and ultrastructure of mature embryo sac.	**CLO2**
UNIT-III 10 hrs	**Pollination and fertilization**: Pollination types and significance; adaptations; structure of stigma and style; path of pollen tube in pistil; double fertilization. **Self-incompatibility:** Basic concepts (interspecific, intraspecific, homomorphic, heteromorphic, GSI and SSI); Methods to overcome self- incompatibility: male sterility.	**CLO3**
UNIT-IV 11hrs	**Embryo, Endosperm and Seed:** Structure and types; General pattern of development of dicot and monocot embryo and endosperm; Suspensor: structure and functions; Embryo-endosperm relationship; Nutrition of embryo; Unusual features; Embryo development in Paeonia. Seed structure, importance and dispersal mechanisms; **Polyembryony and apomixes**: Introduction; Classification; Causes and applications.	**CLO4**

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions,

small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Suggested Reading:

1. Bhojwani, S.S. and Bhatnagar, S.P. (2011). The Embryology of Angiosperms, Vikas Publishing House. Delhi. 5th edition.
2. Shivanna, K.R. (2003). Pollen Biology and Biotechnology. Oxford and IBH Publishing Co. Pvt. Ltd. Delhi.
3. Raghavan, V. (2000). Developmental Biology of Flowering plants, Springer, Netherlands.
4. Johri, B.M. l (1984). Embryology of Angiosperms, Springer-Verlag, Netherlands.

Course Title: Plant Metabolism (Practical-I)

L	T	P	Cr
0	0	4	2

Course Code: BSE.265

Course Learning Outcomes:

1. Chemical separation of photosynthetic pigments.
2. Experimental demonstration of Hill's reaction.
3. To study the effect of light intensity on the rate of photosynthesis.
4. Effect of carbon dioxide on the rate of photosynthesis.
5. To compare the rate of respiration in different parts of a plant.
6. To demonstrate activity of Nitrate Reductase in germinating leaves of different plant sources.
7. To study the activity of lipases in germinating oilseeds and demonstrate mobilization of lipids during germination.
8. Demonstration of fluorescence by isolated chlorophyll pigments.
9. Demonstration of absorption spectrum of photosynthetic pigments.

Course Title: Plant Reproductive Biology (Practical-II)

L	T	P	Cr
0	0	4	2

Course Code: BSE.266

1. Anther: Wall and its ontogeny; Tapetum (amoeboid and glandular); MMC, spore tetrads, uninucleate, bicelled and dehisced anther stages through slides/micrographs, male germ unit (MGU) through photographs and schematic representation.
2. Pollen grains: Fresh and acetolyzed showing ornamentation and aperture, psuedomonads,
3. polyads, pollinia (slides/photographs,fresh material), ultrastructure of pollen wall(micrograph);
4. Pollen viability: Tetrazolium test germination: Calculation of percentage germination in different media using hanging drop method.
5. Ovule: Types-anatropous, orthotropous, amphitropous/campylotropous, circinotropous, unitegmic, bitegmic; Tenuinucellate and crassinu cellate; Special structures: Endothelium, obturator, hypostase, caruncle and aril (permanent slides/specimens/photographs).
6. Female gametophyte through permanent slides/ photographs: Types, ultrastructure of mature egg apparatus.
7. Intra-ovarian pollination; Test tube pollination through photographs.
8. Endosperm: Dissections of developing seeds for endosperm with free-nuclear haustoria.
9. Embryogenesis: Study of development of dicot embryo through permanent slides; dissection of developing seeds for embryos at various developmental stages; Study of suspensor through electron micrographs.

ZOOLOGY (MAJOR)

Course Title: DEVELOPMENTAL BIOLOGY

L	T	P	Cr
4	0	0	4

Course Code: BSE.267

Course Learning Outcomes (CLO)

At the end of the course the prospective teacher-trainees will be able to;

CLO1: Analyzes how organisms grow and develop from a single cell to a complex multicellular organism.

CLO2: Understands the cellular, molecular, and genetic mechanisms driving development.
CLO3: Understand key concepts of stem cells and regeneration.
ClO4: Explains Hox genes and body plan and develops comprehensive knowledge about developmental disorders.

I/ 16 hours	Early Embryonic Development - Gamete Formation and Fertilization Spermatogenesis and oogenesis. Mechanisms of fertilization (species-specificity, prevention of polyspermy). Cleavage and Blastulation Patterns of cleavage. Formation of the blastula/blastocyst. Gastrulation Mechanisms of cell movement (invagination, epiboly, ingression). Formation of germ layers (ectoderm, mesoderm, endoderm). Axis Formation Dorsal-ventral, anterior-posterior, and left-right axes. Fate mapping and cell lineage tracing techniques, Morphogen gradients and their role in early development	CLO1
II/14 hours	Organogenesis -Neurulation Formation of the neural tube. Neural crest cell migration and derivatives. Development of Major Organ Systems Cardiovascular system. Musculoskeletal system. Digestive and respiratory systems. Limb Development Signaling pathways (e.g., Hox genes, FGF, Shh). Proximal-distal, anterior-posterior, and dorsal-ventral patterning. Role of extracellular matrix in organogenesis, Programmed cell death (apoptosis) in development	CLO2
III/14 hours	Stem Cells and Regeneration -Types of Stem Cells Embryonic, adult, and induced pluripotent stem cells (iPSCs). Stem Cell Niches Maintenance and regulation of stem cells. Regeneration Mechanisms of tissue and organ regeneration. Case studies: Planarians, zebrafish, and mammals. Applications in Medicine Regenerative medicine and tissue engineering. Ethical considerations in stem cell research	CLO3
IV/16 hours	Hox Genes and Body Plans Role of Hox genes in body axis specification. Conservation of developmental pathways across species. Developmental Plasticity Phenotypic plasticity and environmental influences on development. Developmental Disorders Congenital Abnormalities Teratogens and their effects (e.g., thalidomide, alcohol). Genetic mutations leading to developmental disorders. Cancer as a Developmental Disease Links between developmental pathways and cancer (e.g., Wnt signaling). Model organisms in developmental biology: *Drosophila*, *Xenopus*, *C. elegans*	CLO4

Suggestive Mode of Transaction
The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Suggested Readings

1. Gilbert, S.F. & Barresi, M.J. (2020). *Developmental Biology* (12th ed.). Sinauer Associates.
2. Wolpert, L., Tickle, C., & Arias, A.M. (2019). *Principles of Development* (6th ed.). Oxford University Press.
3. Slack, J.M.W. (2021). *Essential Developmental Biology* (3rd ed.). Wiley-Blackwell.
4. Carlson, B.M. (2018). *Human Embryology and Developmental Biology* (6th ed.). Elsevier.
5. Hall, B.K., & Wake, D.B. (2021). *The Neural Crest in Development and Evolution*. Springer.
6. Gilbert, S.F. (2013). *Ecological Developmental Biology: Integrating Epigenetics, Medicine, and Evolution* (2nd ed.). Sinauer Associates.

Course Title: Animal Physiology

L	T	P	Cr
4	0	0	4

Course Code: BSE.268

Course Learning Outcomes (CLO)

At the end of the course the prospective teacher-trainees will be able to;

CLO1: Develop a basis for understanding the mechanisms by which animals perform vital functions, maintain homeostasis, and adapt to diverse environments.

CLO2: Understand the circulatory and respiratory systems.

CLO3: Understands comparative aspects of digestive and excretory system.

CLO4: Understands the musculoskeletal system.

Unit/ Hours	Contents	Mapping with CLOs
I/ 15 hours	**Homeostasis**-Concept of homeostasis and feedback mechanisms (positive and negative feedback). Regulatory systems: Nervous and endocrine systems. **Comparative Physiology** Principles of adaptation, acclimation, and acclimatization. Strategies for survival in extreme environments. **Neurons and Synapses** Structure and function of neurons. Action potentials and synaptic transmission. **Central and Peripheral Nervous Systems** Brain and spinal cord structure and function. Autonomic nervous system: Sympathetic and parasympathetic divisions. Thermoregulation in homeotherms and poikilotherms	CLO1
II/15 hours	**Circulatory and Respiratory Systems- Circulatory Systems:** Blood composition and its role in transport, Open vs. closed circulatory systems. Structure and function of the heart and blood vessels. Cardiac cycle and ECG. **Respiratory Systems** Mechanisms of gas exchange: Diffusion, countercurrent exchange. Respiratory structures: Lungs, gills, trachea. Oxygen transport and regulation (hemoglobin function). Respiratory pigments in invertebrates. **Adaptations** High-altitude and diving physiology.	CLO2
III/15 hours	**Digestive and Excretory Systems- Digestive Physiology** Structure and function of digestive organs. Enzymatic digestion and nutrient absorption. Hormonal regulation of digestion (gastrin, secretin, CCK), Gut microbiome and its role in health. **Excretory Physiology** Structure and function of kidneys	CLO3

	and nephrons. Mechanisms of filtration, reabsorption, secretion, and excretion. Osmoregulation and ion balance in aquatic and terrestrial animals. Excretory adaptations in desert animals.	
IV/15 hours	**Musculoskeletal System- Muscle Physiology** Types of muscle: Skeletal, smooth, and cardiac. Mechanism of contraction: Sliding filament theory. Energy sources for muscle contraction, Calcium regulation and muscle fatigue. **Skeletal System** Types of skeletons: Hydrostatic, exoskeleton, and endoskeleton. Bone structure, function, and remodeling. Locomotion and biomechanics.	CLO4

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Suggested Readings

1. 1. Hill, R.W., Wyse, G.A., & Anderson, M. (2021). *Animal Physiology* (5th ed.). Sinauer Associates.
2. Schmidt-Nielsen, K. (1997). *Animal Physiology: Adaptation and Environment* (5th ed.). Cambridge University Press.
3. Moyes, C.D., & Schulte, P.M. (2015). *Principles of Animal Physiology* (3rd ed.). Pearson.
4. Eckert, R., Randall, D., Burggren, W., & French, K. (2001). *Eckert Animal Physiology: Mechanisms and Adaptations* (5th ed.). W.H. Freeman.
5. Guyton, A.C., & Hall, J.E. (2020). *Textbook of Medical Physiology* (14th ed.). Elsevier.
6. Sherwood, L. (2015). *Animal Physiology: From Genes to Organisms* (2nd ed.). Cengage Learning.

Course Title: Developmental Biology (Practical-I)

Course Code: BSE.269

L	T	P	Cr
0	0	4	2

Course Learning Outcomes (CLO)

After completion of the course students will be able to:

CLO1: Learn to identify and differentiate stages of early development (cleavage, blastula, gastrula, neurula) using frog embryos, enhancing comprehension of vertebrate embryology.

CLO2: Acquire the ability to identify ectoderm, mesoderm, and endoderm from histological slides, reinforcing knowledge of tissue differentiation and organogenesis.

CLO3: Observe amphibian limb regeneration to understand morphogenesis, tissue differentiation, and the potential for regenerative medicine applications.

CLO4: Develop an in-depth understanding of spermatogenesis and oogenesis by analyzing testis and ovary sections, highlighting their significance in vertebrate reproduction.

Course Content

1. Prepare and observe testis sections to study the process of spermatogenesis in vertebrates.
2. Analyze ovary sections to study the stages of oogenesis and follicular development in vertebrates.
3. Observe the cleavage, blastula, gastrula, and neurula stages of a frog embryo using preserved specimens or models.
4. Observe Drosophila melanogaster life stages and dissect larvae to study imaginal discs and their role in metamorphosis.
5. Study histological slides to identify the three germ layers (ectoderm, mesoderm, endoderm) in vertebrate embryos.
6. Observe limb regeneration in amphibians like Ambystoma to understand morphogenesis and tissue differentiation.
7. Examine models and slides to study different types of placenta in mammals and their functions.
8. Study the effects of environmental factors like chemicals or temperature on developing embryos to understand congenital malformations.
9. Learn in vitro organ culture methods to study tissue development and differentiation in controlled environments.

Course Title: Animal Physiology (Practical-II)

L	T	P	Cr
0	0	4	2

Course Code: BSE.270

Course Learning Outcomes (CLO)

After completion of the course students will be able to:

CLO1: Gain proficiency in using a hemocytometer to count RBCs and WBCs, enabling evaluation of blood cell density and health status.
CLO2: Learn to measure blood glucose levels, offering insights into metabolic function and disorders like diabetes.
CLO3: Learn the use of a sphygmomanometer to measure blood pressure, understanding its role in assessing cardiovascular health.
CLO4: Understand the effects of pH and temperature on enzymatic activity.

Contents

1. Perform ABO and Rh blood grouping using antigen-antibody reactions to study blood compatibility.
2. Use a hemocytometer to count red and white blood cells, assessing their density in blood samples.
3. Measure blood glucose levels using colorimetric methods or a glucometer to evaluate metabolic function.
4. Use a sphygmomanometer to measure systolic and diastolic blood pressure and understand cardiovascular health.
5. Study the enzymatic breakdown of starch by salivary amylase under different pH and temperature conditions.
6. Record isotonic muscle contractions using a kymograph to study muscle physiology.
7. Measure respiratory rate under different physical conditions such as rest, exercise, and recovery.

8. Examine reflexes like knee-jerk and withdrawal to understand the functioning of the nervous system.
9. Prepare haemin crystals of human blood

PHYSICS (Minor)

Course Title: Modern Physics
Course Code: BSE.276

L	T	P	Cr
3	0	0	3

Course Learning Outcomes;
At the end of the course the prospective teacher-trainees will be able to;
CLO1 Comprehend fundamental quantum principles and apply Schrödinger equation to solve basic quantum systems.
CLO2 Understand angular momentum and spin in quantum systems and analyze atomic structure and magnetic properties.
CLO3 Interpret atomic and molecular spectra and comprehend the working principles and applications of basic laser system.
CLO4 Analyze crystal structures and electronic properties of materials and understand basic semiconductor devices and superconductors.

Unit/Hours	Contents	Mapping with CLOs
UNIT-I **13 hours**	**BASIS OF QUANTUM THEORY AND SCHRODINGER EQUATION** Limitations of classical mechanics; origin of quantum theory; blackbody radiation, photoelectric effect, Compton effect; wave–particle duality & de Broglie waves; Heisenberg uncertainty principle; Schrödinger's time-independent equation; particle in infinite & finite potential wells; tunneling	**CLO1**
UNIT-II **10 hours**	**QUANTUM ANGULAR MOMENTUM** Quantum numbers: Principal quantum number; Orbital quantum number; Magnetic quantum number, Electron probability density. General Formalism of Angular Momentum, Space quantization, Electron Spin and Spin Magnetic Moment, Stern- Gerlach Experiment, Zeeman Effect, Spin-Orbit coupling.	**CLO2**
UNIT-III **10 hours**	**ATOMIC, MOLECULAR SPECTRA AND LASERS:** Quantum model of the hydrogen atom (radial equation), overview of atomic and molecular spectra including rotational, vibrational, and rotational–vibrational spectra of diatomic molecules, lasers: introduction, He–Ne and Ruby lasers, applications	**CLO3**
UNIT-IV **12 hours**	**SOLID STATE PHYSICS & DEVICES:** Fundamentals of crystals and lattice structures, Bravais lattices, Miller indices, and reciprocal lattices for BCC, FCC, and HCP structures. Band theory of solids; classification of materials as conductors, insulators, and semiconductors; Hall effect; intrinsic and extrinsic semiconductors; temperature dependence of Fermi energy; p–n junctions and transistors. Introduction to superconductivity and its types.	**CLO4**

Suggestive Mode of Transaction
The course content transaction will include the following:

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, selections from theoretical readings, flipped learning, blended learning, demonstration, laboratory method

Books for Study

4. Perspectives of Modern Physics, Arthur Beiser, McGraw-Hill Inc.,US; International edition.
5. Introduction to Quantum Mechanics, David J. Griffiths, 2017, Cambridge University Press (CUP).
6. A Text book of Quantum Mechanics, P.M. Mathews & K. Venkatesan, 2nd Ed., 2010, McGraw Hill
7. Solid State Physics, C. Kittel, Wiley (2007)
8. Fundamentals of Molecular Spectroscopy, C. N. Banwell, McGraw Hill, New York, 4th Edition, 2017.

Books for Reference

5. Basic Quantum Mechanics, A.Ghatak (Mc Millan India) 2012.
6. Quantum Mechanics, Eugen Merzbacher, 2004, John Wiley and Sons, Inc.
7. Quantum Mechanics, G. Aruldhas, 2nd Edn. 2002, PHI Learning of India.
8. Quantum Mechanics, Bruce Cameron Reed, 2008, Jones and Bartlett Learning.
9. Solid State Physics, Aschcroft and N.D.Mermin, Thomson Press India (2003)
10. Physics of Atoms and Molecules, B. H.Bransden and C. J Joachain, Pearson, UK, 2nd Edition, 2003.

PHYSICS (MINOR)

Course Title: Physics Practical (Modern Physics)

Course Code: BSE.277

L	T	P	Cr
0	0	2	1

11. Frank-Hertz Experiment.
12. Planck's Constant Measurement.
13. Verification of the inverse square law for light intensity using a phototransistor.
14. Study of Electron spin resonance- determine magnetic field as a function of the resonance frequency
15. To determine the wavelengths of a laser source using diffraction grating
16. To determine the Landé g-factor in a free radical using an electron spin resonance spectrometer.
17. To study the magnetic field dependence of the transverse magnetoresistance of a given semiconductor sample.
18. Band gap of a semiconductor by four probe method.
19. Hall effect in Semiconductor
20. To determine the dielectric constant of material.

CHEMISTRY (MINOR)

Course Title: Foundations of Physical Chemistry

L	T	P	Cr
3	0	0	3

Course Code: BSE.278

Course Learning Outcomes:

At the end of the course the prospective teacher-trainees will be able to;

CLO1 Comprehend the fundamental terms and concepts of thermodynamics, surface chemistry, colloids, polymers, and phase equilibria, explain the laws of thermodynamics and their physical significance, and apply the concept to solve numerical problems.

CLO2 Apply Hess's law and bond enthalpy concepts to determine reaction enthalpies and evaluate the reliability of thermochemical data obtained from experiments or literature.

CLO3 Describe the optical, kinetic, and electrical properties of colloids and compare them with true solutions and suspensions, Interpret phase diagrams for one-, two-, and three-component systems using Gibbs phase rule, Explain the classification, molecular weight distribution, and general properties of polymers

CLO4 Recall the key principles of quantum mechanics, apply them to solve problems like particle-in-a-box and angular momentum, and evaluate the physical meaning and limitations of the solutions.

Units/Hours	Contents	Mapping with Course Learning Outcome
UNIT-I 11hours	**Thermodynamics-Concepts** Basic thermodynamic terms: system, surroundings, thermodynamic parameters and potentials, intensive and extensive properties, state and path functions, thermodynamics process, concept of heat and work, laws of thermodynamics (zero, first, second and third), heat capacities, Joule Thompson law, Carnot engine, Entropy, Gibbs free energy and Helmholtz energy, spontaneity criteria	CLO1 CLO2
UNIT-II 11hours	**Thermochemistry-Application** Standard state, standard enthalpy of formation – Hess's Law of heat summation and its applications. Heat of a reaction at constant pressure and at constant volume, enthalpy of neutralization, bond dissociation energy and its calculation from thermo–chemical data, temperature dependence of enthalpy using Kirchhoff's equation.	CLO1 CLO2
UNIT-III 11hours	**Surface Chemistry:** Adsorption phenomena, adsorption isotherms (Freundlich and Langmuir), catalysis, and industrial applications (Haber-Bosch Process). **Colloids:** Definition, classification, and comparison with true solutions and suspensions; optical, kinetic, and electrical properties. **Polymer Chemistry:** Polymers: Classification, examples and molecular weight distributions of polymers. **Phase Equilibria**: Gibbs phase rule, phase diagrams of one-, two-, and three-component systems, and their applications.	CLO1 CLO3
UNIT-IV 12 hours	**Quantum Chemistry:** Historical development of quantum mechanics, introduction to de Broglie hypothesis, and Heisenberg uncertainty principle; wavefunctions and their significance, postulates of quantum mechanics, operators, eigenvalues and eigenfunctions, Hermitian operators. Schrödinger equation (time-dependent and time-independent), stationary states and quantization. Application of particle-in-a-box (1D, 2D, and 3D) in conjugated alkenes. Formulas for angular momentum operators (orbital, spin, and total) and ladder operator method.	CLO4

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Suggested Readings:

● Glasstone, B. (2003) Thermodynamics for Chemists, East West Press, New Delhi. ISBN– 10: 8176710148.

● Rock, P.A. (1983) Chemical Thermodynamics, University Science Books, Sausalito, CA. ISBN 10: 1891389327

● Maron S.H., Prutton C.F. (1965) Principles of Physical Chemistry, 4th Edition, Mac Millan Publishing Company, New York. ISBN–10: 0023762306

● Atkin, P., Paula J, (2002) Atkin's Physical Chemistry, 7th Edition, Oxford University Press, London. ISBN: 9780199697403

● Kapoor, K.L (2006) A Text Book of Physical Chemistry, 6th Volume, Macmillan Publishers India Ltd., New Delhi. ISBN10: 0230332765

● Laidler, K.J. (1995) The world of Physical Chemistry, 3rd Volume, Oxford University Press, London. ISBN–10: 0198559194
● Jou D., Llebot J.E. (1990) Introduction to the Thermodynamics of Biological Processes, Prentice Hall. ISBN: 9780135028810
● Rajaram J., Kuriacose J. C. (1986) Thermodynamics for Students of Chemistry, Shoban Lal Nagin Chand & Co. Delhi ISBN–13
Negi, A. S.; S. C. Chand, A textbook of Physical Chemistry, 2nd edition, 2014 print.
● Thermodynamics for Chemists, Author: Samuel Glasstone, Publisher: East–West Press Pvt Ltd. (2008), ISBN–13: 8176710148.
Puri, B.R., Sharma, L.R., Pathania, M.S., Principles of Physical Chemistry; 46th edition, Pubs: Milestones Publisher, 2012–13

CHEMISTRY (MINOR)

Course Title: Practical (Physical Chemistry)

L	T	P	Cr
0	0	2	1

Course Code: BSE.279

Course Learning Outcomes:

At the end of the course the prospective teacher-trainees will be able to;

CLO1 To gain a positive, enjoyable learning experience, soundly based on scientific principles and practice.

CLO2 To cultivate good laboratory practice and develop technical skills relevant to quantitative analysis.

CLO3 To develop an environment which encourage an inquiring, investigate approach, developing competence and confidence

CLO4 To supplement and reinforce chemical principles taught in the theory units

Unit/Hours	Content	Mapping with Course Content
Unit-I 5 hours	Determination of heat capacity of the calorimeter and determining 1. Enthalpy of neutralization of strong acid and strong base 2. Heat of solution of Na2SO4 3. Lattice energy of NaCl (using Born–Haber cycle). 4. Enthalpy of hydration of copper sulphate	CLO1
Unit-II 10 hours	Determine the surface tension by (i) drop number (ii) drop weight method. Study the variation of surface tension of detergent solutions with concentration.	CLO2
Unit-III 10 hours	Determination of viscosity of aqueous solutions of (i) polymer (ii) ethanol and (iii) sugar at room temperature. Determination of critical solution temperature and composition of the phenol-water system and to study the effect of impurities on it.	CLO3
Unit-IV 5 hours	Study the kinetics of saponification of ethyl acetate. Preparation of neutral and ionic colloids. Study the equilibrium of $I_2(aq) + I^- \rightarrow I^{3-}$ (aq) by the distribution method:	CLO4

Suggested Readings:

- Khosla, B. D.; Garg, V. C. & Gulati, A., Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011).

- Athawale, V.D. & Mathur, P. Experimental Physical Chemistry New Age International: New Delhi (2001)
- Experiments in General Chemistry, C.N.R. Rao and U.C. Aggarwal, East-West Press.
- Findlay's Practical Physical Chemistry, Author: Alexander Findlay Publisher: Wiley, 1972, ISBN–10:0470258853.
- Advanced Practical Physical Chemistry, Author: J. B. Yadav, Publisher: Krishna Prakashan Media (Pvt) Ltd (2015), ISBN–10: 8182835925.
- Quantitative Organic Analysis by Vogel, Author: A. I. Vogel, Publisher: Wiley, John & Sons, Incorporated, ISBN–13: 780582442504.

MATHEMATICS (MINOR)

Course Name: Algebra-I

Course Code: BSE.280

L	T	P	Cr
4	0	0	4

Course Learning Outcomes

At the end of the course the prospective teacher-trainees will be able to;

CLO1 Understand the concepts of groups, and the properties of group

CLO2 Understand the concepts of subgroups, cyclic groups, and permutation group.

CLO3 Understand homomorphisms, isomorphism theorems,

CLO4 Understand the concept of a vector space and subspaces and apply the principles of linear dependence, linear independence

Units/Hours	Contents	Mapping with CLOs
UNIT-I 15 hours	Binary operations, Semigroup, groups, groups of integers modulo n, Matrix groups, Groups of Quaternions, Elementary properties of groups.	CLO1
UNIT-II 15 hours	Subgroups, Examples of subgroups, Order of group elements, Centralizer, Normalizer of a group. Symmetric groups, cyclic representation of permutations, even and odd permutations.	CLO2
UNIT-III 15hours	Cyclic group, Homomorphisms, Isomorphism Theorems of group, Ring, Field and its simple examples.	CLO3
UNIT-IV 15 hours	Definition of a vector space, subspaces with examples. Linear span, Linear dependence, Linear independence of vectors. Linear combination of vectors.	CLO4

Suggestive Mode of Transaction:

The course content transaction will include the following:

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussions, panel interactions, small theme-based seminars, cooperative teaching, team teaching, flipped learning, blended learning, and demonstration.

Suggestive Mode of Assessment: Assignments, Class tests, Problem-solving, Semester examinations.

Suggestive Readings:

- I.N. Herstein: *Topics in Algebra* (Second Edition), John Wiley & Sons (2003).
- J. B. Fraleigh: *A First Course in Algebra*, Addison Wesley.
- M.L. Santiago: *Modern Algebra*, (TMG).
- Joseph A. Gallian: *Contemporary Abstract Algebra*.
- Shanti Narayan & P.K. Mittal: *A Text Book of Matrices*, 10th Edition (2002), S. Chand & Co.
- Surjit Singh: *Linear Algebra*, 1997.

BOTANY (MINOR)

Course Title: Plant Physiology

L	T	P	Cr
3	0	0	3

Course Code: BSE.212

Course Learning Outcomes:

At the end of the course the prospective teacher-trainees will be able to;

CLO1 understand water potential, absorption, their movement in plants.

CLO2 learn the role of minerals and their deficiency symptoms in plants.

CLO3 understand the mechanism of phloem translocation and associated models to supports source-sink dynamics and roles of phytohormones

CLO4 analyze the physiological mechanisms of flowering.

Units/Hours	Contents	Mapping with CLOs
UNIT-I 10 hrs	**Plant-water relations**: Water Potential and its components, water absorption by roots, aquaporins, pathway of water movement, symplast, apoplast, transmembrane pathways, root pressure, guttation. Ascent of sap–cohesion-tension theory. Transpiration and factors affecting transpiration, antitranspirants, mechanism of stomatal movement.	**CLO1**
UNIT-II 12hrs	**Mineral nutrition**; Essential and beneficial elements, macro and micronutrients, criteria for essentiality, mineral deficiency symptoms, roles of essential elements, chelating agents. **Nutrient Uptake:** Soil as a nutrient reservoir, transport of ions across cell membrane, passive absorption, electrochemical gradient, facilitated diffusion, active absorption, role of ATP, carrier systems, proton ATPase pump and ion flux, uniport, co-transport, symport, antiport.	**CLO2**
UNIT-III 12hrs	**Translocation in the phloem**. Experimental evidence in support of phloem as the site of sugar translocation. Pressure–Flow Model; Phloem loading and unloading; Source–sink relationship. **Plant growth regulators:** Discovery, chemical nature (basic structure), bioassay and physiological roles of Auxin, Gibberellins, Cytokinin, Abscisic acid, Ethylene.	**CLO3**
UNIT-IV 11hrs	**Physiology of flowering**; Photoperiodism, flowering stimulus, florigen concept, vernalization, seed dormancy. **Phytochrome, crytochromes and phototropins**: Discovery, chemical nature, role in photomorphogenesis, low energy responses (LER) and high irradiance responses (HIR), mode of action.	**CLO4**

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions,

small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Suggested Readings:

1. Dennis, D.T., Turpin, D.H., Lefevre, D.D. and Layzell, D.B.(eds.) 1997, *Plant Metabolism* (2nd Edition). Longman, Essex, England.
2. Galston, A.W. 1989. *Life Processes in Plants*. Scientific American Library, Springer, Verlag, New York, USA.
3. Heldt, H.2003. *Plant Biochemistry*, Academic Press, Indian Edition, Reed Elsevier India Pvt. Ltd., New Delhi.
4. HopkinS, W.G. 1999, *Introduction to Plant Physiology* (2nd Edition). John Wiley & Sons, Inc., New York, USA.
5. Lea, P.J. and Leegood, R.C. 1999, *Plant Biochemistry and Molecular Biology*. John Wiley & Sons, Chickester, England.
6. Mohr, H. and Schopfer, P. 1995. *Plant Physiology*. Springer Verlag, Berlin, Germany.
7. Salisbury, F.B. and Ross, C.W. 2005, *Plant Physiology* (4th Edition). Eastern Press Bangalore, Pvt. Ltd.
8. Tiaz, I and Zeiger, E. 2006. *Plant Physiology* (4th Edition) Sinauer Associates, Inc., Publishers, Massachusetts, USA.

Course Title: Plant Physiology (Practical-I)

Course Code: BSE.214

L	T	P	Cr
0	**0**	**2**	**1**

Course Contents

1. Determination of osmotic potential of plant cell sap by plasmolytic method.
2. Determination of water potential of given tissue (potato tuber) by weight method.
3. Study of the effect of wind velocity and light on the rate of transpiration in excised twig/leaf.
4. Calculation of stomatal index and stomatal frequency from the two surfaces of leaves of a mesophyte and xerophyte.
5. To calculate the area of an open stoma and percentage of leaf area open through stomata in a mesophyte and xerophyte (both surfaces).
6. To study the phenomenon of seed germination (effect of light).
7. To study the effect of different concentrations of IAA on *Avena* coleoptile elongation (IAA Bioassay).
8. To study the induction of amylase activity in germinating barley grains.

Zoology (Minor)

Course Title: Cytology
Course Code: BSE.281
Course Learning Outcomes;

L	T	P	Cr
3	0	0	3

After successful completion of this course, the students will be able to;

CLO 1: Describe the structural organization and functional components of prokaryotic and eukaryotic

cells, including cell membranes and cell junctions.

CLO 2: Explain the structure and functions of major cellular organelles and cytoskeletal elements involved in cellular organization and intracellular transport.

CLO 3: Interpret the molecular basis of membrane transport, energy production, and metabolic compartmentalization in eukaryotic cells.

CLO 4: Analyze the mechanisms of cell division, cell cycle regulation, and their significance in growth and development.

CLO 5: Understand the basic principles of cell signaling pathways and their role in cellular communication and regulation.

UNIT/ hours	Content	Mapping With CLO
UNIT- I (12 Hrs.)	Cell and Plasma membrane Overview of Cells: Prokaryotic and eukaryotic cells, virus, viroids, mycoplasma, prions. Plasma membrane: Structure of Plasma membrane, Various models of plasma membrane. Transport across membranes: active and passive transport, facilitated transport. Cell junctions: tight junctions, desmosomes, hemi- desmosomes, gap junctions.	CLO1, CLO3
UNIT-II (11 Hrs.)	Cytoskeleton and Nucleus Cytoskeleton: Structure and functions of microtubules, microfilaments and intermediate filaments. Nucleus: Structure and functions of nucleus including nuclear envelope, nuclear pore complex, nucleolus, chromatin: euchromatin and hetrochromatin and packaging (nucleosome).	CLO1, CLO2
UNIT – III (11 Hrs.)	Endomembrane System, Mitochondria and Peroxisomes Endomembrane system: Structure and functions of endoplasmic reticulum, golgi apparatus, lysosomes. Mitochondria: Structure and functions, semi-autonomous nature, endosymbiotic hypothesis, mitochondrial respiratory chain. Peroxisome: Structure, function, chemiosmotic hypothesis	CLO2, CLO3
UNIT- IV (11 Hrs.)	Cell division and Cell Signaling Cell Division: Mitosis, meiosis, cell cycle and its regulation. Cell Signaling: Introduction to cell signalling, GPCR and role of second messenger (cAMP).	CLO4, CLO5

Suggestive Mode of Transaction

The course content will be transacted through: Interactive lectures with multimedia support, Group discussions and student presentations, Theme-based seminars, Cooperative and team teaching, Flipped and blended learning approaches

Suggested Books

1. Karp, G. (2016). Cell and Molecular Biology: Concepts and Experiments. VIII Edition. John Wiley and Sons. Inc. ISBN No-9781119454175.
2. De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia. ISBN No- 0470483377.
3. Cooper, G.M. and Hausman, R.E. (2019). The Cell: A Molecular Approach. VIII Edition. Oxford University Press; Sinauer Associates, MA. ISBN No 9781605358635.

FURTHER READING

1. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009). The World of the Cell. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco. ISBN No 9780805393934.

2. Bruce Albert, Bray Dennis, Levis Julian, Raff Martin, Roberts Keith and Watson James (2008). Molecular Biology of the Cell, V Edition, Garland publishing Inc., New York and London. ISBN No-9780815341055.

Zoology (Minor)

Course Title: Practical (Cytology)

L	T	P	Cr
0	0	2	1

Course Code: BSE.282

Course Learning Outcomes;

CLO 1: Students will acquire basic knowledge about different types of cells and their organelles.
CLO 2: Students will acquire basic knowledge of mitosis and meiosis.
CLO 3: Students will acquire skill of microtomy.

Content

1. Preparation of temporary stained squash of onion root tip to study various stages of mitosis.
2. Preparation of temporary stained squash of onion inflorescence to study stages of meiosis.
3. Study of various stages of meiosis through permanent slides.
4. Preparation of permanent slide to show the presence of barr body in human female blood cells/cheek cells.
5. Study different cell organelles using electron micrographs.
6. To carry out gram staining of the bacteria to study prokaryotic cells.
7. Project Report/ Model or Chart preparation / Visit to a research lab.

SUGGESTED BOOKS

ESSENTIAL:

1. Lal, S.S. (2016). Practical Zoology Vertebrate, XI Edition. Rastogi Publication, Meerut, ISBN 9789350780169.
2. Karp, G. (2016). Cell and Molecular Biology: Concepts and Experiments. VIII Edition. John Wiley and Sons. Inc. ISBN No-9781119454175.
3. Cooper, G.M. and Hausman, R.E. (2019). The Cell: A Molecular Approach. VIII Edition. Oxford University Press; Sinauer Associates, MA. ISBN No 9781605358635.

FURTHER READING

1.Bruce Albert, Bray Dennis, Levis Julian, Raff Martin, Roberts Keith and Watson James (2008).
2.Molecular Biology of the Cell, V Edition, Garland publishing Inc., New York and London. ISBN No 9780815341055.

STAGE-SPECIFIC CONTENT-CUM-PEDAGOGY COURSES (ANY TWO AS PER THE MAJOR AND MINOR SUBJECT)

PEDAGOGY OF PHYSICS-I

Course Title: Pedagogy of Physics-I

L	T	P	Cr
2	**0**	**0**	**2**

Course Code: BSE.271

Course learning Outcomes;

At the end of the course the prospective teacher-trainees will be able to;

CLO1 understand the nature and scope of Physics.

CLO2 understand the objectives of Physics to teach as senior secondary stage.

CLO3 appreciate the contribution of Indian and World Physicist in the development of Physics.

CLO4 understand the role of co-curricular activities in physics.

Unit/Hours	Contents	Mapping with CLOs
UNIT-I 7 hours	NATURE AND SCOPE OF PHYSICS Nature of science, Physics as a fundamental science, Place and values of teaching physics at senior secondary level, Correlation of Physics with other subjects.	CLO1
UNIT-II 7 hours	OBJECTIVES OF PHYSICS General objectives of teaching physics at the senior secondary school stage, Relation of science and society, impact of Physics on modern Indian society with reference to issues related with environment, globalization, industrialization and information technology.	CLO2
UNIT-III 8 hours	INDIAN AND GLOBAL PHYSICST CONTRIBUTION Contribution of eminent Indian Physicists: C.V Raman, M.N. Shah, K.S. Krishnan, J.V. Narlekar, J.C. Bose, S.N. Bose, H.J. Bhabha, S.Chander Shekhar, Vikram Sarabhai and Abdul Kalam Contribution of eminent world Physicists: Archimedes, Alexander Graham Bell, Madam Curie, Albert Einstein, Newton, Walter Kohn, Max Plank and Neil Bohr	CLO3
UNIT-IV 8 hours	RESOURCES AND ACTIVITIES IN PHYSICS Requirement & availability of local resources, Selecting & guiding projects in Physics, Community resources such Science Centres, Museums, Planatorium & Solar Observatory, Co-curricular Activities-meaning and importance, Guiding Principles for the organization of co-curricular Activities, Organization of Co-Curricular activities related to Physics, Excursions or Field Trip, Science club, Exhibition, Science fair.	CLO4

Suggestive Mode of Transaction

The course content transaction will include the following:

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, selections from theoretical readings, flipped learning, blended learning, demonstration, laboratory method

Books for Study

1. Innovation in Teaching Learning Process, Chauhan, S.S. (2000)., New Delhi: Vikas Publishing House Pvt. Ltd.
2. Science Teaching in Schools, Das, R.C. (1985), New Delhi: Sterling Publishers Pvt. Ltd.
3. Research in Teaching of Science, Gupta, N.K. (1997), New Delhi: APH Publishing Corporation.

Books for Reference

1. Methods and Techniques of Teaching, Kochar, S.K. (1997), New Delhi: Sterling Publishers Pvt. Ltd.
2. Teaching of Physics, Maitre, K. (1991), New Delhi: Discovery Publishing House.
3. Emerging Trends in Teaching of Physics, Prakash R. and Rath, T.N. (1996), New Delhi: Kanisha Publishers.
4. Innovative Science Teaching for Physical Science Teachers, Radha Mohan (2003), New Delhi: Prentice Hall Pvt. Ltd

Pedagogy of Chemistry-I

Course Name: Pedagogy of Chemistry-I

L	T	P	Cr
2	0	0	2

Course Code: BSE.272

Course Learning Outcomes

At the end of the course the prospective teacher-trainees will be able to;

CLO1: explain Nature, Scope and Historical Perspective of Chemistry.

CLO2: illustrate aims and objectives of teaching chemistry for sustainable development of society.

CLO3: categorize approaches and methods of teaching learning chemistry.

CLO4: apply appropriate pedagogy in teaching learning the concepts of chemistry.

Units/Hours	Contents	Mapping with Course Learning Outcome
UNIT-I 8 hrs	Nature, Scope and Historical Perspective of Chemistry a) Nature of science, Chemistry as a fundamental science, place & values of teaching chemistry at senior secondary level, Historical perspective of Physical Sciences. b) Contribution of eminent world and Indian chemists: C.V. Raman, M.N. Shah, K.S. Krishnan, J.V. Narlekar, J.C. Bose, S.N. Bose, H.J. Bhabha, S.Chand Shekhar, Vikram Sarabhai, Madam Curie And Albert Einstein.	CLO1

UNIT-II 8 hrs	Aims and Objectives of Teaching Chemistry a) General objectives of teaching chemistry at the senior secondary school stage, Correlation of chemistry with other subjects. b) Relation of science & society, impact of chemistry on modern Indian society with reference to issues related with environment, globalization, industrialization and information technology.	CLO2
UNIT-III 7 hrs	Various Approaches of Chemistry Teaching a) Inductive deductive, constructivist, experiential learning, art integrated learning in chemistry. b) Sports integrated learning, blended learning, interdisciplinary and multidisciplinary approaches in chemistry.	CLO3
UNIT-IV 7 hrs	Pedagogical Aspects of Chemistry Teaching a) Analytical pedagogical concerns in teaching of chemistry for higher order thinking skills such as critical, creative, communication, decision making, reflective. b) learner–centric and group–centric, lecture cum demonstration, activity based, discussion, problem–solving, laboratory, stem, steam, project based, scientific inquiry, hands on activity, discovery, experimentation, concept–mapping, collaborative and cooperative learning.	CLO4

Suggestive Mode of Transaction

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

SESSIONAL WORK: (Choose any three)

1. Explore contributions of Indian scientists in the development of Chemistry and make presentations on historical development of Chemistry.
2. Analyze recommendations of policies/commissions in context of Chemistry.
3. Develop concept maps on different concepts of chemistry.
4. Demonstrate different pedagogical approaches and strategies for transacting concepts of Chemistry.
5. Prepare write-ups on the teaching of Chemistry using interdisciplinary and multidisciplinary approaches as recommended in NEP 2020.
6. Any other project assigned by HEI.

Suggested Readings:-

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

• National Education Policy 2020, MoE, Government of India. 74

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

• NCERT, Textbooks of Chemistry at Secondary Stage.

• Mohan, R. (2002). Innovative Science Teaching for Physical Science Teachers. Prentice Hall of India Pvt. Ltd., New Delhi.

• Tobin, K.(1993). The Practice of Constructivism in Science Education. Lawrence Erlbaum Associates.

Pedagogy of Mathematics-I

Name of the Course: Pedagogy of Mathematics-I
Course Code: BSE. 273

L	T	P	Cr
2	0	0	2

Course Learning Outcomes:

At the end of the course the prospective teacher-trainees will be able to;

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

Units	Content
Unit-1	**Nature, Scope and Historical Perspective of Mathematics** • Development of Mathematics from a historical perspective. • Nature of Mathematical Knowledge – Axioms and Postulates, Conjectures, Proofs in Mathematics: inductive - deductive reasoning, theorems, mathematical modeling. • Importance of Mathematics knowledge in everyday life. • Recommendations of various committees, commissions and policies related to Mathematics education at Secondary stage (especially in National Education Policies and National Curriculum Frameworks).
Unit-2	**Aims and Objectives of Teaching Mathematics** • Aims and objectives of teaching Mathematics at secondary stage. • Learning outcomes and competencies of teaching Mathematics at the secondary stage. • Linkages of Mathematics with other school subjects and place in school curriculum.
Unit-3	**Pedagogical Aspects of Mathematics-I** • Inculcation of values through teaching of Mathematics. • Implication of various approaches to teaching Mathematics – inductive deductive, analytical synthetical, constructivist, blended learning, experiential learning, transdisciplinary, interdisciplinary, and multidisciplinary. • Learner-centric and participative methods of teaching of Mathematics: lecture cum demonstration, problem-solving, laboratory, project-based.

Unit-4	**Pedagogical Aspects of Mathematics-II** • Analytical pedagogical concerns in teaching of Mathematics for higher-order thinking skills such as critical, creative, decision-making, reflective, collaborative, and cooperative. • Techniques of teaching-learning Mathematics: oral, written, drill work, homework, self-study, group study, supervised study, concept-mapping, learning, art, and sports-integrated learning.

Practicum (Any Three)

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

Suggestive Mode of Assessment: Demonstration, field-based experience, library visits, classroom discussions, self-study, field observations, assignment preparation, classroom presentations, discussion forums, observation, research report, engaging in dialogue, flipped classroom.

Suggestive Readings:

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

PEDAGOGY OF BOTANY-I

Course Title: Pedagogy of Botany – I

L	T	P	Cr
2	0	0	2

Course Code: BSE.274

Course Learning Outcomes (CLO):

At the end of the course the prospective teacher-trainees will be able to;

CLO1 Understand the historical development of botany as a discipline, its significance in education, and the foundational principles for teaching botany effectively at the secondary level.

CLO2 Analyze the botany curriculum for secondary education and apply learner-centered pedagogical approaches to enhance understanding and engagement.

CLO3 Design and utilize appropriate teaching-learning resources and assessment tools to evaluate student understanding of botanical concepts.

CLO4 Explore innovative practices and address challenges in teaching botany, including the integration of technology and environmental awareness.

Units/Hours	Contents	Mapping with CLOs
UNIT-I **12 hours**	**Unit-I: Foundations of Botany and Its Teaching** • Importance of botany in school education. • Historical development of botany as a science. • Aims and objectives of teaching botany at the secondary level. • Correlation of botany with other sciences (chemistry, physics, environmental science). • Blooms taxonomy and its application in botany teaching.	**CLO1**
UNIT-II **12 hours**	**Unit-II: Curriculum and Pedagogical Approaches in Botany** • Critical analysis of the botany curriculum at the secondary level. • Learner-centered approaches: Constructivism, inquiry-based learning, and problem-solving. • Use of analogies, models, and real-life examples in teaching botany. • Lesson planning: Objectives, content, methodology, and evaluation.	**CLO2**
UNIT-III **10 hours**	**Unit-III: Teaching-Learning Resources and Assessment in Botany** • Teaching-learning resources: Herbarium, botanical gardens, microscopy, and digital tools. • Development and use of low-cost teaching aids. • Assessment techniques: Formative and summative assessments, practical examinations, and project-based evaluations. • Diagnostic and remedial teaching in botany.	**CLO3**
UNIT-IV **11 hours**	**Unit-IV: Innovations and Challenges in Botany Education** • Innovations in botany teaching: Virtual labs, simulations, and gamification. • Addressing misconceptions in botany. • Role of botany in promoting environmental awareness and sustainability. • Professional development of botany teachers.	**CLO4**

Suggestive Mode of Transaction

- Interactive lectures and discussions.
- Demonstration of experiments and practical activities.
- Group projects and presentations.
- Use of digital tools and virtual labs.
- Field visits and hands-on activities.
- Peer teaching and micro-teaching sessions.

Suggested Readings

1. Sharma, P. D. (2019). *Botany for Degree Students: Algae*. S. Chand Publishing.
2. Joyce, B., Weil, M., & Calhoun, E. (2015). *Models of Teaching* (9th ed.). Pearson.
3. National Council of Educational Research and Training (NCERT). (2013). *Teaching of Science*. NCERT.
4. Kumar, A. (2018). *Innovative Science Teaching* (4th ed.). PHI Learning.
5. Raven, P. H., Evert, R. F., & Eichhorn, S. E. (2017). *Biology of Plants* (8th ed.). W.H. Freeman and Company.
6. Pandey, B. P. (2020). *Plant Anatomy*. S. Chand Publishing.
7. Aggarwal, J. C. (2010). *Teaching of Life Science*. Vikas Publishing House.
8. Sharma, R. C. (2016). *Modern Science Teaching*. Dhanpat Rai Publishing.
9. Mangal, S. K., & Mangal, U. (2019). *Essentials of Educational Technology*. PHI Learning.
10. Anderson, L. W., & Krathwohl, D. R. (2001). *A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives*. Longman.
11. Passi, B. K. (2016). *Becoming a Better Teacher*. Sage Publications.
12. Vashist, R. P. (2017). *Teaching of Biological Sciences*. Pearson.
13. Carin, A. A., & Sund, R. B. (2015). *Teaching Science Through Discovery*. Pearson.
14. Sharma, R. A. (2018). *Teaching of Science*. R. Lall Book Depot.
15. Vanaja, M. (2016). *Teaching of Biological Science*. Neelkamal Publications.

Pedagogy of Zoology-I

Course Name: Pedagogy of Zoology-I

Course Code: BSE.275

L	T	P	Cr
2	0	0	2

Course Learning Outcomes

At the end of the course the prospective teacher-trainees will be able to;

- explain nature, scope, and importance of Biological Sciences,
- illustrate aims and objectives of teaching Biological Sciences for sustainable development of society,
- outline linkages between Biological Sciences and other subjects,
- identify the values and importance of Biological Sciences and alternative knowledge systems,
- summarize the historical/policies perspective of Biological Sciences,
- examine pedagogical concerns of Biological Sciences,
- categorize approaches and methods of teaching learning Biological Sciences,
- apply proper pedagogy in teaching learning the concepts of Biological Sciences,
- realize the importance of studying Biological Sciences as part of the school curriculum,
- identify the values and significance of Biological Sciences in School curricula,
- apply appropriate method/s in teaching concepts of Biological Sciences.

Unit/hours	Contents	Mapping with CLOs

Unit-I	Nature, Scope and Historical Perspective of Biological Sciences A. Nature, scope, and importance of Biological Sciences. B. Historical perspective of Biological Sciences. C. Contributions of Indian (ancient and modern) and other scientists. D. Biological science for sustaining self, society, environment, and world. E. Recommendations/suggestions of various committees, commissions, and policies in reference to Biological Sciences.	
Unit-II	Aims and Objectives of Biological Sciences A. Aims and objectives of teaching biological science as a component of multidisciplinary science. B. Learning outcomes and competencies of teaching Biological Sciences at secondary stage. C. Linkages of Biological Sciences with other school subjects and place of the Biological Sciences in school curriculum. D. Values of Biological Sciences; ethical, environmental and sustainability concerns.	
Unit-III	Pedagogical Aspects of Biological Sciences A. Implication of various approaches – inductive deductive, constructivist, experiential, art- integrated, blended learning, interdisciplinary and multidisciplinary approaches, stimulating the spirit of investigation and enquiry. B. Analytical pedagogical concerns in teaching of physical sciences for higher order thinking skills such as critical, creative, communication, decision making, reflective.	
Unit-IV	A. Methods of teaching learning Biological Sciences: learner-centric and group-centric, lecture cum demonstration, activity based, discussion, problem-solving, laboratory and hands on activity based, B. Sports- integrated, project based, inquiry, discovery, experimentation, concept-mapping, collaborative and cooperative learning; stem and steam concept.	

Suggestive Practicum (Any Three)

1. Plot a timeline of development of Biological Sciences from ancient to modern times mentioning the important developments.
2. Analyze and prepare a report on pedagogy of Biological Sciences with reference to NEP 2020.
3. Prepare a write up on ancient Indian contributions and practices in Ayurveda/Herbal medicines.
4. Develop concept maps on different concepts of Biological Sciences.
5. Demonstrate different pedagogical approaches and strategies for transacting concepts of Biological Sciences.
6. Any other project assigned by HEI.

Suggestive Mode of Transaction

Lecture cum discussion, demonstration, hands-on activities, experiential learning, inquiry, Group work, Presentations, multimedia.

Suggestive Mode of Assessment

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

Suggestive Reading Material

- National Council of Educational Research and Training. (April 2022). Mandate documents Guidelines for the development of National Curriculum Frameworks.
- National Education Policy 2020, MoE, Government of India.
- National Steering Committee for National Curriculum Frameworks, (2023). Draft National Curriculum Framework for School Education.
- NCERT, Textbooks of Biological Sciences at Secondary Stage.

SEMESTER-V

PHYSICS (MAJOR, Paper-I)

Course Title: Solid State Physics and Spectroscopy

Course Code: BSE.301

L	T	P	Cr
4	0	0	4

Course Learning Outcomes;

At the end of the course the prospective teacher-trainees will be able to;

CLO1 cultivate an in-depth understanding of the fundamental bases of solids.
CLO2 comprehend the concepts of lattice vibrations in solids.
CLO3 apply solid state concepts to obtain electric band structure of solids.
CLO4 understand rotation, vibrational and Raman spectroscopy of molecules.

Unit/Hours	Contents	Mapping with CLOs
UNIT-I **14 hours**	**CRYSTAL STRUCTURE** Lattice, basis, crystal, Lattice structure, Bravais lattice, Miller indices, packing fraction for simple cubic, hcp and fcc, Lattice parameter, interplanar spacing, reciprocal lattice to bcc, fcc and hcp, Crystal symmetry. Chemical Bonding (Ionic, covalent, hydrogen, metallic).	**CLO1**
UNIT-II **16 hours**	**LATTICE DYNAMICS** Vibrations of one dimensional monoatomic and diatomic chain, Normal modes and Phonons, Phonon spectrum, Long wavelength acoustic phonons and elastic constants, specific heat capacity, Density of states, thermal expansion and conductivity, Phonons: Vibrational Properties, normal modes, acoustic and optical phonons. Free Electron Gas in 1D, 2D, 3D. Heat capacity. Electrical conductivity. Hall effect. Thermal conductivity. Nearly Free Electron Approximation	**CLO2**
UNIT-III **16 hours**	**ENERGY BANDS IN SOLIDS** Free electron model-Drude and Sommerfield theories, Band theory of solids, Energy level splitting in a solid as a function of interatomic distance. Band formation in Silicon. Fermi-Dirac probability function, Nearly free electron theory (E-k curve), classification of solids on the basis of band theory, Introduction to semiconductor physics. **MAGNETIC PROPERTIES OF MATERIALS** Dia-, Para-, Ferro- and Antiferro- Magnetism. Introduction to Superconductivity & Superfluidity	**CLO3**

UNIT-IV **14 hours**	**MOLECULAR SPECTROSCOPY** Rotational levels in diatomic and polyatomic molecules, vibrational levels in diatomic and polyatomic molecules, diatomic vibrating rotator, Born-Oppenheimer approximation, vibrational levels, experimental aspects of vibrational and rotational spectroscopy of molecules, polarization of light and Raman effect, Raman Spectroscopy.	**CLO4**

Suggestive Mode of Transaction

The course content transaction will include the following:

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, selections from theoretical readings, flipped learning, blended learning, demonstration, laboratory method

Books for Study

1. Solid State Physics, C. Kittel, Wiley (2007)
2. Perspectives of Modern Physics, Arthur Beiser, McGraw Hill, New York, 6th Edition, 2006.
3. Fundamentals of Molecular Spectroscopy, C. N. Banwell, McGraw Hill, New York, 4th Edition, 2017.

Books for Reference

1. Solid State Physics, Aschcroft and N.D.Mermin, Thomson Press India (2003)
2. Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles, R. Eisberg and R. Resnick, Wiley, United States, 2nd Edition, 2006.
3. Elementary Solid State Physics, Ali Omar, Pearson (1999).
4. Physics of Atoms and Molecules, B. H.Bransden and C. J Joachain, Pearson, UK, 2nd Edition, 2003.

PHYSICS (MAJOR, Paper-II)

Course Title: Electronics (Analog and Digital)

L	T	P	Cr
4	0	0	4

Course Code: BSE.302

Course Learning Outcomes;

At the end of the course the prospective teacher-trainees will be able to;

CLO1 elucidate the fundamental notion of semiconductors, including their inherent features and applications.
CLO2 utilize various transistor configurations to investigate their applications.
CLO3 Evaluate the use of optical fiber in various communication systems and understand the concept of feedback and design of different oscillator circuits.
CLO4 understand of diverse numerical systems to perform arithmetic operations and conversions.

Unit/Hours	Contents	Mapping with CLOs

UNIT-I **14 hours**	**JUNCTION DIODE** pn junctions, V-I characteristics, Zener diode, voltage regulation, tunnel diode, LED and LCD, Solar cell, diode as circuit element, load line concept, Rectifiers: Half Wave, full wave and bridge rectifier, efficiency and ripple factor, filter, Qualitative ideas of filter circuits (Shunt capacitor, L section and π filters), Zener diode and voltage regulation, Introduction to Photonic devices (construction and working of solar cell, photo diode and LED)	**CLO1**
UNIT-II **14 hours**	**TRANSISTORS** Characteristics of a transistor, Transistor as an amplifier, Configurations-Common base(CB), Common emitter (CE) and Common collector (CC), Load line analysis, Operating point, Transistor biasing-Essentials of a transistor biasing circuit, Methods of transistor biasing-Base resistor, Feedback resistor and Voltage divider methods.	**CLO2**
UNIT-III **16 hours**	**FIBER OPTICS** Modes and configurations, Numerical Aperture, Optical sources – LED's and Lasers, Coupling sources to fibers, Optical detectors – PIN and APD detectors, Passive Optical components. **FEEDBACK AND OSCILLATOR CIRCUITS** Feedback concepts, Oscillator operation, Barkhausen condition, Phase shift oscillator, Wein Bridge Oscillator, Crystal Oscillator	**CLO3**
UNIT-IV **16 hours**	**NUMBER SYSTEM** Binary number system, Binary to decimal and decimal to binary conversion, Binary addition and subtraction, Octal number system, Hexadecimal system and conversions. **DIGITAL CIRCUITS** Fundamental gates-AND, OR and NOT gates, NAND and NOR Gates as Universal Gates. XOR and XNOR Gates, De Morgan's theorems, Boolean laws, Half adder, Full adder, Data processing and Sequential circuits, Shift registers and Counters.	**CLO4**

Suggestive Mode of Transaction

The course content transaction will include the following:

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, selections from theoretical readings, flipped learning, blended learning, demonstration, laboratory method

Books for Study

1. Electronic Principles, A.P. Malvino, 3rd Edition(1984), Tata Mcgraw Hill Edition, New Delhi.
2. Principle of Electronics, VK Mehta, S Chand and Company
3. Digital Electronics, Donald P. Leach, Albert Paul Malvino, Gautam Saha, 2014, Malvinolich.

Books for Reference

1. Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
2. Electronic Devices and circuits, S. Salivahanan & N. S. Kumar, 3rd Edition, 2012, Tata McGrawHill.
3. Electronic circuits: Handbook of design and applications, U. Tietze, Ch. Schenk, 2008, Springer.
4. Digital Systems: Principles & Applications, R.J.Tocci, N.S.Widmer, 2001, PHI Learning

PHYSICS (MAJOR)

Course Title: Physics Practical-I

L	T	P	Cr
0	0	4	2

Course Code: BSE.303

1. Band gap of a semiconductor by four probe method.
2. Hall effect in Semiconductor
3. Magnetoresistance measurement of semiconductor.
4. To determine the dielectric constant of material.
5. Measurement of magnetic susceptibility by Quinke's method.
6. To determine the complex dielectric constant and plasma frequency of a metal using Surface Plasmon Resonance (SPR) technique.
7. Four-probe method for resistance measurement.
8. Magnetic hysteresis loop on various magnetic materials
9. Determine the diffraction grating constant by means of the mercury spectrum.
10. To record the Franck-Hertz characteristic curve for Neon.
11. To determine the ionization potential of mercury.
12. Demonstration of Meissner effect.

Course Title: Physics Practical-II

L	T	P	Cr
0	0	4	2

Course Code: BSE.304

1. To determine the reverse saturation current and material constant of PN Junction.
2. Characteristics of Zener diode and construction of Voltage regulator.
3. Study the characteristics of a field effect transistor (FET) and design and study of amplifier of finite gain.
4. Study the Recovery time as a function of frequency of operation and switching current. Recovery time of junction diode and point contact diode..
5. Study the characteristics of a uni-junction transistor.
6. Study the frequency responses of a transistor amplifier (bipolar/FET) and obtain the input and output impedance of the amplifier.
7. Transistor characteristics in different configuration mode.
8. LC Oscillator (Hartley or Colpitt)
9. Full adder using AND, OR and XOR gates.
10. To build Flip-Flop (RS, Clocked RS, D-type and JK) circuits using NAND gates.

CHEMISTRY (MAJOR)

Course Title: Inorganic Chemistry-IV (Organometallic , Reaction Mechanisms and Bioinorganic Chemistry)

L	T	P	Cr
4	0	0	4

Course Code: BSE.305

Course learning Outcomes;

At the end of the course the student teachers will be able to;

CLO1: describe and analyze the structure, bonding, and preparation methods of organometallic compounds and electron counting of metal carbonyls.

CLO2: understand and describe the reaction kinetics and mechanisms of coordination complexes.

CLO3: comprehend and articulate the mechanisms and processes involved in electron transfer reactions and evaluate the role of organometallic compounds in industrial catalysis.

CLO4: understand and evaluate the roles of inorganic elements in biological systems, the function of metalloproteins and metalloenzymes in vital biochemical processes.

Units/Hours	Contents	Mapping with CLOs

UNIT-I **17 Hours**	**Introduction:** Definition and classification of organometallic compounds on the basis of bond type. Concept of hapticity of organic ligands. 18– electron rule: Introduction, 18 electron rule, counting of electrons and finding of metal–metal bonds, Compliance and violation of 18–electron rule. **Metal Carbonyls:** General methods of preparation (direct combination, reductive carbonylation, thermal and photochemical decomposition) of mono and binuclear carbonyls of 3d series. Bonding in metal carbonyls, Bonding modes of carbonyls, pi–acceptor behaviour of CO (MO diagram of CO to be discussed), synergic effect and use of IR data to explain extent of back bonding. **(c)Reactions of Metal Carbonyls:** Displacement reactions, additions reaction, redox reactions. Structures of mononuclear, binuclear, trinuclear and tetranuclear carbonyls. Electron count of mononuclear, polynuclear and substituted metal carbonyls of 3d series. Zeise's salt: Preparation and structure, evidences of synergic effect and comparison of synergic effect with that in carbonyls.	**CLO1**
UNIT-II **12 hours**	**Reaction Kinetics and Mechanism:** Introduction to inorganic reaction mechanisms. Lability and inertness of coordination complexes, Interpretation of lability and inertness of transition metal complexes using valence bond theory and Crystal field theory, Thermodynamic and Kinetic stability, Substitution reactions in octahedral substitution: SN1 and SN2, CFAE in Acid and base hydrolysis, Factors affecting rate of substitution reactions, Substitution reactions in square planar complexes: Trans– effect, theories of trans effect, Mechanism of nucleophilic substitution in square planar complexes.	**CLO3**
UNIT-III **15 Hours**	**Electron Transfer Reactions:** Introduction, Electron transfer processes, Mechanism of electron transfer: outer and inner sphere electron transfer processes, Two electron transfers, complementary reaction, non–complementary reaction **b)** Catalysis by Organometallic Compounds Study of the following industrial processes and their mechanism: 1. Alkene hydrogenation (Wilkinsons Catalyst) 2. Hydroformylation (Co salts) 3. Wacker Process 4. Synthetic gasoline (Fischer Tropsch reaction) 5. Synthesis gas by metal carbonyl complexes	**CLO4**
UNIT-IV **16 hours**	**(a) General Principles of Bioinorganic Chemistry:** Occurrence and availability of Inorganic elements in biological systems. Basics of Bio mineralisation. Uptake, transport and storage of metal ions by organisms - structure and functions of biological membranes - the generation of concentration gradients (the Na+ -K + pump) **(b) Metalloporphyrins/Metalloenzymes:** Dioxygen transport and storage - hemoglobin and myoglobin: electronic and spatial structures - hemeythrin and hemocyanine - synthetic oxygen carriers, model systems - blue copper proteins (Cu) - iron-sulfur proteins (Fe)- cytrochromes electron transport chain - carbon monoxide poisoning - iron enzymes - peroxidase, catalase and cytochrome P-450, copper enzymes - superoxide dismutase, carboxypeptidase, carbonicanhydrase, vitamin B12 and B12 coenzymes, nitrogen fixation. Medicinal bioinorganic chemistry: platinum complexes in cancer therapy – cis-platin and its mode of action – metal toxicity.	

Suggestive Mode of Transaction

The course content transaction will include the following;
Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Suggested Readings:

● Organometallics: A Concise Introduction, C.E.A. salzer, 2nd Edn., 1992.
● Basic Organometallic Chemistry, Concept, Synthesis and Application, 2nd Edn., 1992, B. D. gupta and A.J. Elias
● Huheey, J.E., Inorganic Chemistry, Prentice Hall, 1993.
● Lippard, S.J. & Berg, J.M. Principles of Bioinorganic Chemistry Panima Publishing Company 1994.
● Cotton, F.A. & Wilkinson, G, Advanced Inorganic Chemistry Wiley–VCH, 1999 Purcell,
● K.F & Kotz, J.C. Inorganic Chemistry W.B. Saunders Co, 1977.
● Cotton, F.A., Wilkinson, G., Gaus, P.L., Basic Inorganic Chemistry; 3rd edition, Pubs: John Wiley Sons. 1995.
● Lee, J.D., Concise Inorganic Chemistry; 4th edition, Pubs: Chapman Hall Ltd., 1991.
● Shriver, D.E., Atkins, P.W., Langford, C.H., Inorganic Chemistry; 4th edition, Oxford Publisher: Oxford University Press, 2006.
● Douglas, B. McDaniel, D., Alexander, J., Concepts and Models of Inorganic Chemistry; 3rd edition, Pubs: John Wiley and Sons Inc., 1994.
● Porterfield, W.W., Wesley, A., Inorganic Chemistry; Pubs: Addison–Wesley Publishing Company, 1984.
● Miessler, G.L., Larr, D.A., Inorganic Chemistry; 3rd edition, Pubs: Pearson Education Inc., 2004.
● Jolly, W.L., Modern Inorganic Chemistry; 2nd edition, Pubs: McGraw–Hill Publishing Company Limited, 1991.
● Purcell, K.F., Kotz, J.C., Inorganic Chemistry; Pubs: W.B. Saunders Company, 1977.

CHEMISTRY (MAJOR)

Course Title: Physical Chemistry-II (Quantum Chemistry)

Course Code: BSE.306

L	T	P	Cr
4	0	0	4

Course Learning Outcomes;

At the end of the course the prospective teacher-trainees will be able to;

CLO1: describe the historical development of quantum mechanics and apply the Schrödinger equation to solve problems related to wave functions.
CLO2: apply the general principles of quantum mechanics, including solving the Schrödinger equation for particle systems.
CLO3: solve and interpret the Schrödinger equation for various model systems and explain the significance of hydrogen atom wave functions, quantum numbers, electron spin, and Pauli's principle.
CLO4: apply approximation methods and compare and contrast valence bond and molecular orbital approaches.

Units/Hours	Contents	Mapping with CLOs

UNIT-I **15 hours**	**a)Historical Background of Quantum Mechanics**: Black body radiation, Planck's radiation law, photoelectric effect, Compton effect, de–Broglie hypothesis, Heisenberg's uncertainly principle, Wavefunctions and their significance, well behaved function, normalised and orthogonal wave function, Postulates of quantum mechanics, operators, eigen functions and eigen values, expectation values, commutation relations, Hermitian operators, bra-ket notations. **b)The Schrodinger Equation:** Time-dependent and Time Independent Schrödinger Equation, stationary states, Quantization. Exactly Solvable Model Systems: Free particle, particle-in-a-box (rigorous treatment), quantization of energy levels, zero-point energy and Heisenberg Uncertainty principle; wavefunctions, probability distribution functions, nodal properties.	**CLO1**
UNIT-II **13 hours**	**Concept of particle in 2D and 3D box:** Extension to two and three dimensional boxes, separation of variables, degeneracy, Setting up of Schrödinger equation and discussion of solution and wavefunctions (examples of conjugated alkenes) Operators for orbital and spin as well as total angular momentum, the ladder operator method for angular momentum.	**CLO2**
UNIT-III **15 hours**	**The Hydrogen Atom:** Outline of various steps in the solution of the electronic Schrödinger equation for hydrogen atom in polar coordinates, Radial and angular parts of the hydrogen atomic wave functions (atomic orbitals) and their variations for 1s, 2s, 2p, 3s, 3p and 3d orbitals. Significance of Quantum numbers, orbital and spin angular momentum quantum numbers ml and ms.	**CLO3**
UNIT-IV **15 hours**	**(a)Approximation Methods:** Perturbation method upto inclusion of perturbation of second order. Variation method, Linear variation principle Application of both the methods to Helium atom, self-consistent- field theory. **(b) Chemical Bonding in quantum:** Electron Spin, fermions and Bosons, Pauli's exclusion Principle, electron spin Beyond Exactly Solvable Models: H2+, Many electron wavefunctions (He, H2), Born- Oppenheimer approximation,Setting up of Schrödinger equation for many-electron atoms (He, Li). Quantum mechanical treatment of hybridisation and bonding in polyatomic systems.	**CLO4**

Suggestive Mode of Transaction

The course content transaction will include the following:

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Suggested Readings:-

- Physical Chemistry, A Molecular Approach by D.A. Mcquarrie and J.D. Simon, 2010 university science books.
- Quantum Chemistry, Ira N. Levine, 5th edition 1999 Prentice Hall.
- Quantum Chemistry, H. Eyring J. Walter and G.E. Kimball, 1944, John Wiley & Sons Ink.
- Molecular Quantum Mechanics, P.W. Atkins and R.S. Friedmann, 2010, Oxford University Press.
- Quantum Chemistry, Lowe, J.P. and K. Peteison Academic Press (2005)
- Fundamentals of Quantum Chemistry 2nd Ed. By J.E. House; Elsevier: USA.

● Morrison, R.T., Boyd, R.N., Organic Chemistry; 6th edition, Pubs: Prentice–Hall, 1992.
● Wade Jr., L.G., Singh, M.S., Organic Chemistry; 6th edition, Pubs: Pearson Education, 2008.
● Mukherji, S.M., Singh, S.P., Kapoor, R.P., Organic Chemistry; Pubs: Wiley Eastern Limited, 1985, Vol.I, II, III.
● Solomons, T.W., Fryhle, C.B., Organic Chemistry; 9th edition, Pubs: Wiley India, 2007.
● Carey, F.A., Organic Chemistry; 4th edition, Pubs: McGraw–Hill, 2000.
● Streitwieser, A., Clayton, Jr., Heathcock, H., Introduction to Organic Chemistry; 3rd edition, Pubs: Macmillan Publishing Company, 1989.
● R.K Prasad (2022), Quantum Chemistry. 5th edition, New Age International

CHEMISTRY (MAJOR)

Course Name: Inorganic Chemistry-IV (Practical-I Gravimetric Analysis)

Course Code: BSE.307

L	T	P	Cr
0	0	4	2

Course Learning Outcomes;

At the end of the course the prospective teacher-trainees will be able to;

CLO1: perform gravimetric analysis to accurately determine the concentration of metal ions in various samples.

CLO2: develop quantitative analytical skills necessary for the precise estimation of different metal ions in unknown samples using gravimetric methods.

CLO3: apply knowledge of precipitation reactions and their conditions to estimate metals.

CLO4: interpret and analyze experimental data accurately, ensuring reliable and reproducible results in the gravimetric estimation of metal ions.

Units/Hours	Contents	Mapping with Course Learning Outcome
30 hours	1. Estimation of copper as CuSCN 2. Estimation of Al (III) by precipitating with oxine and weighing as Al (oxine)$_3$ (aluminiumoxinate). 3. Determine nickel (II) in a given sample gravimetrically using dimethylglyoxime. 4. Estimate the iron as its ferric oxide from a given solution of ferrous ammonium sulfate gravimetrically. 5. Estimate chromium (III) as its lead chromate. 6. Estimate lead as its lead molybdate gravimetrically. 7. Estimate cobalt as mercury tetraisothiocyanatocobalt (II) [HgCo (NCS)$_4$]$_n$. 8. Determine silver (I) as its chloride gravimetrically. 9. Determine barium (II) as its chromate gravimetrically. 10. Determine cadmium (II) as [Cd (C_5H_5N)$_2$(SCN)$_2$] gravimetrically.	**CLO1** **CLO2** **CLO3** **CLO4**

Suggested Readings:–

● Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson, 2009.
● Experimental Organic Chemistry, Vol. I & II, P.R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.
● Laboratory Manual in Organic Chemistry, R.K. Bansal, Wiley Eastern.
● Vogel's Textbook of Practical Organic Chemistry, B.S. Furniss, A.J. Hannaford, V. Rogers, P.W.G. Smith and A.R. Tatchell, ELBS.

● Experiments in General Chemistry, C.N.R. Rao and U.C. Aggarwal, East–West Press.

CHEMISTRY (MAJOR)

Course Name: Physical Chemistry-III (Practical -II)

Course Code: BSE.308

L	T	P	Cr
0	0	4	2

Course Learning Outcomes;

At the end of the course the prospective teacher-trainees will be able to;

CLO1: perform potentiometric titrations to determine the concentration of various acids and the formal redox potential of metal ion systems, accurately analyzing the titration curves and interpreting the results.

CLO2: perform conductometric experiments to determine the strength of acids and the hydrolysis constant of salts.

CLO3: conduct colorimetric experiments to verify Lambert-Beer's Law and accurately interpreting absorbance data and applying principles of colorimetry.

CLO4: estimate the concentrations of metals in given solutions using flame photometry.

Units/Hours	Contents	Mapping with Course Learning Outcome
UNIT-I	**(I) Potentiometry:** a. Titration of HCl solution with NaOH solution using quinhydrone solution. b. Titration of CH_3COOH solution with NaOH. c. Titration of oxalic acid solution with NaOH. d. Titration of ferrous ammonium sulphate against potassium dichromate, and hence the formal redox potential of Fe^{2+} – Fe^{3+} system.	**CLO1**
UNIT-II	**(II)Conductometry:** a. To find strength of given strong acid. b. To find strength of mixture of strong and weak acids. c. To find equivalent conductance of a weak electrolyte at infinite dilution by Kohlrausch's law. d. To find dissociation constant of weak electrolyte. e. To find hydrolysis constant of aniline hydrochloride**.**	**CLO2**
UNIT-III	**(III)Colorimetry:** a. To verify the Lambert – Beer's Law. b. Determination of hydroxyl number of polymer.	**CLO3**
UNIT-IV	**(IV) Flame photometry:** a. Estimation of concentrations of Na, K, Ca, Mg in given solutions.	**CLO4**

Suggested Readings:-

● Findlay's Practical Physical Chemistry, Author: Alexander Findlay, Publisher: Wiley, 1972, ISBN–10: 0470258853.

● Advanced Practical Physical Chemistry, Author: J. B. Yadav, Publisher: Krishna Prakashan Media (P) Ltd (2015), ISBN–10: 8182835925.

● Quantitative Organic Analysis by Vogel, Author: A. I. Vogel, Publisher: Wiley, John & Sons, Incorporated, ISBN–13: 780582442504.

● Experimental Inorganic Chemistry, W.G. Palmer, Cambridge.

● Handbook of preparative Inorganic Chemistry, Vol. I & II, Brauer, Academic Press.

● Inorganic Synthesis, McGraw Hill.
● Experiments in General Chemistry, C.N.R. Rao and U.C. Aggarwal, East–West Press.
● Experiments in Physical Chemistry, R.C. Das and B. Behra, Tata McGraw Hill
● Advanced Practical Physical Chemistry, J.B. Yadav, Goel Publishing House.
● Advanced Experimental Chemistry, Vol. I, Physical, J.N. Guru and R. Kapoor, S. Chand & Co.
● Selected Experiments in Physical Chemistry, N.G. Mukherjee, J.N. Ghosh & Sons.
● Experiments Physical Chemistry, J.C. Ghosh, Bharati Bhavan.

MATHEMATICS (MAJOR-I)

Course Title: Ring Theory and Laplace Transforms

L	T	P	Cr
4	0	0	4

Course Code: BSE.309

Course Learning Outcomes:

At the end of the course the prospective teacher-trainees will be able to;

CLO1 Understand the concepts of rings, integral domains, and ideals, and apply the properties of quotient rings

CLO2 Understand and apply the properties of prime and maximal ideals, and use homomorphism and isomorphism theorems.

CLO3 Understand Field of quotients, polynomial rings, Euclidean ideal domain, Euclidean domain and fields.

CLO4 Understand and apply Laplace and Inverse Laplace Transforms to solve linear ordinary differential equations.

Units/Hours	Content	Mapping with CLOs
Unit-1 **15 hours**	Rings, Integral domains, Subrings and Ideals, Characteristic of a ring, Quotient rings.	**CLO1**
Unit-2 **15 hours**	Prime and Maximal Ideals, Homomorphisms, Isomorphism Theorems.	**CLO2**
Unit-3 **15 hours**	Field of quotients, polynomial rings, Euclidean ideal domain, Euclidean domain, definition of fields and its properties, subfield.	**CLO3**
Unit-4 **15 hours**	Laplace Transforms and Inverse Laplace Transforms.	**CLO4**

Suggestive Mode of Transaction:

The course content transaction will include the following:

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussions, panel interactions, small theme-based seminars, cooperative teaching, team teaching, flipped learning, blended learning, and demonstration.

Suggestive Mode of Assessment: Assignments, Class tests, Problem-solving, Semester examinations.

Suggestive Readings:

- J. B. Fraleigh: *A First Course in Algebra,* Addison Wesley.

- M.L. Santiago: *Modern Algebra*, (TMG).
- Joseph A. Gallian: *Contemporary Abstract Algebra*.
- B.S. Grewal: *Higher Engineering Mathematics*, Khanna Publishers, 36th Edition,

Mathematics (Major-II)

Course Title: Statics and Dynamics

Course Code: BSE.310

L	T	P	Cr
4	0	0	4

Course Learning Outcomes:

At the end of the course the prospective teacher-trainees will be able to;

CLO1 Understand and apply the principles of force composition and resolution using methods like parallelogram law, triangle law, polygon law, Lami's Theorem, and (ג-µ) theorem, and solve problems involving resultant forces and coplanar forces in equilibrium.

CLO2 Understand the laws of friction and apply them to analyze equilibrium of particles on rough surfaces, and calculate the centre of gravity of various objects such as rods, triangular laminas, and cones.

CLO3 Understand the concepts of rectilinear motion with uniform acceleration, apply Newton's laws of motion, and analyze the motion of particles connected by a string or moving along an inclined plane, including simple harmonic motion.

CLO4 Understand curvilinear motion of particles, velocity and acceleration concepts, and apply principles of work, power, and energy, including conservation of energy and energy calculations for simple pendulums and projectiles.

Units/ Hours	Content	Mapping with CLOs
Unit-1 **15 hours**	Composition and resolution of forces (parallelogram law, triangle law, polygon law, Lami's Theorem, (ג-µ) theorem, Resultant of a number of coplanar forces, parallel forces. Moments, Varignon's theorem of moments, Couples, Resultant of two Coplanar Couples, Equilibrium of two coplanar couples, Resultant of a force and a couple. Equilibrium of coplanar forces.	**CLO1**
Unit-2 **15 hours**	Friction, Laws of friction, Equilibrium of a particle on a rough plane. Centre of Gravity: Centre of gravity of a rod, triangular lamina, solid hemisphere, hollow hemisphere, solid cone and hollow cone.	**CLO2**
Unit-3 **15 hours**	Rectilinear motion in a starlight line with uniform acceleration, Newton's laws of motion, Motion of two particles connected by a string. Motion along a smooth inclined plane, Variable acceleration, Simple Harmonic Motion.	**CLO3**

Unit-4 **15 hours**	Curvilinear motion of particle in a plane, Definition of velocity and acceleration, projectiles, Oscillations: Free Vibrations, Simple Pendulum, Conical Pendulum. Work, Power and Energy: Kinetic and Potential energy, Conservative forces. Theorem of conservation of energy. Work done against gravity.	**CLO4**

Suggestive Mode of Transaction:

The course content transaction will include the following:

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussions, panel interactions, small theme-based seminars, cooperative teaching, team teaching, flipped learning, blended learning, and demonstration.

Suggestive Mode of Assessment: Assignments, Class tests, Problem-solving, Semester examinations.

Suggestive Readings:

- S.L. Loney: *Statics*, Macmillan and Company, London.
- R.S. Verma: *A Text Book on Statics*, Optical Pvt. Ltd., Allahabad.
- S.R. Gupta: *A Text Book of Dynamics*.
- F. Chorlton: *Dynamics*.
- S.L. Loney: *An Elementary Treatise on the Dynamics of a Particle and of Rigid Bodies*, Cambridge University Press, 1956.

Mathematics (Major-III)

Course Title: Probability and Statistics
Course Code: BSE.311

L	T	P	Cr
4	0	0	4

Course Learning Outcomes: At the end of the course, the students will be able to:

CLO1 Understand and apply core concepts and axioms of probability, solve problems on discrete and continuous probability spaces, and compute expectations.

CLO2 Analyze and apply random variables, probability distributions and density functions, joint, marginal and conditional distributions, and moments.

CLO3 Understand and use important discrete and continuous probability distributions in applications; evaluate means, variances, and moment generating functions.

CLO4 Apply fundamental concepts of statistical inference: sampling distributions, point and interval estimation, hypothesis testing, and basic non-parametric tests.

Units/Hours	Content	Mapping with CLOs
Unit-1 **15 hours**	Probability: classical, empirical and axiomatic definitions; Sample space, events, algebra of events; Conditional probability, Independence, Bayes' theorem; Random variables (discrete and continuous); Expectation, moments, variance, covariance, joint and marginal distributions, conditional expectation.	**CLO1**

Unit-2 **15 hours**	Discrete probability distributions: Binomial, Poisson, and Geometric; Mean, variance, moment generating functions; Continuous distributions: Uniform, Exponential, Normal, distributions; Applications and properties.	**CLO2**
Unit-3 **15 hours**	Conditional distributions (for discrete and continuous cases); Functions of random variables; Covariance, correlation, independence of random variables; Law of large numbers and Central Limit Theorem (statement and applications).	**CLO3**
Unit-4 **15 hours**	Introduction to statistics: Population and sample, statistics and sampling distributions; Point and interval estimation; Confidence intervals for means and proportions; Hypothesis testing: basic ideas, types of errors, large and small sample tests; Simple non-parametric tests (Chi-square, Sign test).	**CLO4**

Suggestive Mode of Transaction:

The course content transaction will include the following:

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussions, panel interactions, small theme-based seminars, cooperative teaching, team teaching, flipped learning, blended learning, and demonstration.

Suggestive Mode of Assessment: Assignments, Class tests, Problem-solving, Semester examinations.

Suggestive Readings:

- S.C.Gupta and V.K.kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons.
- V.K.Rohatgi and A.M.E. Saleh, An Introduction to probability and Statistics, Wiley.
- A.M. Mood, F.A. Graybill, and D.C. Boes, Introduction to the Theory of Statistics, McGraw-Hill.
- Sheldon Ross, A First Course in Probability, Pearson.

BOTANY (MAJOR)

Course Title: Mycology and Pathology

Course Code: BSE.312

L	T	P	Cr
4	0	0	4

Course Learning Outcomes:

At the end of the course the prospective teacher-trainees will be able to;

CLO1 Students will gain an understanding of the classification, and economic importance of fungi.

CLO2 Students will understand the general characteristics of major fungal groups representative genera.

CLO3 Students will learn the occurrence of lichens and their symbiotic relationship between algae and fungi, and the significance of mycorrhiza.

CLO4 Students will understand concepts plant pathology, as well as knowledge of the disease management of major bacterial, viral, and fungal diseases in crops.

Units/Hours	Contents	Mapping with CLOs
UNIT-I **12 hrs**	Fungi: General characteristics, Ecology and Distribution, Cell Wall composition, Ultra structure of mycelium. Fungal nutrition	**CLO1**

	(saprobic, biotrophic and symbiotic). Reproduction: Heterokaryosis and parasexuality. Classification and Economic importance of fungi.	
UNIT-II 12 hrs	General characteristics, thallus organization, mode of reproduction and life cycle: Myxomycota (*Physrum*), Oomycota (*Phytophthora*, *Albugo*), Zygomycota (*Rhizopus*), Ascomycota (*Saccharomyces*, *Aspergillus* and *Penicillium*), Basidiomycota (*Agaricus*), Deuteromycota (*Alternaria* and *Colletotrichum*).	**CLO2**
UNIT-III 10 hrs	Lichen-Occurrence, General characteristics, Growth forms and range of thallus organization, Nature of associations of algal and fungal partners, Reproduction. Mycorrhiza-Ectomycorrhiza, Endomycorrhiza and their significance.	**CLO3**
UNIT-IV 11hrs	Pathology: Terms and concepts, General symptoms, Geographical distribution of diseases, etiology, symptomology. Host-Pathogen relationships, disease cycle and environmental relation, prevention and control of plant diseases. Bacterial diseases-Citrus canker. Viral diseases-Tobacco Mosaic viruses, vein clearing. Fungal diseases-Early & Late blight of potato, Black stem rust of wheat, white rust of crucifers.	**CLO4**

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions,

small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Suggested Readings:

1. Agrios, G.N. (1997). *Plant Pathology*, 4th Edition, Academic Press, U.K.
2. Alexopoulos, C.J., Mims, C.W. and Blackwell, M. (1996). *Introductory Mycology*, 4th Edition, John Wiley and Sons (Asia) Singapore.
3. Singh, R.S. (1984). *Principles of Plant Pathology*. Oxford & IBH Publishing Co., Pvt. Ltd., New Delhi.
4. Singh, R.S. (1998). *Plant Diseases*. 7th Edition, Oxford & IBH, New Delhi.
5. Webster, J. and Weber, R. (2007). *Introduction to Fungi*. 3rd Edition, Cambridge University Press, Cambridge.
6. Mehrotra, R. S. (2010). *Plant Pathology*. Tata McGraw Hill Publishing Co., Pvt. Ltd., New Delhi.

Course Title: Plant Genetics and Breeding

Course Code: BSE.313

L	T	P	Cr
4	0	0	4

Course Learning Outcomes:

At the end of the course the prospective teacher-trainees will be able to;

CLO1 Students will understand the modes of reproduction in plants and the applications of self-incompatibility in plant breeding.

CLO2 Students will understand plant genetic resources, germplasm conservation, and various plant breeding methods.

CLO3 Students will learn hybridization techniques and breeding methods in plants.
CLO4 Students will undersatnd mutation breeding, haploidy, polyploidy and the application of marker-assisted selection (MAS) in plant breeding.

Units/Hours	Contents	Mapping with CLOs
UNIT-I **10 hrs**	Mode of reproduction in plants, Genetic consequences of self and cross fertilization, Mating systems in plants. Types, mechanism and utility of self-incompatibility, apomixis and male sterility in plant breeding.	**CLO1**
UNIT-II **12 hrs**	Plant Genetic resources: centres of origin, gene pool concept, primary, secondary and tertiary gene pool; Germplasm evaluation and conservation, Gene banks. Plant Introduction and selection (Pure line selection, Mass selection, recurrent selection and clonal selection) as methods of plant breeding.	**CLO2**
UNIT-III **11 hrs**	Hybridization: Procedure, choice of parents, pedigree and bulk methods, back cross methods, composite crosses, wide crosses: Significance, crossability, barriers and methods to overcome. Heterosis breeding: Hybrid varieties, synthetic varieties.	**CLO3**
UNIT-IV **12hrs**	Mutation Breeding: Procedure and achievements, Haploidy and polyploidy in plant breeding. Molecular Markers: Types of molecular markers, Mapping of Molecular markers, Marker assisted selection (MAS) for disease resistance and Qualitative Trait Loci (QTLs) and Application of MAS in breeding.	**CLO4**

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions,

small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Suggested Readings:

1. Allard, R.W. 1998. Princples of Plant Breeding, John Wiley & Sons, Inc., Singapore.
2. Chaudhury, R.C. 1994. Introduction to Plant Breeding. Oxford & IBH Pub. Co. Pvt. Ltd., New Delhi.
3. Gupta, P.K. 1999. Cytogenetics, Rastogi & co. Pub., Meerut, India.
4. Heyward, M;.D. , N.O. Bosemark and I. Romagosa 1993. Plant Breeding: Princples and Prospects, Chapman & Hall, Madras.
5. Miesfield, R.L. 1999. Applied Field Crops, Wiley-Liss, New York, USA.
6. Poehlman, J.M. 1987. Breeding Field Crops. An Avi Book Published by Van Nostrand Reinhold, New York.
7. Singh, B.D. 2008. Plant Breeding, Kalyani Publishers, New Delhi.
8. Singh, R.K. and Singh, P.K. 1994. A manual on Genetics and Plant Breeding, Experimental Techniques, Kalyani Publishers, New Delhi.
9. Snustad, D.P. and Simmons, M.J. 2000. Principles of Genetics (IInd. Edition) John Wiley & Sons Inc., New York, USA.

10. Vijendra Das, L.D. 1998. Plant Breeding. New Age International Publishers, New Delhi.
11. Vijendra Das L. D. 2000. Problems facing Plant Breeding, New Age Int. Pub., New Delhi.

Course Title: Mycology and Pathology (Practical-I)
Course Code: BSE.314
Course Learning Outcomes:

L	T	P	Cr
0	0	4	2

Contents

1. Introduction to the world of fungi (Unicellular, coenocytic/septate mycelium, asocarps & basidiocarps).
2. *Rhizopus*: study of asexual stage from temporary mounts and sexual structures through permanent slides.
3. *Aspergillus* and *Penicillium*: study of asexual stage from temporary mounts. Study of Sexual stage from permanent slides/photographs.
4. *Peziza*: sectioning through ascocarp.
5. *Alternaria:* Specimens/photographs and temporary mounts.
6. *Puccinia*: Herbarium specimens of Black Stem Rust of Wheat and infected Barberryleaves; sections/ mounts of spores on wheat and permanent slides of both the hosts.
7. *Agaricus*: Specimens of button stage and full grown mushroom; sectioning of gills of A*garicus*, fairy rings and bioluminescent mushrooms to be shown.
8. Study of phaneroplasmodium from actual specimens and /or photograph. Study of *Stemonitis* sporangia.
9. *Albugo:* Study of symptoms of plants infected with *Albugo*; asexual phase study throughsection/ temporary mounts and sexual structures through permanent slides.
10. Lichens: Study of growth forms of lichens (crustose, foliose and fruticose) on different substrates. Study of thallus and reproductive structures (soredia and apothecium) through permanent slides. Mycorrhizae: ectomycorrhiza and endo mycorrhiza (Photographs).
11. Phytopathology: Herbarium specimens of bacterial diseases; Citrus Canker; Angular leaf spot of cotton, Viral diseases: TMV, Vein clearing, Fungal diseases: Early blight of potato, Black stem rust of wheat and White rust of crucifers.

Course Title: Plant Genetics and Breeding (Practical-II)
Course Code: BSE.315
Course Learning Outcomes:

L	T	P	Cr
0	0	4	2

Contents

1. Visit to field for fixation of materials for meiotic studies.
2. Analysis of abnormal microsporogenesis in *Thespesia populnea/Sambucus*.
3. Analysis of structural hybridity of chromosomes in *Rhoeo discolor*.
4. Analysis of chiasma frequencies in *Vicia faba* and *Pennisetum*.
5. Analysis of frequency of B-chromosomes in *Sambucus nigra*.
6. Calculation of chromosomal associations from given data/ photomicrographs.
7. Study of cytological abnormalities from permanent slides.
8. Study of chromosome number in crop plants (wheat, rice, maize, sugarcane, cotton, potato, mustard).
9. Study of botany of crops (wheat, rice, maize, sugarcane, cotton, potato, mustard).
10. To work out type and level of ploidy of the plant material with given base number (*Sambucus nigra* based on x = 9).
11. Analysis and evolution of karyotypes at intra- or inter- specific level.

ZOOLOGY (MAJOR)

Course Title: HUMAN GENETICS
Course Code: BSE.316
Course Learning Outcomes (CLO)
At the end of the course the prospective teacher-trainees will be able to;

L	T	P	Cr
4	0	0	4

CLO1: Understand about human chromosomes, how to study structure of chromosomes and their modifications causing deadly diseases.
CLO2: Learn the clinical significance of chromosomal abnormalities in genetic disorders.
CLO3: Understand about metabolic disorders, management and treatment.
CLO4: analyze techniques used for diagnosis of human genetic disorders.
CLO5: Gain hands-on experience in observing human genetics disorders.

Units/ Hours	Contents	Mapping with course Learning Outcome
Unit 1 **10 hours**	**Introduction to Human Chromosomes and Human Genetics** • Human Chromosome: Discovery, Classification and nomenclature. • Human karyotyping and its application • Chromosome structural modification: Philadelphia chromosome, Cri-du-chat syndrome, Parder-Willi Syndrome, Burkitt's lymphoma. • **Fragile X syndrome, Huntington's disease** and **muscular dystrophy** • **Chromosome banding techniques (G-banding, Q-banding, R-banding)** **Role of telomeres and centromeres in chromosome stability**	**CLO 1**
Unit 2 **13 hours**	**Human Disorders** • Autosomal disorders: Thalassemia. • X-linked disorders: Hemophilia and Colour blindness • Non-disjunction of autosomes: Down's Syndrome, Patau's Syndrome and Edwards Syndrome • Non-disjunction of sex chromosomes: Klinefelter's Syndrome, Turner's syndrome, XXX Syndrome and XYY Syndrome. • Mitochondrial inheritance disorders (e.g., Leber's Hereditary Optic Neuropathy)	**CLO 2**
Unit 3 **10 hours**	**Metabolism disorders** • Phenylketonuria, Albinism and G6PD Deficiency • Lysosomal storage disorders: Gaucher disease and Tay-Sachs disease. • Metal metabolism disorders: Wilson disease and hemochromatosis. • Glycogen storage disease	**CLO 3**

	• Role of newborn screening in early diagnosis of metabolic disorders	
Unit 4 **12 hours**	**Diagnosis, prevention & treatment of Human Genetic Disorders** • Prenatal Diagnosis: Concept of Prenatal diagnosis and its importance. • Invasive techniques: CVS & Amniocentesis • Non-invasive techniques: Ultrasonography, Biochemical markers • Pedigree Analysis, its importance and Symbols used in Pedigree • Genetic Counselling and its purpose • Gene Therapy for human genetic disorders. • Ethical, legal, and social issues in genetic testing	**CLO 4 & 5**

Suggesting readings

Connor & Smith (1997). Essentials of Medical Genetics. Blackwell

2. Davies (1993). Human Genetic Disease Analysis. IRL
3. Emery and Mueller (1992). Elements of Medical Genetics. ELBS
4. Jorde et al (2005). Medical Genetics. Elsevier

5 .Korf (2006). Human Genetics. Blackwell

6. Lewis (2006). Human Genetics. WCB

7 .Maroni (2001). Molecular and Genetic Analysis of Human Traits. Blackwell

Course Title: Concept of Evolution and Systematics

L	T	P	Cr
4	0	0	4

Course Code: BSE.317

Course Learning Outcomes (CLO)

At the end of the course the prospective teacher-trainees will be able to;

CLO1: Grasp the fundamental principles and mechanisms of evolution, including natural selection, genetic drift, mutation, and gene flow, as driving forces of biodiversity and adaptation

CLO2: evaluate various forms of evidence supporting evolutionary theory, such as fossil records, comparative anatomy, molecular data, and biogeographical patterns.

CLO3: explain the principles of systematics and taxonomy, including the classification of organisms, taxonomic hierarchies, and the rules of nomenclature.

CLO4: construct and analyze phylogenetic trees to infer evolutionary relationships and understand the historical development of species.

Unit/Hours	Contents	Mapping with course learning outcome
Unit I/ **16 Hours**	**Introduction to Evolutionary Biology:** Theories of evolution, Origin of life, Speciation and Extinction, Molecular evidence:	**CLO1**

	DNA and protein sequences. Hardy-Weinberg equilibrium and population genetics, pattern of evolution. Adaptive radiation and convergent evolution, Genetic drift, gene flow, mutation.	
Unit II/ **14 Hours**	**Advance evolutionary biology:** Molecular Evolution, Speciation, gradualism vs. punctuated equilibrium, human and horse evolution, latest evolutionary trends and research, applications of the study of evolution, Evolution of genomes and gene duplication.	**CLO2**
Unit III/ **14 Hours**	**Biosystematics:** basic concepts, concept of species: biological, morphological, phylogenetic, and ecological, Taxonomic Tools and Techniques, Nomenclature and Rules, Use of museum and herbarium in taxonomy.	**CLO3**
Unit IV/ **16 Hours**	**Applications in Biosystematics:** Methods of phylogenetic tree construction, molecular clocks and evolutionary time scales, Software and tools for biosystematics, Protein and nucleotide sequence analysis, Barcoding of life and its use in species identification.	**CLO4**

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Suggested Readings

1. Evolution: Making sense of life by Carl Zimmer and Douglas Emlen, 2020, 3rd Edition
2. Evolution by Carl T. Bergstrom, Lee Alan Dugatkin, 2016. 2nd Edition
3. Modern textbook of Zoology: Vertebrates by R.L. Kothpal, 2019-20, 4th Edition
4. Modern textbook of Zoology: Invertebrates by R.L. Kothpal, 2019-20, 12th Edition
5. Mayr, E. &Ashlock, P.D., Principles of Systematic Zoology. 1991. 2nd edition. McGraw Hill International Edition
6. Relevant research articles and digital resource

Web Resources:

- https://www.britannica.com/animal/animal/Animal-diversity
- https://www.springer.com/series/10153
- https://www.springer.com/series/15188

Course Title: Human Genetics (Practical-I)

L	T	P	Cr
0	0	4	2

Course Code: BSE.318

Course Learning Outcomes (CLO)

After completion of the course students will be able to:

CLO1: Understand the techniques used to prepare and analyze human karyotypes.
CLO2: Learn the clinical significance of chromosomal abnormalities in genetic disorders.
CLO3: Develop the ability to construct family pedigrees from given data.
CLO4: Understand the applications of fingerprint patterns in forensic science for personal identification.

CLO5: Analyze the influence of genetics versus environment on phenotypic traits.

Course Content

1. Preparation and analysis of human karyotypes to identify chromosomal abnormalities like Down syndrome, Turner syndrome, and Klinefelter syndrome.
2. Construction and interpretation of pedigrees to study inheritance patterns of genetic disorders like hemophilia and color blindness.
3. Examination of Barr bodies in epithelial cells to understand X-chromosome inactivation in females.
4. Collection and study of fingerprint patterns to understand their inheritance and applications in forensic science.
5. Preparation and observation of human metaphase chromosomes from cultured lymphocytes.
6. Comparative study of phenotypic similarities and differences in monozygotic and dizygotic twins to explore the influence of genes and environment.
7. Analysis of genetic polymorphisms such as PTC (phenylthiocarbamide) tasting ability and understanding their inheritance.
8. Construction and analysis of family pedigrees to study inheritance patterns of genetic disorders (e.g., sickle-cell anemia).

Course Title: Concept of Evolution and Systematics (Practical-II)

L	T	P	Cr
0	0	4	2

Course Code: BSE.319

Course Learning Outcomes (CLO)

At the end of the course the prospective teacher-trainees will be able to;

CLO1: Students will gain the ability to determine allelic and gene frequencies, understand fossil evidence in tracing evolutionary history, and comprehend the evolutionary significance of vestigial structures.

CLO2: Students will be able to compare DNA or protein sequences to construct phylogenetic trees, and compare embryonic development stages in different vertebrate species to identify homologous structures.

CLO3: Students will observe and analyze morphological or behavioral adaptations of local species,

Contents

1. Determination of allelic and gene frequency
2. observe and identify fossil specimens and understand their role in tracing evolutionary history
3. To compare DNA or protein sequences of different species and construct phylogenetic trees.
4. To compare embryonic development stages in different vertebrate species and identify homologous structures.
5. To identify vestigial structures in humans and other animals and understand their evolutionary significance.
6. Study of different type of taxonomic keys using examples of different taxa
7. Observe the morphological or behavioral adaptations of local plants or animals (e.g., cactus spines, camouflaged insects).
8. To identify vestigial structures in humans and other animals and understand their evolutionary significance.

PHYSICS (MINOR)

Course Title: Thermal and Nuclear Physics

Course Code: BSE.327

Course Learning Outcomes;

L	T	P	Cr
3	0	0	3

At the end of the course the prospective teacher-trainees will be able to;

CLO1 Understand and apply the laws of thermodynamics and kinetic theory

CLO2 Apply classical and quantum statistical methods to interpret macroscopic thermodynamic properties and analyze phase transitions

CLO3 Understand nuclear properties and models, and analyze radioactive decay and nuclear reactions

CLO4 Comprehend radiation detection techniques and classify elementary particles based on their properties and interactions.

Unit/Hours	Contents	Mapping with CLOs
UNIT-I **11 hours**	**THERMODYNAMICS AND KINETIC THEORY** Laws of Thermodynamics (Zeroth, First, Second, Third), Internal energy, Thermodynamic processes, Work in isothermal & adiabatic processes, Reversible & irreversible processes, Entropy, Carnot cycle, Maxwell relations; Kinetic theory: Maxwell velocity distribution, Mean free path, Transport phenomena (viscosity, conduction, diffusion), Equipartition theorem and applications	**CLO1**
UNIT-II **10 hours**	**STATISTICAL MECHANICS** Classical ensembles: Microcanonical, Canonical, Grand Canonical; Partition functions, Thermodynamic quantities, Fluctuations; Maxwell-Boltzmann statistics; Quantum statistics: Bose-Einstein and Fermi-Dirac statistics, Bose-Einstein condensation, Debye theory of specific heat, Fermi gas, Phase transitions, Clausius-Clapeyron equation	**CLO2**
UNIT-III **12 hours**	**NUCLEAR STRUCTURE AND REACTIONS** Nuclear composition: isotopes, isobars, isomers, mirror nuclei; Nuclear properties: mass, charge, size, density, binding energy; Nuclear models: Liquid drop, Shell model; Radioactive decay (α, β, γ), Half-life, Decay series, Dating techniques; Nuclear reactions: Fission, Fusion, Nuclear reactors	**CLO3**
UNIT-IV **12 hours**	**NUCLEAR DETECTORS AND ELEMENTARY PARTICLES** Interaction of radiation with matter; Nuclear detectors: Gas-filled counters, Ionization chamber, GM counter, Proportional counter, Cloud & Bubble chambers, Semiconductor and Scintillation detectors; Elementary particles: Classification, Bosons & Fermions, Leptons, Hadrons, Quarks; Quantum numbers, Fundamental forces, Standard Model	**CLO4**

Suggestive Mode of Transaction

The course content transaction will include the following:

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, selections from theoretical readings, flipped learning, blended learning, demonstration, laboratory method

Books for Study

1. R. K. Pathria and P. D. Beale, Statistical Mechanics, Academic Press, USA, 2011.
2. K. Huang, Statistical Mechanics, Wiley, India, 2nd Edition, 2011.
3. Heat and Thermodynamics, Brijlal and Subramaniam, 2008, S Chand.
4. Perspectives of Modern Physics, International edition, Arthur Beiser, McGraw-Hill Inc.,US.
5. Introduction to Modern Physics, Rich Meyer, Kennard, Coop, 2002, Tata McGraw Hill.
6. Introductory Nuclear Physics, Kenneth S. Krane, 2008, Wiley India Pvt. Ltd..

7. Introduction to Elementary Particles, D. Griffith, John Wiley & Sons

Books for Reference

1. Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, 2009, Springer.
2. Statistical Physics, L. D. Landau and E. M. Lifshitz, UK, 3rd Edition, 1980.
3. F. Reif, Fundamental of Statistical and Thermal Physics, McGraw-Hill, USA, 1965.
4. Modern Physics, J.R. Taylor, C.D. Zafiratos, M.A. Dubson, 2009, PHI Learning.
5. Concepts of Nuclear Physics, Bernard L. Cohen, 1998, Tata McGraw Hill.
6. Atomic and nuclear physics, T. A. Littlefield and N. Thorley, Van Nostrand Reinhold. Digital Electronics, Donald

PHYSICS (MINOR)

L	T	P	Cr
0	0	2	1

Course Title: Physics Practical (Thermal and Nuclear Physics)
Course Code: BSE.328

1. To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method.
2. To determine the Coefficient of Thermal Conductivity of Cu by Searle's Apparatus.
3. To determine the Coefficient of Thermal Conductivity of a bad conductor by Lee and Charlton's disc method.
4. To study the variation of Thermo-Emf of a Thermocouple with Difference of Temperature of its Two Junctions.
5. To determine the Temperature Coefficient of Resistance by Platinum Resistance Thermometer (PRT).
6. To calibrate a thermocouple to measure temperature in a specified Range using (1) Null Method, (2) Direct measurement using Op Amp difference amplifier and to determine Neutral Temperature
7. Solid State Nuclear Track Detector (SSNTD)
8. G.M. Counters: characteristics, dead time and counting statistics
9. Scintillation detector-energy calibration, resolution and determination of gamma ray energy
10. To setup the Millikan oil drop apparatus and determine the charge of an electron

CHEMISTRY (MINOR)

Course Name: Fundamental Concepts of Organic Chemistry and Spectroscopy
Course Code: BSE.329

L	T	P	Cr
3	0	0	3

Course Learning Outcomes:
At the end of the course the prospective teacher-trainees will be able to;

CLO1: Understand, apply, and analyze key concepts of organic chemistry, including classification, nomenclature, electronic effects, reaction mechanisms, stereochemistry, and conformational analysis of alkanes, alkenes, alkynes, and cycloalkanes.

CLO2: Evaluate and analyze the structure, reactivity, and preparation of aromatic hydrocarbons, polynuclear hydrocarbons, alkyl and aryl halides, and organometallic compounds, including their mechanisms and applications.

CLO3: Analyze and evaluate fundamental concepts of aromatic hydrocarbons, including aromaticity, electrophilic aromatic substitution, and reactions of polynuclear hydrocarbons. recall and explain the structures, properties, and reactions of heterocyclic compounds and biomolecules, apply this knowledge to synthesize and analyze their derivatives, and evaluate their significance and applications in real-world chemical, industrial, and medicinal contexts.

CLO4: Understand and apply the basic principles of UV–Visible, IR, and NMR spectroscopy to interpret spectral data and identify the structure of simple organic molecules.

Units/Hours	Contents	Mapping with Course

		Learning Outcome
UNIT-I 11hours	**Basic concepts and simple organic compounds** Structure, bonding, and classification of hydrocarbons, Electronic effects, Homolytic and heterolytic bond fission, stability of reactive species, Fischer, Newman, Sawhorse projections, geometrical (cis/trans, E/Z) and optical isomerism (R/S). **Carbon-carbon sigma and pi bonds:** Synthesis, reactions (Wurtz/Fitig), elimination (E1, E2, E1cb), Baeyer strain theory and conformational analysis (chair/boat/twist boat) of alkanes and cycloalkanes, reactions of alkenes (electrophilic addition, Diels Alder reaction) and alkynes. Acidity of alkynes. **Aromatic compounds:** Aromaticity, Hückel's rule, arenes, cyclic carbocations/carbanions, heterocycles. **Halogenated hydrocarbons:** Synthesis mechanisms (SN1, SN2 mechanisms) and organometallic reagents (Zn and Mg).	CLO1 CLO2
UNIT-II 11hours	**Chemistry of Organic Functional Groups** **O-containing hydrocarbons:** Synthesis and reactions of 1^o, 2^o and 3^o alcohols, glycols, acidic nature of phenols, electronic substitution reactions, preparation and reactions of ether and epoxides. **Carbonyl-containing compounds:** Structure, preparation and reactions of aldehydes and ketones, carboxylic acid, esters, amides. Oxidation reduction reactions, keto-enol tautomerism, Aldol, Cannizaro reaction, Benzoin condensation, Shapiro, Arndt-eistert reaction, Hoffmann bromamide reaction. Iodoform test for methyl ketones, Acidity of carboxylic acid. **N- and S-containing compounds:** Synthesis of amines, nitro compounds, thiols, thioethers, sulfides, sulfonic acids. Basicity of amines. Tests for 1^o, 2^o and 3^o amines.	CLO1 CLO2
UNIT-III 11hours	**Heterocycles, Biomolecules, Natural products and Applied chemistry** **Heterocyclic Compounds:** Basic classification and nomenclature of heterocycles; aromaticity of five- and six-membered heterocycles with one heteroatom. Structure, properties, and reactivity of furan, pyrrole, thiophene, and pyridine. **Natural Products:** Overview of alkaloids, terpenes, and steroids: occurrence, general structural features, and medicinal importance of nicotine, quinine and camphor. **Chemistry in Daily Life:** Applications of chemistry in glass and silicate industry, surface coatings, batteries, fuels, fertilizers, pesticides, cosmetics, and pharmaceuticals. **Biomolecules:** Enzymes: classification, mechanism of action, and factors affecting enzyme activity. Carbohydrates: classification, basic structures, and biological importance of mono-, di-, and polysaccharides.	CLO3
UNIT-IV	**Spectroscopic techniques: UV-visible spectroscopy:** Basic principles and range of UV–visible radiation; electronic transitions; concepts of λmax and εmax; chromophores and auxochromes; qualitative effects of substituents on absorption.	

12 hours	**FTIR spectroscopy:** Fundamental principles of infrared spectroscopy; characteristic absorption frequencies of common functional groups; fingerprint region and its role in functional group identification. **NMR spectroscopy:** Basic principles of NMR; chemical shift and factors affecting it; spin–spin coupling; elementary interpretation of ^{1}H NMR spectra of simple organic molecules. Applications of UV–Vis, IR, and NMR spectroscopy for the identification and structural characterization of simple organic compounds.	CLO4

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Suggested Readings

- Eliel, E. L. &Wilen, S. H. *Stereochemistry of Organic Compounds*, Wiley: London, 1994.
- Finar, I. L. *Organic Chemistry (Volume 1)*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- Finar, I. L. *Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products)*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education.
- Fundamentals of Organic Chemistry, Solomons, John Wiley.
- Introduction to Organic Chemistry, Sireitwieser, Heathcock and Kosover, Macmilan.
- McMurry, J.E. *Fundamentals of Organic Chemistry*, 7th Ed. Cengage Learning India Edition, 2013.
- Wade Jr., L.G., Singh, M.S., Organic Chemistry; 6th edition, Pubs: Pearson education, 2008.
- **Kemp, W.** (2011). *Organic Spectroscopy* (3rd Ed.). Palgrave Macmillan. ISBN: 9780230576630.
- **Pavia, D. L., Lampman, G. M., Kriz, G. S. & Vyvyan, J. A.** (2014). *Introduction to Spectroscopy* (5th Ed.). Cengage Learning. ISBN: 9781285460123.

CHEMISTRY (MINOR)

Course Name: Practical (Organic Chemistry)

Course Code: BSE.330

L	T	P	Cr
0	0	2	1

Course Learning Outcomes;

At the end of the course the prospective teacher-trainees will be able to;

CLO1 experience a positive and enjoyable learning based on sound scientific principles and practice.

CLO2 foster good laboratory practice and develop technical skills relevant to quantitative analysis.

CLO3 accurately identify and analyze the presence of various functional groups, .

CLO4 evaluate and implement green chemistry approaches in the synthesis of organic compounds.

Units/Hours	Contents	Mapping with Course Learning Outcome
	Qualitative analysis of unknown organic compounds containing simple functional groups like, alcohols, phenols, carbonyl compounds, acids, amines, halo and nitro hydrocarbons and carbohydrates.	CLO1 CLO2

30 hours	Checking the calibration of the thermometer. Purification of organic compounds by crystallization using the following solvents: (i)Water, (ii)Alcohol (iii) Alcohol-Water, Determination of the melting points of above compounds and unknown organic compounds, Determination of boiling point of liquid compounds. (Boiling point lower than and more than 100 °C by distillation method). Separation of a mixture of two dyes or a mixture of organic compounds (o-and p-nitrophenol or o-and p-aminophenol) by paper, thin-layer and column chromatography. Acetylation or Benzoylation of an amine or phenol using conventional and/or green methods. Bromination or Nitration of an aromatic compound using conventional or green method. Oxidation (Iodoform reaction) or Reduction of a nitro or carbonyl compound using a mild reducing agent. Aldol condensation *or* preparation of a carbonyl derivative (semicarbazone) followed by hydrolysis of an ester or amide	CLO3 CLO4

Suggested Readings:-

- Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009)
- Furniss, B.S., Hannaford, A.J., Smith, P.W.G. & Organic Chemistry, 5th Ed. Pearson. Tatchell, A.R. Practical
- Ahluwalia, V.K. & Aggarwal, R.(2000).Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press.
- Ahluwalia, V.K. & Dhingra, S. (2000).Comprehensive Practical Organic Chemistry: Qualitative Analysis, University Press.
- Atkins, P., Paula, J.de,(2000). Atkins Physical Chemistry; 8th edition, Pubs: Oxford University Press.
- Puri, B.R., Sharma, L.R., Pathania, M.S. (2008). Principles of Physical Chemistry; 43rd edition, Pubs: Vishal Publishing Co.
- Barrow, G.M. (1996). Physical Chemistry; 6th edition, Pubs: McGraw Hill Inc.
- Rao, C.N.R., (1985). University General Chemistry; Pubs: Macmillan India.
- Chandrika Parsad: Text book on Algebra and Theory of Equations, Pothishala Pvt. Ltd., Allahabad.
- H.S. Hall and S.R. Knight: Higher Algebra, H.M. Publications, 1994.
- K.B. Dutta: Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd., New Delhi (2002).

Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry*, Pearson Education (2009).

Mathematics (Minor)

Course Title: Foundations of Probability, Statistics, and Linear Algebra
Course Code: BSE.331

L	T	P	Cr
4	0	0	4

Course Learning Outcomes:
At the end of the course, the students will be able to;

CLO1 Understand the problems on discrete and continuous probability spaces, and compute expectations.

CLO2 Understand and use important discrete and continuous probability distributions in applications; evaluate means, variances, and moment generating function**.**

CLO3 Apply fundamental concepts of statistical inference: sampling distributions, hypothesis

testing, and basic non-parametric tests.

CLO4 Understand the concept of Basis of vector space, linear transformations, and apply the Rank-Nullity theorem.

Units/Hours	Content	Mapping with CLOs
Unit-1 15 hours	Random variables (discrete and continuous); Expectation, moments, variance, covariance, joint and marginal distributions, conditional expectation.	**CLO1**
Unit-2 15 hours	Discrete probability distributions: Binomial and Poisson; Mean, variance, moment generating functions. Continuous distributions: Uniform and Normal distributions; Applications and properties.	**CLO2**
Unit-3 15 hours	Introduction to statistics: Population and sample, statistics and sampling distributions. Hypothesis testing: basic ideas, types, large and small sample tests; Simple non-parametric tests (Chi-square test).	**CLO3**
Unit-4 15 hours	Basis of a vector space, Finitely generated vector spaces, Linear transformation. Algebra of linear transformation. Rank- Nullity theorem.	**CLO4**

Suggestive Mode of Transaction:

The course content transaction will include the following:

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussions, panel interactions, small theme-based seminars, cooperative teaching, team teaching, flipped learning, blended learning, and demonstration.

Suggestive Mode of Assessment: Assignments, Class tests, Problem-solving, Semester examinations.

Suggestive Readings:

- S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons.
- V.K. Rohatgi and A.M.E. Saleh, An Introduction to probability and Statistics, Wiley.
- A.M. Mood, F.A. Graybill, and D.C. Boes, Introduction to the Theory of Statistics, McGraw-Hill.
- Sheldon Ross, A First Course in Probability, Pearson.
- Shanti Narayan & P.K. Mittal: *A Text Book of Matrices*, 10th Edition (2002), S. Chand & Co.
- Surjit Singh: *Linear Algebra*, 1997.

Botany (Minor)

Course Title: Plant Reproductive Biology

L	T	P	Cr
3	0	0	3

Course Code: BSE.264

Course Learning Outcomes:

At the end of the course the prospective teacher-trainees will be able to;

CLO1 Students will understand the reproductive development of plants and anther biology..

CLO2 Students will learn the structure and development of ovule in plants. genetic and molecular mechanisms of flowering, anther and pollen biology, ovule development, pollination and fertilization processes, self-incompatibility systems, and the structure and development of embryos, endosperms, and seeds, including their unique features and reproductive adaptations

CLO3 Students will learn pollination, fertilization and self-incompatibility systems in plants.
CLO4 Students will understand structure and development of embryos, endosperms, and seeds.

Units/Hours	Contents	Mapping with CLOs
UNIT-I 14 hrs	**Reproductive development**: Induction of flowering; flower as a modified determinate shoot. Flower development: genetic and molecular aspects. **Anther and pollen biology:** Anther wall: Structure and functions, microsporogenesis, callose deposition and its significance. Microgametogenesis; Pollen wall structure, MGU (male germ unit) structure, NPC system; Palynology and scope (a brief account); Pollen viability, storage and germination; Abnormal features: Pseudomonads, polyads, massulae, pollinia.	**CLO1**
UNIT-II 10 hrs	**Ovule**: Structure; Types; Special structures–endothelium, obturator, aril, caruncle and hypostase; Female gametophyte– megasporogenesis (monosporic, bisporic and tetrasporic) and megagametogenesis (details of Polygonum type); Organization and ultrastructure of mature embryo sac.	**CLO2**
UNIT-III 10 hrs	**Pollination and fertilization**: Pollination types and significance; adaptations; structure of stigma and style; path of pollen tube in pistil; double fertilization. **Self-incompatibility:** Basic concepts (interspecific, intraspecific, homomorphic, heteromorphic, GSI and SSI); Methods to overcome self- incompatibility: male sterility.	**CLO3**
UNIT-IV 11hrs	**Embryo, Endosperm and Seed:** Structure and types; General pattern of development of dicot and monocot embryo and endosperm; Suspensor: structure and functions; Embryo-endosperm relationship; Nutrition of embryo; Unusual features; Embryo development in Paeonia. Seed structure, importance and dispersal mechanisms; **Polyembryony and apomixes**: Introduction; Classification; Causes and applications.	**CLO4**

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions,

small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Suggested Reading:

5. Bhojwani, S.S. and Bhatnagar, S.P. (2011). The Embryology of Angiosperms, Vikas Publishing House. Delhi. 5th edition.
6. Shivanna, K.R. (2003). Pollen Biology and Biotechnology. Oxford and IBH Publishing Co. Pvt. Ltd. Delhi.
7. Raghavan, V. (2000). Developmental Biology of Flowering plants, Springer, Netherlands.
8. Johri, B.M. l (1984). Embryology of Angiosperms, Springer-Verlag, Netherlands.

Course Title: Plant Reproductive Biology (Practical-II)

Course Code: BSE.266

L	T	P	Cr
0	0	2	1

1. Anther: Wall and its ontogeny; Tapetum (amoeboid and glandular); MMC, spore tetrads,
2. uninucleate, bicelled and dehisced anther stages through slides/micrographs, male germ unit (MGU) through photographs and schematic representation.
3. Pollen grains: Fresh and acetolyzed showing ornamentation and aperture, psuedomonads,
4. polyads, pollinia (slides/photographs,fresh material), ultrastructure of pollen wall(micrograph);
5. Pollen viability: Tetrazolium test germination: Calculation of percentage germination in different media using hanging drop method.
6. Ovule: Types-anatropous, orthotropous, amphitropous/campylotropous, circinotropous,
7. unitegmic, bitegmic; Tenuinucellate and crassinu cellate; Special structures: Endothelium,
8. obturator, hypostase, caruncle and aril (permanent slides/specimens/photographs).
9. Female gametophyte through permanent slides/ photographs: Types, ultrastructure of mature egg apparatus.
10. Intra-ovarian pollination; Test tube pollination through photographs.
11. Endosperm: Dissections of developing seeds for endosperm with free-nuclear haustoria.
12. Embryogenesis: Study of development of dicot embryo through permanent slides; dissection of developing seeds for embryos at various developmental stages; Study of suspensor through electron micrographs.

Zoology (MINOR)

Course Title: Ecology and Environment

Course Code: BSE.332

L	T	P	Cr
3	0	0	3

Course Learning Outcomes;

After successful completion of this course, the students will be able to;

CLO 1: Explain the fundamental concepts of ecology, including levels of organization, ecosystem structure, and energy flow.

CLO 2: Analyze population and community dynamics with reference to growth patterns, species interactions, and ecological niches.

CLO 3: Describe biodiversity at different levels and evaluate the causes and consequences of biodiversity loss with special reference to India.

CLO 4: Assess conservation strategies and the role of protected areas in biodiversity conservation.

CLO 5: Understand major environmental issues, environmental legislation, and principles of sustainable development.

UNIT/ hours	**Content**	**Mapping With CLO**
Unit 1: (12 Hours)	**Fundamentals of Ecology** Ecology: Definition and levels of organization • Ecosystem: Concept, structure, and components • Energy flow: Food chains, food webs, trophic levels • Ecological pyramids • Ecological succession: Types and significance	CLO1
Unit 2:	**Population and Community Ecology**	CLO2

(11 Hours)	• Population characteristics and growth patterns • Population regulation and limiting factors • Biotic interactions: Competition, predation, mutualism, parasitism • Community structure and species diversity • Habitat and ecological niche: Fundamental and realized niche	
Unit 3: (11 Hours)	**Biodiversity and Conservation** Biodiversity: Definition, levels, and importance • Biodiversity hotspots in India • Endangered species and Red Data Book • Causes of biodiversity loss • Conservation strategies: In situ and ex situ • Protected Areas: National Parks, Sanctuaries, Biosphere Reserves	CLO3, CLO4
Unit 4: (11 Hours)	**Environmental Issues and Sustainability** • Environmental pollution: Air, water, soil, noise • Climate change and global warming • Biomagnification and Eutrophication, Ozone depletion and acid rain • Environmental legislation: Wildlife Protection Act, Environmental Protection Act • Sustainable development and role of community	CLO5

Suggestive Mode of Transaction

The course content will be transacted through: Interactive lectures with multimedia support, Group discussions and student presentations, Theme-based seminars, Cooperative and team teaching, Flipped and blended learning approaches

Suggested Readings

1. P.D. Sharma – *Ecology and Environment* (Rastogi Publications)
2. Odum, E.P. – *Fundamentals of Ecology*
3. Cunningham, W.P. & Cunningham, M.A. – *Principles of Environmental Science*
4. Miller, G.T. & Spoolman, S. – *Environmental Science*

Course Title: Practical (Ecology and Environment)
Course Code: BSE.333

L	T	P	Cr
0	0	2	1

Course Learning Outcomes;

At the end of the course, the prospective teacher-trainees will be able to:

CLO1: Apply standard ecological methods to estimate species richness and biodiversity using Simpson's and Shannon–Wiener indices in different ecosystems.

CLO2: Analyze ecosystem structure by identifying biotic and abiotic components, population characteristics, and variations in biodiversity across pond, garden, and grassland ecosystems.

CLO3: Evaluate conservation status and environmental quality through the study of Indian endangered species, protected areas, polluted sites, soil characteristics, and carbon dioxide levels in water samples.

CLO4: Prepare and present field-based reports and case studies based on ecosystem visits, environmental surveys, and laboratory analyses for academic and educational purposes.

1. Estimation of Species Richness and Diversity using Simpson's / Shannon–Wiener Index
2. Interpretation of biodiversity in different ecosystems (pond, garden, grassland)
3. Identification of biotic and abiotic components of terrestrial and aquatic ecosystems using charts/models/field observations
4. Study of Local Population Characteristics such as Population density, dispersion, age structure and growth patterns
5. Study of Indian endangered animal species using IUCN and Red Data Book
6. Study of important National Parks, Wildlife Sanctuaries, and Biosphere Reserves of India
7. Study of local Environmental Polluted sites (Case study)
8. Characterization of local soil samples

9. Calculation of Carbon Dioxide in given water samples
10. Field Visit and demonstration of a Local Ecosystem

STAGE-SPECIFIC CONTENT-CUM-PEDAGOGY COURSES (ANY TWO AS PER THE MAJOR AND MINOR SUBJECT)

PEDAGOGY OF PHYSICS-II

Course Title: Pedagogy of Physics-II
Course Code: BSE.320

L	T	P	Cr
2	0	0	2

Course Learning Outcomes;
At the end of the course the prospective teacher-trainees will be able to;
CLO1 develop the skill of planning teaching learning activities.
CLO2 develop competencies in selection and use of teaching approaches and devices.
CLO3 develop competencies in the use of teaching methods.
CLO4 plan, manage physics laboratory and organize physics practical work.

Unit/Hours	Contents	Mapping with CLOs
UNIT-I **8 hours**	**TEACHING SKILLS** Meaning & importance of Teaching Skill, Teaching Skills relevant in Physics: Questioning, Blackboard Writing, Demonstration, Stimulus Variation, Reinforcement, Probing, Illustration with example, Class Room Management.	**CLO1**
UNIT-II **8 hours**	**INSTRUCTIONAL MATERIALS** Meaning and importance of the term instructional materials, Guiding principles for the effective use of audio- visual aids, Classification of audio-visual aids, Instructional material employed in Physics: Bulletin Board, Flannel Board, Charts, Models , LCD Projector , computer & Internet, smart board, smart class, Improvised Apparatus, Text-books: Meaning and Importance of Physics Text-book, Criteria for Evaluation of Physics Text-book,	**CLO2**
UNIT-III **7 hours**	**METHOD OF PHYSICS TEACHING** Physics teaching methods: Lecture Method, Demonstration Method, Laboratory Method, Heuristic Method, Inductive & Deductive Method, Project Method, Problem Solving Method.	**CLO3**
UNIT-IV **7 hours**	**PEDAGOGICAL ANALYSIS AND PLANNING IN PHYSICS** Meaning, Phases and Stages of Pedagogical Analysis, Formulation of Instructional Objectives in Physics, Planning of lesson in Physics.	**CLO4**

Suggestive Mode of Transaction
The course content transaction will include the following:
Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, selections from theoretical readings, flipped learning, blended learning, demonstration, laboratory method

Books for Study

1. Methods and Techniques of Teaching, Kochar, S.K. (1997), New Delhi: Sterling Publishers Pvt. Ltd.

2. Teaching of Physics, Maitre, K. (1991), New Delhi: Discovery Publishing House.
3. Emerging Trends in Teaching of Physics, Prakash R. and Rath, T.N. (1996), New Delhi: Kanisha Publishers.

Books for Reference

1. Innovative Science Teaching for Physical Science Teachers, Radha Mohan (2003), New Delhi: Prentice Hall Pvt. Ltd
2. Innovation in Teaching Learning Process, Chauhan, S.S. (2000)., New Delhi: Vikas Publishing House Pvt. Ltd.
3. Science Teaching in Schools, Das, R.C. (1985), New Delhi: Sterling Publishers Pvt. Ltd.
4. Research in Teaching of Science, Gupta, N.K. (1997), New Delhi: APH Publishing Corporation.

PEDAGOGY OF CHEMISTRY-II

Course Name: Pedagogy of Chemistry-II

Course Code: BSE.321

L	T	P	Cr
2	0	0	2

Course Learning Outcomes

At the end of the course the prospective teacher-trainees will be able to;

CLO1: Identify teaching learning aids / materials and illustrate their importance in teaching learning the concepts of Physical Sciences.

CLO2: develop teaching learning aids/material/kits/learning resources for teaching learning the concepts of Chemistry**.**

CLO3: develop lesson plan based on learning outcomes and experiential learning using appropriate strategies.

CLO4: relate ICT integration and elaborate its use in classroom situations,

Units/Hours	Contents	Mapping with Course Learning Outcome
UNIT-I **9 hrs**	**Teaching Learning Aids** **a)** Teaching learning aids/materials: concept, definition, role and importance in classroom teaching learning the Chemistry. **b)** Types of teaching learning aids/ materials: print media such as textbook, teachers' manual/ handbook, laboratory manual and other print materials, non–print and digital media such as radio, TV, websites, animations, audios, videos, images, simulations, digital repository, Augmented Reality (AR), Virtual Reality (VR) and Artificial Intelligence (AI) based digital resources and Open Educational Resources (OERs) for offline/ online classroom teaching learning reflective journals, charts, 2–D and 3–D models, games, cards, worksheets, multimedia.	**CLO1**
UNIT-II **6 hrs**	**Teaching Learning Resources** **a)** Identification and use of learning resources in Chemistry from the local environment. **b)** Resource room/ laboratory/ library, virtual laboratories, teaching learning kits, physical sciences clubs, fairs, exhibitions, educational parks, excursions, community resources and pooling of resources.	**CLO2**

UNIT-III **8 hrs**	**Content Analysis & Lesson Planning for Teaching Chemistry** **a)** Pedagogical analysis of content taking examples from topics of Chemistry textbooks at secondary stage, Formulation of Instructional Objectives in Chemistry, Planning of lesson in Chemistry. **b)** Developing unit plans and lesson plans based on learning outcomes and experiential learning by selecting topics from textbooks of Chemistry at secondary stage, Developing ICT integrated lesson plans by taking topics of Chemistry at secondary stage using Technological Pedagogical Content Knowledge (TPCK) for classroom and online teaching.	**CLO3**
UNIT-IV **7 hrs**	**ICT Integration and Applications** **a)** Scope and importance of ICT in Chemistry, Use of ICT such as Artificial Intelligence, machine learning, smart boards in the teaching learning, assessment, and resource management. **b)** Tools, software, and platforms for teaching learning of Chemistry at secondary stage.	**CLO4**

SESSIONAL WORK: (Choose any three)

- Analyze the content of textbooks of Chemistry (Classes 9–12).
- Identify the learning resources for transiting the concepts of Chemistry.
- Develop teaching aids/teaching materials for teaching concepts of Chemistry at secondary stage.
- Prepare learning outcomes and experiential learning–based lesson plan for the concepts of Chemistry.
- Develop e–content for the concepts of Chemistry at Secondary Stage
- Develop learning outcomes for the concepts of Chemistry at the secondary stage.
- Develop a project on the concepts of Chemistry using interdisciplinary and multidisciplinary approaches as recommended in NEP 2020.

Suggested Readings:-

- Textbooks: 1. Vaidya, N. (1999). Science Teaching for 21st Century. Deep & Deep Publications.
- Mohan, R. (2002). Innovative Science Teaching for Physical Science Teachers. Prentice Hall of India Pvt. Ltd., New Delhi.
- Das, R.C. (2009). Science Teaching in Schools. Sterling, New Delhi
- Gupta, S. K. (1985). Teaching of Physical Science in Secondary Schools. New Delhi.
- NCERT (2013). Pedagogy of Science, Textbook of B.Ed., Part I&II, National Council for Educational Research and Training, New Delhi.
- NCERT (2005). National Curriculum Framework for School Education. National Council of Educational Research and Training (NCERT), New Delhi.
- NCERT (2006). Position Paper of National Focus Group on Teaching of Science. New Delhi: NCERT
- Tobin, K.(1993). The Practice of Constructivism in Science Education. Lawrence Erlbaum Associates.
- Tony L., Matt C., Bernie K. and Judith T.(2010).Teaching Science. New Delhi, Sage Publication India Pvt. Ltd.

PEDAGOGY OF MATHEMATICS-II

Course Name: Pedagogy of Mathematics
Course Code: BSE.322
Course Learning Outcomes:

L	T	P	Cr
2	0	0	2

At the end of the course the prospective teacher-trainees will be able to;

- discuss the nature and functions of various instructional resources,
- explore and utilize the teaching-learning resources to support pedagogical experiences of Mathematics,
- organize and manage supportive activities for the development of mathematical aptitude of secondary school students,
- plan appropriate experiences for teaching Mathematics,
- explore diverse backgrounds and interests of children to set up an inclusive classroom for Mathematics learning,
- elaborate technological tools for teaching and learning of Mathematics,
- integrate technology to judiciously facilitate learning to enhance an inclusive environment.

Units	**Content**
Unit-1	**Teaching Learning Resources** • Teaching learning materials: meaning and importance for secondary school Mathematics. • Types of teaching-learning resources: print media (Mathematics textbook, teachers' manual/ handbook, laboratory manual), non-print and digital media (charts, 2-D and 3-D models, games, web resources, interactive boards, animations, videos, images, simulations) for offline/ online classroom teaching and learning • Identification and use of learning resources in Mathematics from the local environment, community resources, and pooling of resources. • Mathematics resource room/ laboratory – equipment and management, concept of virtual laboratories. • Organization of Mathematics clubs, fairs, exhibitions, learner community
Unit-2	**Content Analysis and Planning for Teaching Mathematics** • Analysis for identification of axioms, concepts, rules, formulas, theorems, corollaries; pedagogical content knowledge of arithmetic, algebra, geometry, mensuration, and trigonometry of secondary stage. • Planning and evaluating learning experiences in an inclusive setup based on learning outcomes and competencies, building a community of mathematicians in classrooms. • Developing annual plan, unit plan, lesson plan – need, main consideration, and format.
Unit-3	• Strategies for method-based lesson plans for secondary classes - inductive-deductive, analytical-synthetical, lecture cum demonstration, problem-solving, laboratory, and project-based. • Scope and importance of ICT for teaching and learning Mathematics. • Use of ICT (digital repository, Augmented Reality (AR), Virtual Reality (VR), and Artificial Intelligence (AI) based digital resources, open education resources, blogs, forums, interactive boards, and devices) in the teaching-learning, assessment, and resource management of secondary Mathematics.
Unit-4	• Use of tools, software, and platforms such as GeoGebra, Khan Academy along with national teacher's portal, DIKSHA, SWAYAM. • Developing ICT-integrated lesson plans using Technological Pedagogical Content Knowledge (TPCK) for Mathematics classroom and online teaching.

Practicum (Any Three)

- Develop learning resources for Mathematics teaching learning.
- Prepare an annual plan for any secondary class.
- Prepare a unit plan from the Mathematics textbook at the secondary stage.
- Prepare learning outcomes-based lesson plans using experiential learning for any one topic of Mathematics at the secondary stage.
- Develop a lesson plan on a topic of Mathematics at the secondary stage by integrating ICT tools.
- Write script for developing e-content on any one topic of Mathematics for online teaching.
- Any other project assigned by the course coordinator.

Suggestive Mode of Assessment: Lecture cum discussion, group work, ICT-enabled methods, Activity-based and Art Integrated Demonstration, Field-based experiences, Library Visits, Self-study, Field observations, and Assignment preparation. Classroom presentations, Discussion forums, Observation, Flip classroom, Use of digital platforms.

Suggestive Readings:

- NCERT: A Handbook for Designing Mathematics Laboratory in Schools
- NCERT: Manual for Higher Secondary Mathematics Kit

PEDAGOGY OF BOTANY-II

L	T	P	Cr
2	0	0	2

Course Title: Pedagogy of Botany – II
Course Code: BSE.323
Course Learning Outcomes (CLO):
At the end of the course the prospective teacher-trainees will be able to;

CLO1 Explain advanced botanical concepts and develop strategies to teach them effectively at the higher secondary level.

CLO2 Design and conduct practical experiments and activities to foster experiential learning in botany.

CLO3 Apply inclusive education practices and differentiated instruction to cater to diverse learners in botany classrooms.

CLO4 Engage in action research and continuous professional development to improve botany teaching practices.

Units/Hours	Contents	Mapping with CLOs
UNIT-I **12 hours**	**Unit-I: Advanced Botanical Concepts and Their Pedagogy** • Photosynthesis, respiration, and plant physiology: Teaching strategies. • Genetics and plant breeding: Pedagogical approaches. • Plant taxonomy and systematics: Methods to teach classification. • Biotechnology and its applications in botany.	**CLO1**
UNIT-II **12 hours**	**Unit-II: Practical Work and Experimental Learning in Botany** • Importance of practical work in botany education. • Designing experiments: Photosynthesis, transpiration, and seed germination. • Field studies: Plant collection, identification, and ecological surveys.	**CLO2**

	• Safety measures in the botany laboratory.	
UNIT-III **10 hours**	**Unit-III: Inclusive Education and Differentiated Instruction in Botany** • Inclusive education: Addressing the needs of students with disabilities. • Differentiated instruction: Adapting content, process, and product for diverse learners. • Gender-sensitive teaching in botany. • Collaborative learning strategies.	**CLO3**
UNIT-IV **11 hours**	**Unit-IV: Research and Professional Development in Botany Education** • Action research in botany education: Identifying problems and proposing solutions. • Professional development: Workshops, seminars, and online courses. • Reflective practices for botany teachers. • Contributions of professional organizations to botany education.	**CLO4**

Suggestive Mode of Transaction

- Hands-on laboratory experiments and demonstrations.
- Case studies and problem-based learning.
- Collaborative group work and peer teaching.
- Use of multimedia and virtual labs.
- Field trips and ecological surveys.

Suggested Readings

1. Raven, P. H., Evert, R. F., & Eichhorn, S. E. (2017). *Biology of Plants* (8th ed.). W.H. Freeman and Company.
2. Pandey, B. P. (2020). *Plant Anatomy*. S. Chand Publishing.
3. Joyce, B., Weil, M., & Calhoun, E. (2015). *Models of Teaching* (9th ed.). Pearson.
4. Kumar, A. (2018). *Innovative Science Teaching* (4th ed.). PHI Learning.
5. Sharma, P. D. (2019). *Botany for Degree Students: Algae*. S. Chand Publishing.
6. Aggarwal, J. C. (2010). *Teaching of Life Science*. Vikas Publishing House.
7. Sharma, R. C. (2016). *Modern Science Teaching*. Dhanpat Rai Publishing.
8. Mangal, S. K., & Mangal, U. (2019). *Essentials of Educational Technology*. PHI Learning.
9. Anderson, L. W., & Krathwohl, D. R. (2001). *A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives*. Longman.
10. Passi, B. K. (2016). *Becoming a Better Teacher*. Sage Publications.
11. Vashist, R. P. (2017). *Teaching of Biological Sciences*. Pearson.
12. Carin, A. A., & Sund, R. B. (2015). *Teaching Science Through Discovery*. Pearson.
13. Sharma, R. A. (2018). *Teaching of Science*. R. Lall Book Depot.
14. Vanaja, M. (2016). *Teaching of Biological Science*. Neelkamal Publications.
15. Tomlinson, C. A. (2014). *The Differentiated Classroom: Responding to the Needs of All Learners*. ASCD.

PEDAGOGY OF ZOOLOGY-II

Course Title: Pedagogy of Zoology-II
Course Code: BSE.324

L	T	P	Cr
2	0	0	2

Course learning Outcomes:
At the end of the course the prospective teacher-trainees will be able to;

- categorize different teaching learning resources and plan their appropriate usage in teaching learning of concepts of Biological Science,
- develop simple teaching learning materials using easily available/local materials,
- analyze the content of Biological Science textbooks at secondary stage,
- review various methods and strategies for teaching Biological Sciences,
- develop learning outcome-based lesson plan to promote experiential learning and higher order thinking skills,
- develop unit plans and lesson plans on different chapters in biology (Grades IX to XII).

Unit/ Hours	**Contents**	**Mapping with CLOs**
Unit-I 8hrs	Teaching Learning Resources I A. Teaching learning aids/materials: concept, definition, role, and importance in classroom teaching learning the Biological Sciences. B.Types of teaching learning aids/ materials: print media such as textbook, teachers' manual/ handbook, laboratory manual and other print materials, non-print and digital media such as museum, aquarium, terrarium, games, toys, radio, TV, websites, animations, audios, videos, images, simulations; Biological Sciences mobile apps, digital repository, Augmented Reality (AR), Virtual Reality (VR) and Artificial Intelligence (AI) based digital resources and Open Educational Resources (OERs) for offline/ online classroom teaching learning (reflective journals, charts, 2-d and 3-d models, games, cards, worksheets, multimedia etc.	
Unit-II 7hrs	Teaching Learning Resources II A.Identification and use of learning resources in Biological Sciences from the local environment - using nature as a laboratory; biology laboratory - designing, management and safe practices; virtual laboratories and museums. B. Resource room/ laboratory/ library, virtual laboratories, teaching learning kits, Biological Sciences clubs, fairs, exhibitions, science parks, zoo, botanical gardens, excursions community resources and pooling of resources.	
Unit-III 8hrs	Content Analysis and Planning for Teaching Biological Sciences A.Pedagogical analysis of content taking examples from topics of Biological Sciences textbooks at secondary stage, identification of concepts, listing learning outcomes and competencies, planning, and evaluating learning experiences in an inclusive setup. B.Concept, types and importance of unit and lesson planning. Developing unit plans and lesson plans based on learning outcomes and experiential learning by selecting topics from textbooks of Biological Sciences at secondary stage.	
Unit-IV 7hrs	ICT Integration and Application A,Scope and benefits of using IT in teaching learning process; Artificial Intelligence, machine learning, smart	

	boards. B.Specific features and limitations of using ICT. C.Open Educational Resources in Biological Sciences – BIOIDAC, MOOC, National Teachers Portal, DIKSHA, SWAYAM. Developing ICT integrated lesson plans by taking topics of physical sciences at secondary stage using Technological Pedagogical Content Knowledge (TPCK) for classroom and online teaching.	

Suggestive Practicum (Any three)

1. Analyze the content of textbooks of Biological Sciences (Classes 9-12).
2. Develop e-content for the concepts of Biological Sciences at Secondary Stage.
3. Develop unit plans of selected chapters of Textbooks of Biological Sciences.
4. Prepare learning outcomes and experiential learning-based lesson plan for the concepts of Biological Sciences.
5. Developing ICT integrated lesson plans for offline and online classes.
6. Explore a course of Biological Sciences of MOOC and prepare a write up.
7. Any other project assigned by HEI.

Suggestive Mode of Transaction

Lecture cum discussion, demonstration, Hands-on activities, experiential learning, inquiry, Group work, Presentations, multimedia.

Suggestive Mode of Assessment

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

Suggested readings for Course

1. **Joyce, B., Weil, M., & Calhoun, E. (2015).** *Models of Teaching* (9th Edition). Pearson.
2. **National Research Council. (1996).** *National Science Education Standards*. National Academies Press.
3. **Mayer, R. E. (2021).** *Multimedia Learning* (3rd Edition). Cambridge University Press.
4. **Anderson, L. W., & Krathwohl, D. R. (2001).** *A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives.* Longman.
5. **Bybee, R. W. (2014).** *The BSCS 5E Instructional Model: Creating Teachable Moments.* NSTA Press.

ABILITY ENHANCEMENT & VALUE-ADDED COURSES

Course Name: ICT IN EDUCATION
Course Code: BSE.325

L	T	P	Credits
2	0	0	2

Course Learning Outcomes (CLOs)

At the end of the course the prospective teacher-trainees will be able to;

CLO1. Explain the nature, scope and importance of educational technology and ICT
CLO2. Enhance their professional skills through the practice of various skills of microteaching
CLO3. Develop the skills in utilizing various models of teaching in classroom settings.
CLO4: Familiarize themselves with the concept of Artificial intelligence
CLO5. Demonstrate the concept of Blended and Flipped learning in their teaching and learning process
CLO6. Analyze the social, ethical, and legal issues related to technology

Units/Hours	Contents	Mapping with CLOs
Unit I **6 hours**	• Meaning, Nature, importance of Information Technology, Communication Technology & Information and Communication Technology (ICT) • Phases of teaching and Levels of learning. • Micro-teaching: Concept & applications. • Bloom's (Revised) taxonomy of objectives, • Implication of Learning Theories in ICT in Education: Behaviorism, Cognitivism & Constructivism. **Learning Activities:** Group discussion, Individual presentation and writing of learning outcomes for lesson plans.	**CLO1** **CLO2**
Unit II **10 hours**	• Models of teaching: Families of Teaching model, Classroom teaching model by Robert Glaser. • Systems Approach to Instructional Design, Models of Development of Instructional Design: ADDIE**,** ASSURE, Dick and Carey model and their educational implications. • Artificial Intelligence: Concept and Applications of Artificial Intelligence in education.. **Learning Activities:** Preparation of e-learning module on any topic of prescribed syllabus.	**CLO3** **CLO4**
Unit III **6 hours**	• E-learning Concept, methods, and media (LMS, Virtual Universities, Massive Open Online Course (MOOCs), Types of MOOCs: cMOOCs, xMOOCs & LMOOCs). • Concept of Cooperative learning, Blended and Flipped learning and , using technology to connect, collaborate, create and development of critical thinking • Open Education Resources (Creative Commons: Concept, and Application).Gamification in Education (Meaning, history, importance, tools and uses). • Ethical issues & safety in ICT- (Teaching, Learning and Research and concept of Cyber bullying, **Learning Activities:** Demonstrate an understanding and use of emerging classroom technologies such as ICT tools in classroom as Google Classroom, Padlet and Prezi	**CLO5**
Unit IV **8 hours**	• Plagiarism: Definition, search engines, regulations, policies and documents/thesis/manuscripts checking through software, knowing and avoiding plagiarism. • Online and offline assessment tools – e-portfolio, Rubrics, survey tools, puzzle makers, test generators, reflective journal (Blog) and question bank. **Learning Activities:** Design a blog and e- portfolio for effective sharing of information and communication of ideas. Students will be checking their assignments and term paper by using plagiarism software.	**CLO6**

Transaction Mode

Lecture cum demonstration, blended learning, team teaching, peer learning, flipped learning problem solving, mobile teaching, collaborative and cooperative learning

Suggested Readings

- Allan, B. (2007). *Blended learning: Tools for teaching and training*. London: Facet Publishing:
- Encyclopedia Britannica. (2020). *Artificial intelligence*. Available at: https://www.britannica.com/technology/artificial-intelligence
- Holmes,W., Bialik,M., & Fadel, C. (2019). *Artificial intelligence in education promises and implications for teaching and learning.* Boston, MA: The Center for Curriculum Redesign. Available at: https:// curriculumredesign.org/wp-content/uploads/AIED-Book-Excerpt-CCR.pdf
- Laanpere, M., Pata, K., Normak, P. &Põldoja, H. (2014). Pedagogy-driven design of digital learning ecosystems. *Computer Science and Information Systems*, 11(1),419–442.
- MHRD (2012). *National policy on information and communication technology (ICT) in school education*. New Delhi: MHRD, Government of India.
- OECD. (2019). *Artificial intelligence in society.* Paris: OECD Publishing. Available at: https://ec.europa.eu/jrc/communities/sites/jrccties/files /eedfee77-en.pdf
- Roberts, T. S. (2008). *Student plagiarism in an online world: Problems and solutions*. Hershey, USA: IGI Global.
- Roll, I., & Wylie, R. (2016). Evolution and revolution in artificial intelligence in education. *International Journal of Artificial Intelligence in Education*, 26 (2), 582-599.
- Sammons, J., &Cross, M. (2017). *The basics of cyber safety: Computer and mobile device safety made easy*. US: Elsevier Inc.
- Zhadko, O. &K, S. (2020). *Best practices in designing courses with open educational resources*. New York: Routledge.
- Zimmerman, M.R.(2018). *Teaching AI: Exploring new frontiers for learning*. Portland, Oregon: International Society for Technology in Education

SCHOOL EXPERIENCES

Course Title: PRE-INTERNSHIP PRACTICE (DEMONSTRATION LESSONS AND PEER TEACHING)

L	T	P	Cr
0	0	4	2

Course Code: BSE.326

Course Learning Outcomes (CLOs)

At the end of the course the prospective teacher-trainees will be able to;

CLO1 acquainted with various pedagogic practices, classroom management skills, assessment tools and learning standards,

CLO2 get experience of conducting classes by observing lessons transacted by teacher educators (demonstration lessons),

CLO3 develop lesson plans to transact them using appropriate pedagogies and learning resources,

CLO4 develop and practice teaching skills in a guided environment to be an effective teacher,

CLO5 be prepared for the school internship

A. Course Content

Orientation of student teachers to different pedagogic approaches like storytelling, art integrated, sports-integrated, project-based, and ICT-integrated for developing critical thinking, attention to life aspirations, and greater flexibility and classroom management skills.

• Observation of the lesson demonstrated by teacher educators/experts in the institute.

• Designing guided activities, including a laboratory for each class/subject based on learning outcomes.

• Study Secondary Stage Learning Standards in the NCF
• Content analysis and development of the unit plan, concept map and lesson plan.
• Discussion on unit plan and lesson plan with teacher educators/experts
• Preparation of a Portfolio (for self-work) that the student-teacher will use to keep all her/his work.
• Participate in discussions/reflective sessions for conceptualizing teaching-learning practices.
• Exploring available learning resources and educational videos
• Developing local, low-cost, and innovative TLM s
• Reading and reflecting on inspiring books on pedagogic practices

B. Mode of Conduct of Pre-Internship Practice (Demonstration Lessons and Peer Teaching)

• Demonstration lesson (minimum 2 in the pedagogical subject by the teacher educator)
• Peer Group teaching and peer observation (minimum 10 in each pedagogical subject)
• Observation of lessons by teacher educators during peer group teaching
• Reflective group discussions/workshops/seminars
• Preparation and presentation of the video content illustrating best classroom practices.

C. Activities to be conducted:

• Observation of lessons transacted by teacher educators to identify pedagogic skills.
• Exposure to various types of lesson plans through workshops.
• Development of relevant Teaching Learning Materials (TLMs).
• Participation in screening and discussion of educational videos on pedagogy and assessment.
• Learning about inclusiveness in school education
• Orientation for Action Research/case study

D. Assessment Procedure

Competence	**Method of assessment**	**Assessed By**	**Credits**	**Marks**
Classroom teaching skills and assessment tools (including learning standards)	Simulated Presentation	Teacher-Educator	1	25
Reflective group discussions/workshop	Observations	Teacher-Educator	0.5	12.5
Lesson Plans, TLM, Curated Videos and action research procedures	Evaluation	Teacher-Educator	0,5	12.5

Suggestive Reading Material

- National Council of Educational Research and Training. (April 2022). Mandate documents Guidelines for the development of National Curriculum Frameworks.
- National Education Policy 2020, MoE, Government of India.
- National Steering Committee for National Curriculum Frameworks, (2023). Draft National Curriculum Framework for School Education.
- NCERT, Textbooks of Biological Sciences at Secondary Stage.

SEMESTER-VI

FOUNDATIONS OF EDUCATION

Course Title: Assessment and Evaluation

L	T	P	Cr
2	0	0	2

Course Code: BSE.351

Course Learning Outcomes (CLOs)

At the end of the course the prospective teacher-trainees will be able to;

CLO1: differentiate measurement, assessment and evaluation
CLO2: analyze different approaches to evaluation
CLO3 comprehend and use different types of tools of evaluation
CLO4 interpret the achievement of students

Course Content

Units/Hours	Contents	Mapping with CLOs
UNIT I **9 hours**	**Measurement, Assessment and Evaluation** Measurement, Assessment and Evaluation: Meaning and significance • Purpose of Measurement, Assessment, Examination, Appraisal and Evaluation in Education. • Taxonomy of Objectives (Revised in 2001) and Implications. • Forms of Assessment: Formative, Summative, Diagnostic, prognostic. • Internal and External assessment. • Assessment for learning, of learning and as learning. **Learning Activities:**	**CLO1**
UNIT II **6 hours**	**Process of Assessment and Evaluation** Approaches to assess and evaluate student performance: Time-constrained examinations; closed/open-book tests; problem-based assignments; practical assignment reports; observation of practical skills; individual and group project reports; oral presentations; viva-voce interviews; computerized adaptive testing; peer and self -assessment **Learning Activities:**	**CLO2**
UNIT III **9 hours**	**Tools and Techniques of Assessment** Objective and Subjective tests: concept, types and process of construction • Observation, rating scale, check list, anecdotes, interviews. rubrics • Assessment of attitudes and interests. • Socio-metric techniques. • Criteria for assessment of social and personal behaviour. • Self-assessment and Peer Assessment. **Learning Activities:**	**CLO3**
UNIT IV **6 hours**	**Analysis and Interpretation** • Analysis of students' performance and its graphical representation, Process of credit and grading • Interpretation of student's performance and improving learner's performance, constructive feedback. • Reporting student's performance: 360-degree progress reports, cumulative records and their uses, portfolios, rubrics, qualitative	**CLO4**

	reporting based on the observations, descriptive indicators in report-cards. **Learning Activities:**	

Transaction Mode

Lecture, Seminar, e-team teaching, e-tutoring, dialogue, peer group discussion, mobile teaching, self-learning, Through SOLE, Collaborative learning, Cooperative learning and Role play

Suggested Readings

- Anastasi, A. and Urbina, S. (2005). *Psychological Testing*. Singapore: Pearson Education.
- Ebel, R . L& Frisbe, D .A.(2009) E*ssentials of Educational Measurement* ,New Delhi: PHI Learning Pvt. Ltd.
- Gronlund, N.E. and Linn, R.L. (2003). *Measurement and assessment in Teaching.* Singapore: Pearson Education.
- Miller, M.D., Linn, R.L., and Gronlund, N. E. (2009*). Measurement and Assessment in Teaching, 10th ED.* Pearson Education, Inc., Upper Saddle River, NJ
- NCERT(2015) Learning Indicators, New Delhi
- Newman, F. M. (1996). A*uthentic achievement: Restructuring schools for intellectual quality.* San Francisco, C,A,:Jossey-Bass.
- Popham, W. J. (2000). *Modern educational measurement: Practical Guidelines for Educational leaders* (3rd ed.). Needham, MA: Allyn & Bacon.
- Reynolds, C. R., Livingston, R. V., &Willson, V. (2006). *Measurement and assessment in education.* Boston, MA: Pearson Education, Inc.
- Salkind, N. J. (2006). *Tests & measurement for people who (think they) hate tests and measurement*. Thousand Oaks, CA: Sage Publications.
- Stanley, J.C. and K.D. Hopkins (1978). *Educational and Psychological Measurement and Evaluation.* New Delhi: Prentice Hall of India.
- Thorndike, R.M (2010) *Measurement and Evaluation in Psychology and Education*, New Delhi: PH

Course Title: Inclusive Education

L	T	P	Credits
2	0	0	2

Course Code: BSE.352

Course Learning Outcomes (CLOs)

At the end of the course the prospective teacher-trainees will be able to;

CLO1: Develop sensitization/ awareness regarding inclusivity, equity and rehabilitation
CLO2: Identify diverse needs of the learners on the basis of their Geographical, Gender, Disabilities and SEDs and Substance Abuse
CLO3: Critically analyze the various suggestions and provisions given by Legal Acts on inclusive education
CLO4: Examine the multipurpose role of various TLM and Assistive devices for remedial teaching/ therapeutic intervention used by diverse learners
CLO5: Discuss upon the collaborative roles of Government and community for the enablement and empowerment of children with diverse needs

Units/	Contents	Mapping

Hours		with CLOs
UNIT I **9 hours**	**Inclusion and Diversities** A. Inclusive Education: Conceptual understanding, Models, Principles and Barriers B. Understanding Diversities, Protection and Prevention: Geographical, Gender, Disabilities and SEDs C. Children in Vulnerable Situations: Orphans, Migrants/Displaced and Substance Abuse **Learning Activities:** Sensitization/ awareness of the community regarding inclusivity, equity and rehabilitation by executing Nukkad Natak/Rallies/Poster Making/ Slogan etc.	**CLO 1** **CLO 2**
UNIT II **8 hours**	**Legal Acts and Provisions** A. Constitutional Provisions for Children with additional needs B. Right to Education Act, 2009 C. RPwDs Act, 2016 D. National Education Policy 2020 E. International provisions: UNCRPD, UNESCO & UNICEF **Learning Activities:** Dialogue with a person with disability/diverse needs on schemes and benefits concerning above mentioned acts and provisions.	**CLO 3**
UNIT III **8 hours**	**Educational Provisions** A. Development of Individualized Education Plan (IEP) B. Conceptual understanding on Resource Room and co-curricular activities C. Rehabilitation/ possible measures to Health and Disabilities challenges of Divers Learners/ Children D. Role and usage of TLM and Assistive technologies **Learning Activities:** Enlist various TLM and Assistive devices for remedial teaching/ therapeutic intervention used by children with additional needs. Submit a report with images	**CLO 4**
UNIT IV **5 hours**	**Collaboration and Transition** A. Understanding the role of Parents-Teachers Meeting (PTM) B. Government Organization and NGOs: Role and collaboration towards equitable quality education C. Transition of students with diverse needs: School to Home, Home to Community and Community to Workplace **Learning Activities:** Presentation of reflections on collaboration and transitions in the form of group discussion/Seminar.	**CLO 5** **CLO 3**

Transaction Mode

Lecture, Seminar, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning, Cooperative Learning and Role Play

Suggested Readings

Ainscow, M., Booth, T. (2003). *The Index for inclusion: Developing learning and participation in schools*. Bristol: Center for Studies in Inclusive Education.

Clough, P., & Corbett, J. (2000). *Theories of Inclusive Education*. Paul Chapman Publishing, London.

Dimitraidi, S. (2014). *Diversity, special needs, and inclusion in early years education*. Sage Publication: New Delhi.

Gargiulo, R. M. (2014). *Special education in contemporary society: An introduction to exceptionally* (5th edition). Sage Publication.

Govind, R. L (2007). *Perspective on special education*. Neelkamal Publication: Hyderabad.
Jha, J. & Jhingran, D. (2002). *Elementary education for the poorest and other deprived groups: the real challenge of universalizatio*n. New Delhi: Centre for Policy Research.
Jha, M. M. (2002). *School without walls: Inclusive education for all*. Chennai: Heinemann Educational publishers, Multivista Global Ltd.
Alan, J. (2010). The sociology of disability and the struggle for inclusive education. *British Journal of Sociology of Education, 31*(5). 603-619.
Kauffman J. M., Hallahan D. P., Pullen P. C., Badar (2018). *Special education: What it is and why we need it*. 2nd Edition, London: Routledge
Kuffman, J. M. (2019). *On educational inclusion*: *Meanings, history, issues and international perspectives.* 1st Edition, London: Routledge
Bika S. L. (2017). *Special education service models: Parental satisfaction and concerns*. Global Books Organization and Publication: New Delhi.
Webliography
https://give.do/discover/news/ngos-redefining-inclusion-education-for-children-with-special-needs/
https://www.jetir.org/papers/JETIR2212277.pdf
https://specialeducationnotes.co.in/paper10Unit5.htm#google_vignette
https://journals.sagepub.com/doi/10.1177/2165143413482137?icid=int.sj-abstract.citing-articles.59
https://www.jstor.org/stable/1170626?seq=1
https://pmc.ncbi.nlm.nih.gov/articles/PMC3893941/

PHYSICS (MAJOR)

Course Title: Thermal and Statistical Physics

L	T	P	Cr
4	0	0	4

Course Code: BSE.353

Course Learning Outcomes;

At the end of the course the prospective teacher-trainees will be able to;

CLO1 comprehend the basic concepts and laws of thermodynamics.

CLO2 develop the capacity to understand the kinetic theory of gases.

CLO3 understand the theories and mathematical approaches of statistical ensembles, equipartition theorem and Maxwell-Boltzmann statistics

CLO4 illustrate the fundamental concepts of Bose-Einstein and Fermi-Dirac Statistics

Unit/Hours	Contents	Mapping with CLOs
UNIT-I **11 hours**	**LAWS OF THERMODYNAMICS** Zeroth Law of thermodynamics, First law and internal energy, Various thermodynamical processes, Work done during isothermal and adiabatic processes, Compressibility and Expansion Coefficient, Reversible and irreversible processes, Second law and Entropy, Carnot's cycle & theorem, Entropy-temperature diagrams, Third law of thermodynamics, Maxwell Relations.	**CLO1**

UNIT-II **11 hours**	**KINETIC THEORY OF GASES** Derivation of Maxwell's law of distribution of velocities and its experimental verification, Mean free path (Zeroth Order), Transport Phenomena: Viscosity, Conduction and Diffusion (for vertical case), Law of equipartition of energy and its applications to specific heat of gases; mono-atomic and diatomic gases.	**CLO2**
UNIT-III **11 hours**	**CLASSICAL STATISTICS MECHANICS** Micro-Canonical Ensemble, Canonical Ensemble: derivation of partition function and thermodynamic quantities, Grand Canonical Ensemble, Gibbs Distribution, Fluctuations in the number of particles, Applications of Canonical and Grand Canonical Ensembles, Equipartition Theorem and its applications, Maxwell-Boltzmann Statistics.	**CLO3**
UNIT-IV **12 hours**	**QUANTUM STATISTICS MECHANICS** Bosons, Bose-Einstein Statistics; Debye theory of specific heat; Grand partition function for ideal Bose Gas; Black Body Radiation; Bose-Einstein Condensation, Fermions: Occupation Number; Fermi-Dirac Statistics; Ideal Fermi gas, Pauli Paramagnetism, First and Second Order Phase Transitions, Ising Model, Phase Equilibria: Equilibrium Conditions; Simple Phase Diagrams; Clausius-Clapeyron Equation.	**CLO4**

Suggestive Mode of Transaction

The course content transaction will include the following:

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, selections from theoretical readings, flipped learning, blended learning, demonstration, laboratory method

Books for Study

1. R. K. Pathria and P. D. Beale, Statistical Mechanics, Academic Press, USA, 2011.
2. K. Huang, Statistical Mechanics, Wiley, India, 2nd Edition, 2011.
3. Heat and Thermodynamics, Brijlal and Subramaniam, 2008, S Chand.

Books for Reference

1. Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, 2009, Springer.
2. Perspectives of Modern Physics, Arthur Beiser, International edition, McGraw-Hill Inc.,US.
3. Statistical Physics, L. D. Landau and E. M. Lifshitz, UK, 3rd Edition, 1980.
4. F. Reif, Fundamental of Statistical and Thermal Physics, McGraw-Hill, USA, 1965.

Course Title: Nuclear and Particle Physics

Course Code: BSE.354

L	T	P	Cr
4	0	0	4

Course Learning Outcomes;

At the end of the course the prospective teacher-trainees will be able to;

CLO1 understand the structure and properties of atomic nucleus.

CLO2 acquire the ability to calculate the lifetime and radioactive decay rates of nuclie.

CLO3 identify the difference between varieties of nuclear detectors and counters and the comprehension of their application.

CLO4 develop comprehension of classification of elementary particles and fundamental forces.

Unit/Hours	Contents	Mapping with CLOs

UNIT-I **11 hours**	**NUCLEAR STRUCTURE AND MODELS** Nuclear composition, Isotopes, Isobars, Isotones, Mirror nuclei, Properties of nucleus- mass, charge, Size, Density and Binding energy, Liquid drop model, Shell model.	**CLO1**
UNIT-II **11 hours**	**RADIOACTIVITY AND NUCLEAR REACTIONS** Radioactive decay, Types of radiation: alpha, beta and gamma decays, Properties, Half-life, Radioactive series, Dating techniques, Nuclear reactions, Nuclear fission, Nuclear fusion, Nuclear reactors.	**CLO2**
UNIT-III **11 hours**	**NUCLEAR DEECTORS AND COUNTERS** Interactions of radiation with matter, Fundamental ideas, Gas filled counters, Ionization chamber, Proportional counter, G.M. counter, Cloud chamber, Bubble chamber, Semiconductor detectors and Scintillation counters.	**CLO3**
UNIT-IV **12 hours**	**ELEMENTARY PARTICLES** Classification of elementary particles, Bosons, Fermions, Pauli exclusion principle, Leptons, Hadrons, Elementary particle quantum numbers, Basics of quarks, Fundamental forces, Standard model.	**CLO4**

Suggestive Mode of Transaction

The course content transaction will include the following:

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, selections from theoretical readings, flipped learning, blended learning, demonstration, laboratory method

Books for Study

8. Perspectives of Modern Physics, International edition, Arthur Beiser, McGraw-Hill Inc.,US.
9. Introduction to Modern Physics, Rich Meyer, Kennard, Coop, 2002, Tata McGraw Hill.
10. Introduction to Elementary Particles, D. Griffith, John Wiley & Sons

Books for Reference

7. Modern Physics, J.R. Taylor, C.D. Zafiratos, M.A. Dubson, 2009, PHI Learning.
8. Concepts of Nuclear Physics, Bernard L. Cohen, 1998, Tata McGraw Hill.
9. Atomic and nuclear physics, T. A. Littlefield and N. Thorley, Van Nostrand Reinhold. Digital Electronics, Donald
10. Introductory Nuclear Physics, Kenneth S. Krane, 2008, Wiley India Pvt. Ltd..

Course Title: Physics (Practical-I)

Course Code: BSE.355

L	T	P	Cr
0	**0**	**4**	**2**

11. To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method.
12. To determine the Coefficient of Thermal Conductivity of Cu by Searle's Apparatus.
13. To determine the Coefficient of Thermal Conductivity of a bad conductor by Lee and Charlton's disc method.
14. To study the variation of Thermo-Emf of a Thermocouple with Difference of Temperature of its Two Junctions.
15. To determine the Temperature Coefficient of Resistance by Platinum Resistance Thermometer (PRT).
16. To calibrate a thermocouple to measure temperature in a specified Range using (1) Null Method, (2) Direct measurement using Op Amp difference amplifier and to determine Neutral Temperature

Course Title: Physics (Practical-II)
Course Code: BSE.356

L	T	P	Cr
0	0	4	2

1. Solid State Nuclear Track Detector (SSNTD)
2. G.M. Counters: characteristics, dead time and counting statistics
3. Scintillation detector-energy calibration, resolution and determination of gamma ray energy
4. To setup the Millikan oil drop apparatus and determine the charge of an electron.
5. Nuclear Magnetic Resonance
6. To determine the wavelength of H-alpha emission line of Hydrogen atom

CHEMISTRY (MAJOR)

Course Title: Spectroscopic Techniques in Chemistry (molecular spectroscopy, UV-visible, FTIR, NMR and photochemistry)
Course Code: BSE.357
Course learning Outcomes;

L	T	P	Cr
4	0	0	4

At the end of the course the prospective teacher-trainees will be able to;

CLO1: understand Heterocyclic compounds, classification and nomenclature and synthesis and reactions of Benzo–Fused Five–Membered Heterocycles with one–heteroatom.
CLO2: comprehend Synthesis and reactions of Five–Membered Heterocycles with Two heteroatom. Synthesis and reactions
CLO3: evaluate Hoffmann's exhaustive methylation, Emde's modification, structure elucidation and synthesis of Hygrine and Nicotine.
CLO4: sustain their knowledge related to steroids: occurrence, nomenclature, Diel's hydrocarbon and stereochemistry.

Units/Hours	Contents	Mapping with CLOs
Unit-I **17 hrs**	**Molecular Spectroscopy-Rotational, Vibrational and Raman:** Interaction of electromagnetic radiation with molecules and various types of spectra; Relevance of Born- Oppenheimer approximation to molecular spectroscopy. Intensity and broadening of spectral lines. Rotational spectroscopy: Selection rules, intensities of spectral lines, determination of bond lengths of diatomic and linear triatomic molecules, isotopic substitution. Vibrational spectroscopy: Classical equation of vibration, computation of force constant, amplitude of diatomic molecular vibrations, anharmonicity, Morse potential, dissociation energies, fundamental frequencies, overtones, hot bands, degrees of freedom for polyatomic molecules, modes of vibration, concept of group frequencies. Vibration-rotation spectroscopy: diatomic vibrating rotator, P, Q, R branches. Raman spectroscopy: Qualitative treatment of Rotational Raman effect, Effect of nuclear spin, Vibrational Raman spectra, Stokes and anti-Stokes lines; their intensity difference, rule of mutual exclusion.	CLO1

Unit-II **15 hrs**	**UV-visible spectroscopy:** Basic principles and range of UV-visible radiations, electronic transitions, λmax & εmax, chromophore, auxochrome, bathochromic and hypsochromic shifts. Application of electronic spectroscopy and Woodward rules for calculating λmax of conjugated dienes and α,β – unsaturated compounds. **FTIR spectroscopy:** Basic principles of infrared spectroscopy, features, selection rules, modes of vibrations, IR frequencies of various functional groups, effect of H-bonding, conjugation, resonance and ring size on IR absorptions; Fingerprint region and its significance; application in functional group analysis.	CLO2
Unit- **III** **13 hrs**	**NMR spectroscopy:** Basic principles of Proton Magnetic Resonance, chemical shift and factors influencing it; Spin – Spin coupling and coupling constant; Anisotropic effects in alkene, alkyne, aldehydes and aromatics, Interpretation of NMR spectra of simple compounds. Applications of IR, NMR and UV-vis for identification of simple organic molecules.	CLO3
Unit- **IV** **15 hrs**	**a) Photochemistry:** Characteristics of electromagnetic radiations, difference between thermal and photochemical processes, Laws of photochemistry; Lambert–Beer's Law and its limitations, Grotthus–Drapper law, Einstein law of photochemical equivalence. **b)** Jablonski diagram depicting various processes occurring in the excited state like fluorescence, phosphorescence, non– radiative processes. Quantum yield, actinometry, kinetics of low and high quantum yield photochemical reactions; hydrogen–chlorine and hydrogen–bromine reactions, photolysis of hydrogen iodide, ammonia, and anthracene. Photochemical equilibrium, photosensitized reactions, quenching, Stern–Volmer equation. Chemiluminescence. Role of photochemical reactions in biochemical processes.	CLO4

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Suggested Readings:-

- Banwell, C. N. & McCash, E. M. (2017). *Fundamentals of Molecular Spectroscopy* (5th Ed.). McGraw Hill Education, New Delhi. ISBN: 9780074620254.
- Atkins, P. & Friedman, R. **(**2011). *Molecular Quantum Mechanics* (5th Ed.). Oxford University Press. ISBN: 9780199541423.
- Kemp, W. (2011). *Organic Spectroscopy* (3rd Ed.). Palgrave Macmillan. ISBN: 9780230576630.
- Pavia, D. L., Lampman, G. M., Kriz, G. S. & Vyvyan, J. A. (2014). *Introduction to Spectroscopy* (5th Ed.). Cengage Learning. ISBN: 9781285460123.

Course Title: Physical Chemistry-IV (Electrochemistry, Phase equilibria, Properties of Solutions and Chemical Kinetics)

Course Code: BSE.358

L	T	P	Cr
4	0	0	4

Course Learning Outcomes;

At the end of the course the students will be able to;

CLO1: understand Electrochemistry: Chemical cells, reversible and irreversible cells with examples.

CLO2: comprehend Applications of Clausius–Clapeyron equation to solid–liquid, liquid–vapour and solid–vapour equilibria.

CLO3: analyse Thermodynamic properties of solutions, Ideal solutions and Raoult's law.
CLO4: help them to understand Laws of photochemistry; Lambert–Beer's Law and its limitations.

Units/Hours	Contents	Mapping with CLOs
Unit-I **15 hrs**	**a) Electrochemistry:** Chemical cells, reversible and irreversible cells with examples. Electromotive force of a cell and its measurement, Nernst equation; Standard electrode (reduction) potential and its application to different kinds of half–cells. Applications of EMF measurements in determining (I) thermodynamic quantities (ΔF, ΔH and ΔS) of a cell reaction. **b)** Equilibrium constants, and (III) pH values using hydrogen, quinone–hydroquinone, glass electrodes. Types of electrodes; gas electrodes, metal–metal ion electrodes, metal–insoluble salt electrode, amalgam electrodes, oxidation–reduction electrodes. Concentration cells with and without transference, liquid junction potential; determination of activity coefficients and transference numbers, solubility product. Potentiometric titrations (acid–base, precipitation).	CLO1
Unit-II **15 hrs**	**a) Phase Equilibria:** Concepts of phases, components and degrees of freedom, derivation of Gibbs Phase Rule, Applications of Clausius–Clapeyron equation to solid–liquid, liquid vapour and solid–vapour equilibria, Phase diagrams for one component (H_2O, CO_2 and S) systems. Phase diagrams for two component (solid–liquid equilibria) involving eutectic systems; Bi–Cd, Pb–Ag, KI–H_2O. **b)** Phase diagrams for solid solutions; compound formation with congruent Melting Points (Fe_2Cl_6–H_2O system), compound formation with incongruent Melting Points (CaF_2–$CaCl_2$ system). Solid–gas equilibria ($CuSO_4$–H2O). Three Component Systems: Triangular plots, partially miscible three–liquid systems, Water– chloroform–acetic acid system, Applications of ternary liquid diagrams.	CLO2
Unit-III **15 hrs**	**a) Solutions and Their Properties:** Types of solutions and their properties, expressions of concentration (molarity, normality, mole fraction, mass percentage), solubility of gases and solids in liquids, Henry's Law, Raoult's Law for liquid solutions, ideal and non-ideal solutions, processes like fractionating column, distillation of immiscible liquids (steam distillation), distillation diagrams of partially miscible and immiscible liquid pairs. b) **Colligative Properties** Relative lowering of vapour pressure, molecular weight determination. Osmosis, Law of osmotic pressure and its measurement, determination of molecular weight from osmotic pressure. Elevation of boiling point and depression of freezing point. Thermodynamic derivation of relation between molecular weight and elevation in boiling point and depression in freezing point. Experimental methods for determining various colligative properties. Abnormal molar mass, degree of dissociation and association of solutes (Van't Hoff factor).	CLO3

Unit-IV **15 hrs**	**Chemical Kinetics:** Order and molecularity of a reaction, rate laws in terms of the advancement of a reaction, differential and integrated forms of rate expressions up to third-order reactions, experimental methods of the determination of rate laws, half-life, kinetics of simple reactions, chain reactions. Temperature dependence of reaction rates; Arrhenius equation; activation energy. qualitative treatment of Collision theory of reaction rates, Lindemann mechanism and activated complex theory.	CLO4

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Suggested Readings:-

● Principles of Physical Chemistry, Author: S.H. Maron & C.F. Prutton, Publisher: Collier Macmillan Ltd; 4th Revised edition (Dec. 1965), ISBN–10: 0023762306.

● Physical Chemistry, Author: P.W. Attkins, Publisher: W H Freeman & Co., 6th edn. (Nov, 1997), ISBN–10: 0716728710.

● Physical Chemistry, Author: W.J. Moore, Publisher: Longman; 1st Revised edition (July 1972), ISBN–10: 0582442346.

● Thermodynamics for Chemists, Author: Samuel Glasstone, Publisher: East–West Press Pvt Ltd. (2008), ISBN–13: 8176710148.

● Physical Chemistry: A Molecular Approach, Author: D.A. McMarrie & J.D. Simon. Publisher: University Sci. Books; 1 edn (July, 1997), ISBN–10: 09357.

● Cotton, F.A., Wilkinson, G., Gaus, P.L., Basic Inorganic Chemistry; 3rd edition, Pubs: John Wiley Sons. 1995. ● Lee, J.D., Concise Inorganic Chemistry; 4th edition, Pubs: Chapman Hall Ltd., 1991.

● Shriver, D.E., Alkins, P.W., Langford, C.H., Inorganic Chemistry; 4th edition, Oxford Publisher: Oxford University Press, 2006

. ● Douglas, B. McDamiel, D., Alexander, J., Concepts and Models of Inorganic Chemistry; 3rd edition, Pubs: John Wiley and Sons Inc., 1994.

● Porterfield, W.W., Wesley, A., Inorganic Chemistry; Pubs: Addison–Wesley Publishing Company, 1984.

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

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

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

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

CHEMISTRY (MAJOR)

Course Name: Organic Chemistry-IV: (Practical-I Preparation of Organic Compounds)

Course Code: BSE.359

L	T	P	Cr
0	0	4	2

Course Learning Outcomes

At the end of the course the prospective teacher-trainees will be able to;

CLO1: synthesize various organic compounds using both conventional and green methods.

CLO2: understand and apply different reaction mechanisms, such as acetylation, benzoylation, and

oxidation.

CLO3: accurately perform and analyze specific reactions, including nitration, reduction, and hydrolysis.

CLO4: evaluate and implement green chemistry approaches in the synthesis of organic compounds.

Units/Hours	Contents	Mapping with Course Learning Outcome
30 hrs	**Preparation of organic Compounds** **1.** Acetylation of one of the following compounds: amines (aniline, o–, m–, p–toluidines and o–, m–, p–anisidine) and phenols (β–naphthol, vanillin, salicylic acid) by any one method: **a.** Using conventional method. **b.** Using green approach **2.** Benzolyation of one of the following amines (aniline, o–, m–, p– toluidines and o–, m–, p– anisidine) and one of the following phenols (β–naphthol, resorcinol, p–cresol) by Schotten–Baumann reaction. **3.** Oxidation of ethanol/ isopropanol (Iodoform reaction). **4.** Bromination of any one of the following: **a.** Acetanilide by conventional methods **b.** Acetanilide using green approach (Bromate–bromide method) **5.** Nitration of any one of the following: **a.** Acetanilide/nitrobenzene by conventional method **b.** Salicylic acid by green approach (using ceric ammonium nitrate). **6.** Selective reduction of meta dinitrobenzene to m–nitroaniline. **7.** Reduction of p–nitrobenzaldehyde by sodium borohydride. **8.** Hydrolysis of amides and esters. **9.** Semicarbazone of any one of the following compounds: acetone, ethyl methyl ketone, cyclohexanone, benzaldehyde. **10.** Aldol condensation using either conventional or green method.	**CLO1** **CLO2** **CLO3** **CLO4**

Suggested Readings:-

● Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009)

● Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. Practical OrganicChemistry, 5thEd., Pearson (2012)

● Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press (2000).

● Ahluwalia, V.K. & Dhingra, S. Comprehensive Practical Organic Chemistry: Qualitative Analysis, University Press (2008).

● Cotton, F.A., Wilkinson, G., Gaus, P.L., Basic Inorganic Chemistry; 3rd edition, Pubs: John Wiley Sons. 1995.

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

● Shriver, D.E., Alkins, P.W., Langford, C.H., Inorganic Chemistry; 4th edition, Oxford Publisher: Oxford University Press, 2006.

● Douglas, B. McDamiel, D., Alexander, J., Concepts and Models of Inorganic Chemistry; 3rd edition, Pubs: John Wiley and Sons Inc., 1994.

● Porterfield, W.W., Wesley, A., Inorganic Chemistry; Pubs: Addison–Wesley Publishing

Company, 1984.
● Miessler, G.L., Larr, D.A., Inorganic Chemistry; 3rd edition, Pubs: Pearson Education Inc., 2004.
● Jolly, W.L., Modern Inorganic Chemistry; 2nd edition, Pubs: McGraw–Hill Publishing Company Limited, 1991.
● Purcell, K.F., Kotz, J.C., Inorganic Chemistry; Pubs: W.B. Saunders Company, 1977.
● Puri, B.R., Sharma, L.R., Kalia, K.C., Principles of Inorganic Chemistry; 30th edition, Pubs:● Milestones Publisher, 2006–07

CHEMISTRY (MAJOR)

Course Name: Physical Chemistry-IV (Practical -II)

Course Code: BSE.360

L	T	P	Cr
0	0	4	2

Course Learning Outcomes;

At the end of the course the prospective teacher-trainees will be able to;
CLO1: evaluate the validity of Freundlich and Langmuir adsorption isotherms, and determine adsorption isotherms for various solutes.
CLO2: prepare colloidal solutions, determine the precipitating values of various salts for colloidal systems.
CLO3: determine the mutual solubility curves of binary systems and calculate distribution coefficients in various solvent systems.
CLO4: determine the molecular weight of various substances using different techniques.

Units/ Hours	Contents	Mapping with Course Learning Outcome
UNIT-I	**Adsorption** **(a)** To investigate the adsorption of oxalic acid from aqueous solution by activated charcoal and examine the validity of Freundlich and Langmuir's adsorption isotherms. **(b)** To determine the adsorption isotherms of CH_3COOH from aqueous solutions by charcoal.	**CLO1**
UNIT-II	**Colloidal State:** **(a)** To prepare colloidal solutions of arsenius sulphide, cadmium sulphide and ferric hydroxide. **(b)** To determine the precipitating values of KCl, K_2SO_4 and $K_3Fe(CN)_6$ for ferric hydroxide solution. **(c)** To study the protective action of hydrophilic colloid on the precipitation of a hydrophobic colloid.	**CLO2**
UNIT-III	**Phase Equilibria:** **(a)** To determine the mutual solubility curve of phenol and water and hence the consolute point. **(b)** To study the distribution of benzoic acid between benzene and water,	**CLO3**

	and hence show that benzoic acid dimerizes in benzene. **(c)** To determine the distribution coefficient of I_2 between CCl_4 and H_2O.	
UNIT-IV	**Molecular weight determination:** **(a)** Determination of molecular weight of a volatile substance by Victor Mayer's method. **(b)** Determination of molecular weight of a liquid by steam distillation. **(c)** Determination of molecular weight of high polymer (polystyrene) by viscosity measurements. **(d)** To determine the critical micelle concentration of a soap (potassium laurate) by surface tension measurements. **(e)** To extract oil from given seeds with the help of soxhlet apparatus.	**CLO4**

Suggested Readings:-

● Findlay's Practical Physical Chemistry, Author: Alexander Findlay Publisher: Wiley, 1972, ISBN–10:0470258853.

● Advanced Practical Physical Chemistry, Author: J. B. Yadav, Publisher: Krishna Prakashan Media (Pvt) Ltd (2015), ISBN–10: 8182835925.

- Quantitative Organic Analysis by Vogel, Author: A. I. Vogel, Publisher: Wiley, John & Sons, Incorporated, ISBN–13: 780582442504.

MATHEMATICS (MAJOR-I)

Course Title: Linear Algebra

Course Code: BSE.361

L	T	P	Cr
4	0	0	4

Course Learning Outcomes:

At the end of the course the prospective teacher-trainees will be able to;

CLO1 Understand the concept of a vector space and its subspaces and apply the principles of linear dependence, linear independence, linear combinations, and direct sum of subspaces.

CLO2 Understand the concept of a basis for a vector space, the existence theorem for bases, and apply the principles of dimension, quotient spaces, and the invariance of the number of elements in a basis.

CLO3 Understand the concept of linear transformations, their algebra, and apply the Rank-Nullity theorem, along with the principles of isomorphism and isomorphic spaces.

CLO4 Understand the concept of the matrix of a linear transformation, apply changes of basis, and analyze linear operators.

Units/Hours	Content	Mapping with CLOs
Unit-1 **15 hours**	Definition of a vector space, subspaces with examples. Direct sum of subspaces. Linear span, Linear dependence, Linear independence of vectors. Linear combination of vectors.	**CLO1**

Unit-2 **15 hours**	Basis of a vector space, Finitely generated vector spaces. Existence theorem for basis. Invariance of the number of elements of the basis set. Dimension of sum of two subspaces. Quotient space and its dimension.	**CLO2**
Unit-3 **15 hours**	Linear transformation. Algebra of linear transformation. Rank- Nullity theorem, Isomorphism and Isomorphic spaces.	**CLO3**
Unit-4 **15 hours**	Matrix of a linear transformation. Changes of basis, Linear operator.	**CLO4**

Suggestive Mode of Transaction:

The course content transaction will include the following:

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussions, panel interactions, small theme-based seminars, cooperative teaching, team teaching, flipped learning, blended learning, and demonstration.

Suggestive Mode of Assessment: Assignments, Class tests, Problem-solving, Semester examinations.

Suggestive Readings:

- K. Hoffman & R. Kunze: *Linear Algebra*, 2nd Edition, Prentice Hall, New Jersey, 1971.
- V. Krishnamurthy, V. P. Mainra and J.L. Arora: *An Introduction to Linear Algebra*, East West Press, 1976.
- Shanti Narayan & P.K. Mittal: *A Text Book of Matrices*, 10th Edition (2002), S. Chand & Co.
- Surjit Singh: *Linear Algebra*, 1997.

Mathematics (Major-II)

Course Title: Number Theory

L	T	P	Cr
4	0	0	4

Course Code: BSE.362

Course Learning Outcomes:

At the end of the course the prospective teacher-trainees will be able to;

CLO1 Understand and apply concepts of divisibility, GCD, LCM, Euclidean Algorithm, and solve linear Diophantine equations. Understand the fundamental theorem of arithmetic.

CLO2 Understand and apply the concepts of number-theoretic functions such as Euler's Phi-function, Mobius function, and the Inversion formula, and solve related problems.

CLO3 Understand the concepts of congruences, solve linear congruences, and apply the Chinese Remainder Theorem to solve systems of congruences.

CLO4 Understand and apply Fermat's Theorem, Euler's Theorem, and Wilson's Theorem in number theory, and explore their applications in cryptography, including RSA and factorization methods.

Units/Hours	Content	Mapping with CLOs
Unit-1 **15 hours**	Preliminaries: Proof by induction, Binomial Theorem. Divisibility in Integers: Basic Definitions and Properties, The division Algorithm, GCD, The Euclidean Algorithm, LCM, Existence and determination of solution to the linear Diophantine equation $ax + by = c$, primes-definition & Properties, the fundamental theorem of Airthmetic.	**CLO1**
Unit-2 **15 hours**	Number-theoretic functions: the greatest integer function, Euler's Phi-function, Sum & number of divisors functions, Mobius function & the Inversion formula.	**CLO2**
Unit-3 **15 hours**	Congruences-definition and properties, linear congruences, existence & solution of the linear congruence, $ax \equiv b\ (mod\ m$), Complete and reduces residue systems, Chinese remainder theorem.	**CLO3**
Unit-4 **15 hours**	Fermat's theorem, Euler's theorem, Pseudoprimes Wilson's theorem. Application to Cryptography-Factorization methods due to Fermat, RSA.	**CLO4**

Suggestive Mode of Transaction:

The course content transaction will include the following:

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussions, panel interactions, small theme-based seminars, cooperative teaching, team teaching, flipped learning, blended learning, and demonstration.

Suggestive Mode of Assessment: Assignments, Class tests, Problem-solving, Semester examinations.

Suggestive Readings:

- David M. Burton: *Elementary Number Theory*, Seventh Edition, McGraw-Hill, Indian Reprint, 2012.
- Ivan Niven, Herbert S. Zuckerman & Hugh L. Montgomery: *An Introduction to the Theory of Numbers*, Wiley, Fifth Edition, 1991.
- Tom M. Apostol: *An Introduction to Analytical Number Theory*, Springer-Verlag, UTM.

Mathematics (Major-III)

L	T	P	Cr
4	0	0	4

Course Title: Graph Theory
Course Code: BSE.363

Course Learning Outcomes: At the end of the course, the students will be able to:

CLO1 Understand fundamental concepts and types of graphs, subgraphs, operations, and basic properties.

CLO2 Analyze and apply ideas of connectedness, trees, spanning trees, and cut-sets; solve classical problems of traversability.

CLO3 Examine planarity, duality, Euler and Hamiltonian graphs, and applications in proofs and network analysis.

CLO4 Use graph coloring, chromatic number, independence, matching, and related properties; analyze real-life and mathematical applications.

Units/Hours	Content	Mapping with CLOs
Unit-1 **15 hours**	Definition and types of graphs (simple, multigraphs, pseudographs), degree of a vertex, subgraphs, isomorphism, homomorphism, automorphism, complements, graph operations (union, join, product), walks, paths, cycles, connected/disconnected graphs and components.	**CLO1**
Unit-2 **15 hours**	Trees: definitions and properties, pendant vertices, centers, binary trees, spanning trees, minimal spanning trees (Prim's and Kruskal's algorithms), cut-vertices and bridges, cut-sets, fundamental circuits, connectivity and Menger's theorem (statement and simple applications).	**CLO2**
Unit-3 **15 hours**	Eulerian and Hamiltonian graphs, necessary and sufficient conditions, Fleury's and Dirac's theorems, planar graphs, Euler's formula, platonic graphs, Kuratowski's theorem (statement), dual graphs, applications.	**CLO3**
Unit-4 **15 hours**	Vertex coloring, chromatic number, clique, independence number, edge coloring, chromatic index, matching and coverings, bipartite graphs, Hall's marriage theorem (statement and applications), applications to scheduling and assignment problems.	**CLO4**

Suggestive Mode of Transaction:

The course content transaction will include the following:

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussions, panel interactions, small theme-based seminars, cooperative teaching, team teaching, flipped learning, blended learning, and demonstration.

Suggestive Mode of Assessment: Assignments, Class tests, Problem-solving, Semester examinations.

Suggestive Readings:

S.C. Gupta and V.K.Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons.

V.K. Rohatgi and A.M.E. Saleh, An Introduction to Probability and Statistics, Wiley.

A.M. Mood, F. A. Graybill, and D.C. Boes, Introduction to the Theory of Statistics, McGraw-Hill.

Sheldon Ross, A First Course in probability, Pearson.

BOTANY (MAJOR)

L	T	P	Cr
4	0	0	4

Course Title: Plant Tissue Culture
Course Code:BSE.364
Course Learning Outcomes:
At the end of the course the prospective teacher-trainees will be able to;
CLO1 Students will learn the history, principles, and techniques of plant tissue culture
CLO2 Students will understand the composition of culture media, use of nutrient and hormone and their role in micro-propagation of ornamental and horticultural plants.
CLO3 Students will learn the techniques for callus subculture maintenance, growth measurement and the processes of morphogenesis, organogenesis and somatic embryogenesis.
CLO4 Students will learn techniques and applications of embryo, endosperm, and tissue culture in plant propagation and conservation.

Units/Hours	Contents	Mapping with CLOs
UNIT-I 12 hrs	History of plant tissue culture research - basic principles of plant tissue callus culture, meristem culture, organ culture, Totipotency of cells, differentiation and dedifferentiation.	**CLO1**
UNIT-II 11 hrs	Composition of media; Nutrient and hormone requirements (role of vitamins and hormones); Medium for micro-propagation/clonal propagation of ornamental and horticulturally important plants	**CLO2**
UNIT-III 10 hrs	Callus subculture maintenance, growth measurements, morphogenesis in callus culture – organogenesis, somatic embryogenesis.	**CLO3**
UNIT-IV 12hrs	Endosperm culture – Embryo culture -culture requirements – applications, embryo rescue technique. Tissue culture applications (micropropagation, androgenesis, virus elimination, secondary metabolite production, haploids, triploids and hybrids; Cryopreservation; Germplasm Conservation).	**CLO4**

Suggestive Mode of Transaction
The course content transaction will include the following;
Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Suggested Readings:

1. Bhojwani, S.S. and Razadan, M.K. 1996. *Plant Tissue Culture: Theory and Practice* (A revised Edition), Elsevier Science Pub., New York, U.S.A.
2. Collins, H.A. and Edwards, S. 1998. *Plant Cell Culture*, Bios Scientific Pub., Oxford , U.K.
3. Kartha, K.K. 1985. *Cryopreservation of Plant Cells and Organs*, CRC Press, Boca Raton, Florida, U.S.A.
4. Razadan, M.K. 1993. *An Introduction to Plant Culture*. Oxford & IBH Pub., Co., New Delhi, India.
5. Yeoman, M.N. (Ed.) 1987. *Plant Cell Culture Technology*, Narosa Publ, New Delhi, India.

Course Title: Plant Molecular Biology

L	T	P	Cr
4	0	0	4

Course Code: BSE.365

Course Learning Outcomes:

At the end of the course the prospective teacher-trainees will be able to;

CLO1 Students will gain the knowledge of genetic material and the unique features of organelle DNA.

CLO2 Students will understand nucleosome organization, chromatin structure, DNA replication mechanisms, and the principles of the central dogma and genetic code.

CLO3 Students will understand the mechanisms of transcription in prokaryotes and eukaryotes, including transcriptional regulation, gene expression control, and gene silencing.

CLO4 Student will also learn the processes of translation, including ribosome structure, tRNA charging, protein synthesis steps, fidelity, inhibitors, and post-translational modifications.

Units/Hours	Contents	Mapping with CLOs
UNIT-I **12 hrs**	**Structures of DNA and RNA / Genetic Material**: Types of genetic material, DNA as the carrier of genetic information (Griffith's, Hershey & Chase, Avery, experiment). **DNA Structure**: Miescher to Watson and Crick- historic perspective, Salient features of double helix, Types of DNA, denaturation and renaturation, cot curves; Organization of DNA- Prokaryotes, Viruses, Eukaryotes. RNA Structure. Organelle DNA: mitochondria and chloroplast DNA.	**CLO1**
UNIT-II **12 hrs**	**Nucleosome**: Concept, Chromatin structure- Euchromatin, Heterochromatin- Constitutive and Facultative heterochromatin. **Replication of DNA**: General principles – bidirectional, semi-conservative and semi discontinuous replication, RNA priming; Central dogma and genetic code.	**CLO2**
UNIT-III **10 hrs**	**Transcription**: Transcription in prokaryotes and eukaryotes. Principles of transcriptional regulation; Prokaryotes: Regulation of lactose metabolism and tryptophan synthesis in *E.coli*. Eukaryotes: transcription factors, heat shock proteins, steroids and peptide hormones; Gene silencing.	**CLO3**
UNIT-IV **11hrs**	**Translation**: Ribosome structure and assembly, mRNA; Charging of tRNA, aminoacyl tRNA synthetases; Various steps in protein synthesis, proteins involved in initiation, elongation and termination of polypeptides; Fidelity of translation; Inhibitors of protein synthesis; Post-translational modifications of proteins.	**CLO4**

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Suggested Readings:

1. Watson J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M., Losick, R. (2007). Molecular Biology of the Gene, Pearson Benjamin Cummings, CSHL Press, New York, U.S.A. 6th edition.
2. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics. John Wiley and Sons Inc., U.S.A. 5th edition.
3. Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. Benjamin Cummings. U.S.A. 9th edition.
4. Russell, P. J. (2010). Genetics- A Molecular Approach. Benjamin Cummings, U.S.A. 3rd edition.
5. Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis. W. H. Freeman and Co., U.S.A. 10th edition.

Course Title: Plant Tissue Culture (Practical-I)

Course Code: BSE.366

L	T	P	Cr
0	0	4	2

Course Learning Outcomes:

1. Preparation of MS medium.
2. Demonstration of *in vitro* sterilization and inoculation methods using leaf and nodal explants of tobacco, *Datura*, *Brassica* etc.
3. Study of anther, embryo and endosperm culture, micropropagation, somatic embryogenesis & artificial seeds through photographs.
4. Field visit to a lab involved in tissue culture

Course Title: Plant Molecular Biology (Practical-II)

Course Code: BSE.367

L	T	P	Cr
0	0	4	2

1. Preparation of LB medium and raising *E. Coli.*
2. Isolation of genomic DNA from *E. Coli.*
3. DNA isolation from cauliflower head.
4. DNA estimation by diphenylamine reagent/UV Spectrophotometry.
5. Study of DNA replication mechanisms through photographs (Rolling circle, Theta replication and semi-discontinuous replication).
6. Study of structures of prokaryotic RNA polymerase and eukaryotic RNA polymerase II through photographs.
7. Photographs establishing nucleic acid as genetic material (Messelson and Stahl's, Avery et al, Griffith's, Hershey & Chase's and Fraenkel & Conrat's experiments)
   Study of the following through photographs: Assembly of Spliceosome machinery; Splicing mechanism in group I & group II introns; Ribozyme and Alternative splicing.

ZOOLOGY (MAJOR)

Course Title: Principles of Ecology and Wildlife Management

Course Code: BSE.368

L	T	P	Cr
4	0	0	4

Course Learning Outcomes (CLO)

At the end of the course the prospective teacher-trainees will be able to;

CLO1: Understand the basic concepts of ecology and analyze the ecological dynamics of major terrestrial habitats.

CLO2: Comprehend ecosystem functioning, energy flow, and niche concepts to evaluate ecological interactions and biodiversity.

CLO3: Understand the status of endangered fauna in India and the implications of the Wildlife Protection Act.

CLO4: Understand wildlife conservation approaches, protected area management, and species-specific conservation projects in India.

CLO5: Explore challenges in wildlife trade, sustainable biodiversity use, and community-driven conservation solutions.

Unit/ Hours	Contents	Mapping with CLOs
Unit 1 **12 hours**	**Introduction to Ecology** • Ecology, basic concepts. Ecology of major terrestrial habitats (Deserts, Grasslands, Wetlands, Forests). • Ecosystem; Basic concepts and structure of ecosystem. • Functioning of ecosystem, energy flow, food chains, food webs and trophic levels. • Ecological succession: types and significance • Habitat and niche: Concept of habitat and niche; niche width and overlap; fundamental and realized niche; resource partitioning; character displacement. • Biogeochemical cycles: carbon, nitrogen, and phosphorus cycles	**CLO 1 & 2**
Unit 2 **10 hours**	**Introduction to Wildlife** • Wildlife and importance of its study • Wildlife habitats: Definition, types and importance • Physical and biological parameters. • Endangered wild fauna of India • Red Data Book • Wildlife Protection Act • CITES (Convention on International Trade in Endangered Species)	**CLO 3**
Unit 3 **13 hours**	**Wildlife Depletion and Conservation** • Causes of depletion of wildlife and its prevention • Management and restoration of degraded habitat • Human Wildlife Conflict: Causes and Control measures. • Wildlife Conservation: In situ and ex situ conservation • Concept and Types of Protected Areas (National Parks, Sanctuaries, Biosphere Reserves). • Species conservation projects in India: Tiger, Lion, Rhino, coral reefs. • Role of NGOs and international organizations (e.g., WWF, WCS)	**CLO 4**
Unit 4 **10**	**Wildlife trade and ecotourism** • Trade in wild animals: Challenges and solutions • Sustainable Utilization of Biodiversity Resources • Ecotourism: Concept and types	**CLO 5**

hours	• Wildlife Protected Areas as venue of Ecotourism in India • Community involvement in wildlife conservation • Illegal wildlife trade and wildlife crime control bureaus	

Suggestive Mode of Transaction

The course content transaction will include the following;
Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method.

Suggested Readings

1. Caughley G. and A. R. Sinclair. 1994. Wildlife Ecology and Management. Blackwell Press.
2. Mills, S. L. 2007. Conservation of wildlife populations. Demography, Genetics and Management. Blackwell Publishing.
3. Primack, R.B. 1993. Essentials of Conservation Biology, Third Edition. Sinauer Associates Inc., Sunderland, MA.
4. Sinclair, A. R. 2006. Wildlife Ecology Conservation and Management. Blackwell Press.

Course Title: APPLIED ZOOLOGY (Non Chordates)

Course Code: BSE.369

L	T	P	Cr
4	0	0	4

Course Learning Outcomes (CLO)

At the end of the course the prospective teacher-trainees will be able to;

CLO1: understand the various concepts of prawn culture and pearl culture related to industries as well as commercial values.
CLO2: establish a sustainable approach for lac in India.
CLO3: focus on sericulture and related techniques involved in it and commercial value.
CLO4: judge a broad array of career options and activities related to vermiculture as a viable future option

Units/ Hours	Contents	Mapping with course Learning Outcome
Unit I/ 3 Hours	**Aquaculture and apiculture:** culture of fresh and marine water prawn, preparation of farm, processing & export of prawn, Fish culture, species and life cycle of honey bees in India, methods of beekeeping, bee products & their uses , seasonal management and migration practices in apiculture.	**CLO1**

Unit II/ 12 Hours	**Lac culture**: lac insect & its life cycle, cultivation of lac insect, host plants, processing & uses of lac. **Poultry Farming:** Breeds of fowl, breeding methods, layers and broilers.	**CLO2**
Unit III/ 10 Hours	**Sericulture**: sericulture and type of silk, silkworms & their host plants, mulberry silkworm culture, life history of silkworm, natural enemies of silkworm and their control , silk reeling, processing, and grading.	**CLO3**
Unit IV/ 10 Hours	**Vermiculture:** biology of *Eisenia fetida*, rearing of earthworms, equipment & devices used in vermiculture, vermicompost technology, vermiwash collection, Economics of Vermiculture Enemies of earthworm, Environmental benefits and sustainable aspects of vermiculture.	**CLO4**

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, flipped learning, blended learning, demonstration, laboratory method

Suggested Readings:

1. Shukla G.S. & Upadhyay V.B. (2016). Economic Zoology, Rastogi Publications
2. Jabde P.V. (2008). Text Book of Applied Zoology, Discovery Publishing House

Web Resources:

1. https://www.conserve-energy-future.com/aquaculture-types-benefits-importance.php
2. https://biology.homeomagnet.com/apiculture/
3. https://www.notesonzoology.com/insects/lac-culture-of-insects-zoology/6565
4. https://www.dairyknowledge.in/article/digital-dairy-management
5. https://www.britannica.com/topic/poultry-farming
6. https://www.vedantu.com/biology/vermiculture

Course Title: Ecology and Wildlife (Practical-I)

Course Code: BSE.370

L	T	P	Cr
0	0	4	2

Course Learning Outcomes (CLO)

At the end of the course the prospective teacher-trainees will be able to;

CLO1: Develop the ability to calculate species richness and diversity indices, providing insights into ecosystem health and biodiversity levels.

CLO2: Gain knowledge about endangered wild birds and mammals using models or photomicrographs, enhancing conservation awareness.

CLO3: Acquire expertise in identifying venomous snakes of India and other wildlife using key morphological features and field guides.

CLO4: Gain proficiency in using essential wildlife study tools, such as GPS, cameras, and binoculars, for effective field research.

CLO5: Develop hands-on experience in wildlife rehabilitation, including medical care and reintroduction, promoting practical conservation methods.

Course Content

1. Calculate species richness and diversity indices in various ecosystems to assess biodiversity levels.
2. Study of Endangered wild birds through Models/Photomicrographs
3. Study of Endangered wild mammals through Models/Photomicrographs
4. Identification and Study of Venomous snakes of India.
5. Plot the important National Parks of India on a Map.
6. Demonstration of Basic Equipment needed for wildlife study (compass, binoculars, Cameras and lenses, range finder and GPS).
7. Gain hands-on experience in rehabilitating injured or orphaned wildlife, including medical care and reintroduction to the wild.
8. Conduct field surveys to observe wildlife populations and their habitats, learning to identify species and track their movements.
9. Learn to identify different wildlife species through field guides, focus on key morphological features and distinguishing characteristics.

Course Title: APPLIED ZOOLOGY (Practical-II)
Course Code: BSE.371
Course Learning Outcomes (CLO)

L	T	P	Cr
0	0	4	2

At the end of the course the prospective teacher-trainees will be able to;

CLO1: Develop an understanding of the life cycles and morphological features of key species

CLO2: demonstration of various culture techniques and equipments

CLO3: Study the morphology of earthworm species commonly used in vermicomposting to understand their roles in organic waste management.

Content

1. Study of life cycles of silkworm using models, charts or video.
2. Study of life cycle and morphology of the *Apis dorsata* (rock bee), *Apis cerana* (Indian bee), *Apis mellifera* (European bee), and *Apis florea* (little bee). using models, charts or video.
3. Study of life cycles of silkworm using models, charts or video.
4. Identification of common edible non-chordates like prawns, oysters, and clams.
5. Identification of the queen, drones, and worker bees in a hive.
6. Demonstration of the honey extraction process using a honey extractor.
7. Study of honey quality parameters (e.g., color, viscosity, aroma).
8. Identification of different cocoon types (single-shelled, double-shelled).
9. Study the morphology of commonly used species: *Eisenia fetida* (red worm) and *Perionyx excavatus*.
10. Demonstration of the setup for vermicomposting (layers of soil, organic waste, and earthworms).
11. Visit to nearby industry to obtain practical experiences

STAGE-SPECIFIC CONTENT-CUM-PEADAGOGY COURSES (ANY TWO AS PER THE MAJOR AND MINOR SUBJECT)

PEDAGOGY OF PHYSICS-III

Course Title: Pedagogy of Physics-III
Course Code: BSE.372
Course Learning Outcomes:

L	T	P	Cr
2	0	0	2

At the end of the course the prospective teacher-trainees will be able to;

CLO1 plan and critically appraise physics curriculum at senior secondary level.
CLO2 plan and critically appraise the physics practical work.
CLO3 select and effectively make use of teaching aids.
CLO4 prepare, use and analyze achievement tests for evaluation of learning outcomes of physics.

Unit/Hours	Contents	Mapping with CLOs
UNIT-I **7 hours**	**PHYSICS CURRICULUM** Meaning and Concept of Curriculum, Need & Importance of Curriculum, Principles of Curriculum Construction. Critical Appraisal of existing Physics Curriculum at the Senior Secondary level prescribed by Central Board of Secondary Education, New Delhi.	**CLO1**
UNIT-II **7 hours**	**PLANING AND GUIDING PRACTICAL WORK** Planning & guiding practical work in Physics, Importance of Physics Laboratory, Equipments and other items for Physics laboratory, Maintenance of laboratory equipments and records, State & National level institutions & Laboratories: ANRF, NPL, ISRO, CSIR, IUAC, DRDO	**CLO2**
UNIT-III **8 hours**	**INSTRUCTIONAL SUPPORT SYSTEM AND INOVATION IN PHYSICS TEACHING** Teacher's role in training students in scientific method, developing scientific attitude, critical thinking & creativity, Physics Lab. : Meaning and Qualities, responsibilities & professional ethics of a Physics teacher, Approaches of Physics- Constructivist approach, Collaborative Learning approach & Activity based approach, Models of Physics Teaching: Concept attainment and inquiry training model, Techniques of teaching Physics-Team teaching, Programmed Instruction, Cooperative learning, Computer Assisted Instruction, Concept Mapping & Content analysis.	**CLO3**
UNIT-IV **8 hours**	**EVALUATION IN PHYSICS** Evaluation: Meaning, Objectives, Importance, Purposes & Steps of Evaluation process, Difference between Evaluation & Measurement, Types & Techniques of Evaluation, Preparation of Blue Print, Development of Achievement Test, Evaluation of Practical Work in Physics, Critical analysis of present examination system.	**CLO4**

Suggestive Mode of Transaction

The course content transaction will include the following:

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, selections from theoretical readings, flipped learning, blended learning, demonstration, laboratory method

Books for Study

1. Innovation in Teaching Learning Process, Chauhan, S.S. (2000)., New Delhi: Vikas Publishing House Pvt. Ltd.
2. Science Teaching in Schools, Das, R.C. (1985), New Delhi: Sterling Publishers Pvt. Ltd.
3. Research in Teaching of Science, Gupta, N.K. (1997), New Delhi: APH Publishing Corporation.

Books for Reference

1. Innovative Science Teaching for Physical Science Teachers, Radha Mohan (2003), New Delhi: Prentice Hall Pvt. Ltd.
2. Methods and Techniques of Teaching, Kochar, S.K. (1997), New Delhi: Sterling Publishers Pvt. Ltd.
3. Teaching of Physics, Maitre, K. (1991), New Delhi: Discovery Publishing House.
4. Emerging Trends in Teaching of Physics, Prakash R. and Rath, T.N. (1996), New Delhi: Kanisha Publishers.

PEDAGOGY OF CHEMISTRY-III

Course Name: Pedagogy of Chemistry-III

Course Code: BSE.373

L	T	P	Cr
2	0	0	2

Course Learning Outcomes

At the end of the course the prospective teacher-trainees will be able to;

CLO1: Explain the significance of acquiring 21st–century skills for Physical Sciences teaching

CLO2: Outline the need for and importance of assessment and evaluation in the teaching of Chemistry.

CLO3: Utilize appropriate tools and techniques for assessment and evaluation in teaching learning of Chemistry.

CLO4: Identify recent trends in research related to the teaching and learning and its implications in teaching learning of Chemistry.

CLO5: Relate ICT integration and elaborate its use in classroom situations.

Units/Hours	Contents	Mapping with Course Learning Outcome
UNIT-I **8 hrs**	**21st Century Skills for Learning** **a)** Need for and importance of how to learn 21st century skills for learners and teachers of Chemistry. Psychological, sociological, and philosophical perspective of teaching and learning Physical Sciences **b)** Qualities of a Chemistry teacher as professional for enhancing teaching learning skills and Role of a teacher in facilitating learning and creating dynamic learning environment of Physical Sciences.	**CLO1** **CLO5**
UNIT-II **7 hrs**	**Assessment and Evaluation** **a)** Assessment and Evaluation: Need for and Importance of Chemistry. **b)** Assessment based on learning outcomes, strategies for continuous assessment, school–based assessment, qualitative assessment; formative and summative assessment, formal, informal and 360◦ assessment.	**CLO2** **CLO5**
UNIT-III **8 hrs**	**a) Performance Assessment:** Assessment of group activities, field observations, recording and reporting, creating platform and portfolio management, assessment of laboratory skills, assignments, projects, and presentations. **b) Tools and Techniques of Assessment and Evaluation** – Unit test based on Table of Specification (TOS) and its	**CLO3** **CLO5**

	importance, basic steps of question paper setting, types of test items and preparing answer key and criteria for school, assessment, and feedback mechanism in teaching learning the content of Chemistry.	
UNIT-IV **7 hrs**	**a.**Recent trends in research related to teaching learning of Chemistry. **b.Action research**: meaning, significance, steps and planning. c.Evidence–based practices and reflection, school–based research in Chemistry	**CLO4** **CLO5**

SESSIONAL WORK: (Choose any three)

- Prepare, administer, and analyze scores of an achievement test.
- Explore AI based assessment tools and prepare an E–Portfolio for a student of Secondary Stage.
- Conduct Simulated Teaching session for the concepts of Chemistry and observation by self, peer, and teacher.
- Explore development of multidisciplinary projects and present using PowerPoint.
- Interpret the concept of Chemistry with Psychological, Sociological and Philosophical Perspective.
- Apply innovative practices in classroom teaching learning of Chemistry.
- Make a presentation on the role of Chemistry in sustainable development of society.
- Plan action research for Continuous Professional Development (CPD) of Chemistry teacher.

Suggested Readings:-

- Textbooks: 1. Vaidya, N. (1999). Science Teaching for 21st Century. Deep & Deep Publications.
- Mohan, R. (2002). Innovative Science Teaching for Physical Science Teachers. Prentice Hall of India Pvt. Ltd., New Delhi.
- Das, R.C. (2009). Science Teaching in Schools. Sterling, New Delhi
- Gupta, S. K. (1985). Teaching of Physical Science in Secondary Schools. New Delhi.
- NCERT (2013). Pedagogy of Science, Textbook of B.Ed., Part I&II, National Council for Educational Research and Training, New Delhi.
- NCERT (2005). National Curriculum Framework for School Education. National Council of Educational Research and Training (NCERT), New Delhi.
- NCERT (2006). Position Paper of National Focus Group on Teaching of Science. New Delhi: NCERT
- Tobin, K. (1993). The Practice of Constructivism in Science Education. Lawrence Erlbaum Associates.

PEDAGOGY OF MATHEMATICS-III

Name of the Course: Pedagogy of Mathematics-III
Course Code: BSE.374

L	T	P	Cr
2	0	0	2

Course Learning Outcomes:

At the end of the course the prospective teacher-trainees will be able to;

- analyze the sources of the development of 21st century skills through Mathematics teaching and learning,
- determine role of teacher in facilitating learning and creating dynamic learning environment of Mathematics,
- describe need for and importance of assessment in the learning process of Mathematics,
- develop various types of tests for assessing students learning in Mathematics,
- design and develop innovative strategies and techniques for successful in teaching and learning Mathematics,
- conduct school- based research in Mathematics teaching,

- explain the various methods of exploring knowledge,
- explore innovative ideas for teaching and learning of Mathematics,
- assess the steps of action research.

Units	Content
Unit-1	**Century Skills for Learning Mathematics** • Need for and importance of how to learn 21st-century skills such as practicing imagination, spatial visualization, mathematical reasoning, and problem-solving for learners and teachers of Mathematics. • Psychological, sociological, and philosophical perspective of teaching learning and development of Mathematics. • Qualities of a Mathematics teacher as a professional. • Role of a teacher in facilitating learning and creating a dynamic learning environment of Mathematics.
Unit-2	**Assessment for Learning in Mathematics** • Meaning, need, and organization of oral, written, and practical assessment in Mathematics. • Construction of types of questions in Mathematics: objective, short answer, long answer, considerations for the marking different types of questions in Mathematics. • Planning and developing teachers-made tests in Mathematics -Table of Specification (TOS), question paper setting, and preparing answer key.
Unit-3	**Research and Innovative Practices in Teaching of Mathematics** • Tools to identify learning difficulties and provide corrective measures in Mathematics, concept of 360° assessment, holistic progress card, and assessment of mathematical aspects of students. • Divergent thinking for innovation in psychological, sociological, and philosophical perspectives of Mathematics for quality learning experiences. • Innovative practices in Mathematics. • Research on issues of gender, class and culture in Mathematics learning and achievement • - expectations, attitudes, and stereotypes; access to higher Mathematics; interrogating the notion of 'Achievement Gap'; construction of learners' identity in a Mathematics classroom.
Unit-4	• Recent trends and research related to teaching-learning of Mathematics – digital gaming, digital storytelling, and using Artificial Intelligence for Mathematics teaching and learning. • Action research for solving problems of teaching and learning Mathematics: meaning, significance, steps, and planning.

Practicum (Any Three)

- List 21st-century skills with reference to various topics of school Mathematics.
- Writing a paper on recent trends and research related to teaching-learning of Mathematics.

- Prepare a scrapbook for 'Mathematics in Print Media'.
- Prepare a small video for recent trends in Mathematics on social media.
- Plan a teacher-made test for a unit of secondary Mathematics.
- Prepare a report after using an innovative idea to teach a difficult topic of secondary Mathematics.
- Plan for action research on any one problem of teaching-learning Mathematics.
- Any other project assigned by the course coordinator.

PEDAGOGY OF BOTANY-III

Course Title: Pedagogy of Botany – III

L	T	P	Cr
2	0	0	2

Course Code: BSE.375

Course Learning Outcomes (CLO):

At the end of the course the prospective teacher-trainees will be able to;

1. Explore emerging trends and technologies in botany education and their implications for teaching and learning.
2. Develop strategies to integrate environmental education and sustainability into botany teaching.
3. Apply advanced pedagogical strategies, including flipped classrooms and blended learning, to enhance botany education.
4. Understand the importance of professional ethics and leadership in botany education and develop skills for effective classroom management.

Units/Hours	Contents	Mapping with CLOs
UNIT-I **12 hours**	**Unit-I: Emerging Trends in Botany Education** • Integration of technology in botany teaching: Virtual labs, simulations, and AI tools. • Role of citizen science in botany education. • Climate change and its impact on botany education. • Global perspectives in botany education.	**CLO1**
UNIT-II **12 hours**	**Unit-II: Environmental Education and Sustainability** • Concepts of environmental education and sustainability. • Teaching biodiversity and conservation. • Role of botany in addressing environmental challenges. • Project-based learning on environmental issues	**CLO2**
UNIT-III **10hrs**	**Unit-III: Advanced Pedagogical Strategies in Botany** • Flipped classrooms: Concepts and implementation. • Blended learning: Online and offline integration. • Gamification and storytelling in botany teaching. • Critical thinking and problem-solving in botany.	**CLO3**
UNIT-IV **11 hours**	**Unit-IV: Professional Ethics and Leadership in Botany Education** • Professional ethics for botany teachers. • Leadership skills for educators. • Classroom management strategies. • Building a positive learning environment.	**CLO4**

Suggestive Mode of Transaction

- Flipped classroom and blended learning approaches.

- Project-based learning and case studies.
- Workshops and seminars on emerging trends.
- Collaborative group work and peer discussions.
- Use of digital tools and online resources.

Suggested Readings

1. Sharma, P. D. (2019). *Botany for Degree Students: Algae*. S. Chand Publishing.
2. Raven, P. H., Evert, R. F., & Eichhorn, S. E. (2017). *Biology of Plants* (8th ed.). W.H. Freeman and Company.
3. Joyce, B., Weil, M., & Calhoun, E. (2015). *Models of Teaching* (9th ed.). Pearson.
4. Kumar, A. (2018). *Innovative Science Teaching* (4th ed.). PHI Learning.
5. Pandey, B. P. (2020). *Plant Anatomy*. S. Chand Publishing.
6. Aggarwal, J. C. (2010). *Teaching of Life Science*. Vikas Publishing House.
7. Sharma, R. C. (2016). *Modern Science Teaching*. Dhanpat Rai Publishing.
8. Mangal, S. K., & Mangal, U. (2019). *Essentials of Educational Technology*. PHI Learning.
9. Anderson, L. W., & Krathwohl, D. R. (2001). *A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives*. Longman.
10. Passi, B. K. (2016). *Becoming a Better Teacher*. Sage Publications.
11. Vashist, R. P. (2017). *Teaching of Biological Sciences*. Pearson.
12. Carin, A. A., & Sund, R. B. (2015). *Teaching Science Through Discovery*. Pearson.
13. Sharma, R. A. (2018). *Teaching of Science*. R. Lall Book Depot.
14. Vanaja, M. (2016). *Teaching of Biological Science*. Neelkamal Publications.

Tomlinson, C. A. (2014). *The Differentiated Classroom: Responding to the Needs of All Learners*. ASCD.

PEDAGOGY OF ZOOLOGY-III

Name of the Course: Pedagogy of Zoology-III
Course Code: BSE.376
Course Learning Outcomes:

L	T	P	Cr
2	0	0	2

At the end of the course the prospective teacher-trainees will be able to;

CLO1 appraise different types of assessment and strategies for continuous assessment and distinguish between assessment and evaluation,

CLO2 compare merits and demerits of different types of assessment and develop unit test item based on TOS and develop different type of test items,

CLO3 construct and administer the achievement test, familiarize with basic statistical methods for analyzing performance in tests,

CLO4 plan offline and online activity for testing higher order thinking skills and recognize challenges in modern day classrooms and plan appropriate strategies, relate ICT integration and elaborate its use in classroom situations.

Units/Hours	Contents	Mapping with CLOs
Unit-I	21st Century Skills for Learning A. Need for and importance of how to learn 21st century skills for learners and teachers of Biological Sciences. B. Psychological, sociological, and philosophical perspective of teaching and learning Biological Sciences. C. Qualities of a Biological Sciences teacher as professional for enhancing teaching learning skills. D. Role of a teacher in facilitating learning and creating dynamic	**CLO1**

	learning environment of Biological Sciences.	
Unit-II	Assessment and Evaluation I A. Assessment and evaluation: concept, need for and importance of teaching learning the Biological Sciences. B. Assessment based on learning outcomes, strategies for continuous assessment, school- based assessment, qualitative assessment; formative and summative assessment, formal, informal, and 360-degree assessment.	**CLO2**
Unit-III	Assessment and Evaluation II A. Performance assessment: assessment of group activities, field observations, recording and reporting, creating platform and portfolio management, assessment of lab skills, assignments, projects, and presentations based on the concepts of Biological Sciences. B. Unit test based on Table of Specification (TOS) and its importance; basic steps of question paper setting of Biological Sciences, types of test items and preparing answer key and criteria for school, assessment, and feedback mechanism in teaching learning the concepts of physical science at secondary stage.	**CLO3**
Unit-IV	Research and Innovative Practices in Biological Sciences A. Divergent thinking and innovation in psychological, sociological, and philosophical perspectives for quality learning experiences, creating a sensitive and conducive classroom environment for learning and practicing life skills. B. Recent trends in research related to teaching learning of Biological Sciences. C. Action research: meaning, significance, steps, and planning. D. Evidence-based practices and reflection, school-based research in Biological Sciences.	**CLO4**

Suggestive Practicum (Any Three)

1. Prepare, administer, and analyze scores of an achievement test.
2. Explore AI based assessment tools and prepare an E-Portfolio for a student of Secondary Stage.
3. Identify a topic and Plan action research at secondary stage.
4. Conduct Simulated Teaching session for the concepts of Biological Sciences and observation by self, peer, and teacher.
5. Apply innovative practices in classroom teaching learning of Biological Sciences.
6. Any other project assigned by HEI.

Suggestive Mode of Transaction

Lecture cum discussion, demonstration, Hands-on activities, experiential learning, inquiry, Group work, Presentations, multimedia.

Suggestive Mode of Assessment

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

Suggestive Reading Material

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

- NCERT, Textbooks of Biological Sciences at Secondary Stage.

ABILITY ENHANCEMENT & VALUE-ADDED COURSES

Course Name: Mathematical & Quantitative Reasoning

L	T	P	Cr
2	0	0	2

Course Code: BSE.377

Course Learning Outcomes;

At the end of the course the prospective teacher-trainees will be able to;

CLO1: **Analyse** the foundational concepts of mathematical and quantitative reasoning

CLO2: Interpret educational data from diverse sources, and make informed, data-driven decisions in educational settings

CLO3: Apply appropriate statistical tools to interpret and visually represent educational data for meaningful insights and decision-making

Units/Hours	Contents	Mapping with CLOs
UNIT – I (10 hours)	**Foundations of Mathematical and Quantitative Reasoning** A. Definition, nature, and scope of mathematical and quantitative reasoning. B. Importance and interdisciplinary applications of mathematical and quantitative reasoning. C. Types of quantitative reasoning: Deductive, inductive, and probabilistic reasoning D. The role of mathematical reasoning in problem-solving and decision-making. E. The concept and significance of mathematization across various domains	**CLO1**
UNIT – II (10 hours)	**Data and Its Role in Education** A. Understanding data: Sources, classification, and relevance in educational research B. Key educational indicators: • School enrolment (Gross and Net Enrolment Ratios). • Dropout rates and progression statistics. • Literacy measurement techniques. C. The Indian Census and its role in data collection: Key parameters and insights. D. Nationwide sample surveys: National Family Health Survey (NFHS), District Level Household Survey (DLHS), and Unified District Information System for Education (UDISE)	**CLO2**
UNIT – III (10 hours)	**Data Analysis and Interpretation** A. Introduction to data interpretation techniques using equations, diagrams, graphs, and tables. B. Statistical tools for educational data analysis: • Measures of Central Tendency (Mean, Median, Mode). • Measures of Variability (Standard Deviation, Variance, Range). • Percentiles and their applications	**CLO3**

	C. Visual and numerical representation of data: Bar graphs, histograms, pie charts, and scatter plots. D. Introduction to Learning Analytics: Concept, significance, levels, and applications in education	

Suggested Practicum

1. Collect and analyse UDISE data from the last five years to examine trends in school enrolment, teacher-student ratios, and infrastructure development.
2. Interpret and visualize real-world educational datasets using statistical tools.
3. Develop and present a case study analysing key educational indicators for a selected district or state.
4. Conduct a small-scale survey among peers and apply statistical methods for data interpretation.

Suggested Mode of Transaction

The course will employ diverse instructional strategies to enhance student engagement and ensure practical application of concepts:

- **Active Learning**: Engaging students through group discussions, case studies, and problem-solving exercises
- **Real-World Applications**: Integrating real-life scenarios and case studies to illustrate the significance of mathematical reasoning in education
- **Collaborative Learning**: Encouraging teamwork through peer discussions and cooperative learning activities.
- **Technology Integration**: Utilizing tools such as Excel, R, Python, and data visualization software to enhance analytical skills
- **Interactive Teaching**: Implementing flipped classroom methods, online simulations, and gamification strategies to foster student participation and retention

Suggested Mode of Assessment

A combination of formative and summative assessments will be used to evaluate student learning outcomes effectively:

- **Quizzes and Online Assessments** – To assess conceptual understanding.
- **Assignments and Data Analysis Reports** – To apply mathematical reasoning in real-world educational contexts.
- **Group Projects and Case Studies** – To promote collaborative problem-solving.
- **Presentations and Data Interpretation Exercises** – To develop communication skills in quantitative reasoning.
- **Final Examination** – To evaluate comprehensive understanding and application of course concepts

Suggested References

- Batanero, C. (2005). *Statistical Education: Challenges for Mathematics Education*. ICME Monographs.
- Black, P., & Wiliam, D. (1998). Assessment and classroom learning. *Assessment in Education: Principles, Policy & Practice*, 5(1), 7-74.
- Boaler, J. (2016). *Mathematical Mindsets: Unleashing Students' Potential through Creative Math, Inspiring Messages and Innovative Teaching*. Jossey-Bass.
- Bonwell, C., & Eison, J. (1991). *Active Learning: Creating Excitement in the Classroom*. ASHE-ERIC Higher Education Report No. 1.
- Brookhart, S. M. (2013). *How to Create and Use Rubrics for Formative Assessment and Grading*. ASCD.
- Gal, I. (2002). *Adult's Statistical Literacy: Meanings, Components, Responsibilities*. International Statistical Review.
- Garfield, J., & Ben-Zvi, D. (2008). *Developing Students' Statistical Reasoning: Connecting Research and Teaching Practice.* Springer.
- Gravetter, F. J., & Wallnau, L. B. (2020). *Statistics for the Behavioral Sciences (11th ed.).* Cengage Learning.
- Kilpatrick, J., Swafford, J., & Findell, B. (2001). *Adding It Up: Helping Children Learn Mathematics*. National Academy Press.

- Niss, M., & Højgaard, T. (2019). *Mathematical Competencies in Mathematics Education*. Springer.
- National Council of Educational Research and Training (NCERT). (2020). *National Achievement Survey (NAS) Report.* NCERT, India.
- OECD. (2012). *PISA 2012 Results: What Students Know and Can Do*. OECD Publishing.
- Polya, G. (1957). *How to Solve It*. Princeton University Press.
- Shavelson, R. J. (2013). *Statistical Reasoning for the Behavioral Sciences*. Pearson.
- Siemens, G., & Baker, R. S. J. D. (2012). Learning analytics and educational data mining: Towards communication and collaboration. *Proceedings of the 2nd International Conference on Learning Analytics & Knowledge*.
- Tufte, E. R. (2001). *The Visual Display of Quantitative Information (2nd ed.).* Graphics Press.
- Wing, J. M. (2006). Computational thinking. *Communications of the ACM*, 49(3), 33-35.

SCHOOL EXPERIENCES

Course Title: SCHOOL OBSERVATION (FIELD PRACTICE)

L	T	P	Cr
0	0	4	2

Course Code: BSE. 378

Course Learning Outcomes (CLOs)

At the end of the course the prospective teacher-trainees will be able to;

CLO1 describe various schooling systems,
CLO2 describe the processes, practices, and overall environment of the school,
CLO3 establish rapport with the stakeholders of the school system
CLO4 describe the available school infrastructure (classrooms, libraries, laboratories, playground, sanitation, drinking water facility, mid-day meal facility, inclusive facilities, safety and security, rainwater harvesting),
CLO5 describe the availability and usage of ICT and TLMs, summarize the available documents in both physical and digital modes, including UDISE data,
CLO6 reflect upon relationships among the stakeholders,
CLO7 Analyze various assessment processes adopted in different types of schools,
CLO8 prepare and present a comprehensive profile of the schools observed (including classroom processes).

Content

The school observation as a field-based activity that will cover observation of school and classroom processes. The student teachers under the mentorship of teacher educators will visit schools, interact with teachers and students and other stakeholders, and relate the observation with the courses studied during the previous semesters, i.e. Foundations of Education, Disciplinary Courses, Pedagogy courses and Ability Enhancement & Value-Added Courses. Further the student teachers need to develop thorough understanding on the following aspects;

• Meaning and Nature of school observation process
• Difference between monitoring and observation
• Theory and practices of school observation components such as:

1. Schooling system
2. Rapport with all the stakeholders
3. Office management procedures of different types of schools
4. School environment in all perspectives
5. Process of conducting curricular activities in the schooling process
6. Existing infrastructure available in the school
7. Utility of ICT and TLM facilities
8. Interpersonal relationships among the stakeholders
9. Various assessment processes adopted in different types of schools.
10. Engagement of parents and other community members in school activities.

Suggestive Mode of Transaction

• Observation
• Interaction
• Discussion
• Reviewing the available literature on the different schooling system
• Collection of relevant documents and data

Preparation for school observation

• Orientation on the school observation process
• Development of the observation formats/tools

School Observation (minimum three types of schools)

• Student teachers will go for school observation in small groups to observe and collect data by using the developed formats/tools.
• Analysis of the collected data
• Preparing a comprehensive profile of the schools observed

Post-school observation session

• Group-wise presentation of the school profile
• Discussion and Feedback
• Reflection on the understanding of various types of schooling systems

Activities to be conducted

Visit three types of secondary schools with observation formats developed in the institute and get acquainted with various schooling systems. Establish rapport with all stakeholders.

• Collect information about the demography of students in classes IX to XII and understand the linkage of the secondary stage with the middle stage and higher education through interaction with teachers, students and staff.
• Observe school processes and transactions of the curriculum through experiential learning and prepare a report.
• Interact with teachers and students and report on implementing ten bag-less days and internship opportunities to learn vocational subjects.
• Study the available opportunities for learning interdisciplinary subjects.
• Observe the availability and usage of library resources, laboratories (Atal Tinkering Lab, Physics, Chemistry, Biology, Mathematics, Languages, Social Science, Computer), sports facilities, and art and music learning facilities.
• Study the provision of other student support services- guidance and counselling, NCC, NSS, health and wellness programme.
• Observe the organization of various activities like classroom teaching-learning processes, laboratory activities, library activities, sports and games, debate/elocution/essay writing and other competitions.
• Interact with School heads and subject teachers to understand how students are evaluated by following different tools and techniques of evaluation, how examinations are conducted, how answers are assessed, and how the result is communicated to parents in at least two different types of schools.

Suggested Components for school observation report

- School information (Context, Vision and Mission, Association with the Board)
- School Infrastructure
- Provision for CWSN/Divyang Children
- Inclusiveness at all levels
- Teacher-Student Ratio
- Teaching-Learning process
  - Academic plan
  - Classroom activities
  - Assessment
- School Development Plan (SDP)
- Academic Calendar
- Administrative processes

- Maintenance of students' records
- Maintenance of teachers' records
- Cultural activities
- Sports activities
- Annual Day
- National and Social functions
- School Management
- School Discipline
- Interpersonal Relationships
- Understanding different types (socio-economic status, ability) of students and their needs
- Development of ICT and TLMs
- Engagement of parents and community members in the school activity
- Office Management
- The assessment process includes provision and practices for 360-degree holistic assessment.
- The overall progress of the school (planning, organizing, staffing, directing, motivating and controlling)
- Challenges faced and overcoming them.

Assessment

Competence	Method of assessment	Assessed By	**Credits**	**Marks**
Involvement and active participation during the school visit	Observations	Teacher Educator	**0.5**	**12.5**
Comprehensive school profile	Presentation & reflection	Teacher Educator	**1.5**	**37.5**

Suggestive Mode of Assessment: Lecture cum discussion, group work, ICT- enabled methods, activity-based and art-integrated demonstration, field-based experiences, library visits, self-study, field observations, assignment preparation, classroom presentations, discussion forums, observation, flip classroom, use of the digital platform.

Suggestive Readings:

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

SEMESTER-VII

FOUNDATIONS OF EDUCATION

Course Name: Perspectives on School Leadership and Management

L	T	P	Cr
2	0	0	2

Course Code: BSE.401

At the end of the course the prospective teacher-trainees will be able to;

CLO-1 Describe the diversity of schools in India, its structure, its governance, issues, challenges and School diverse issues

CLO-2 Explain the concept of Educational management and Best Practices in Education Management

CLO-3 Build a quality of Good Leadership among teachers

CLO-4 Plan for school vision, mission, goals and proper school functioning.

Units/Hours	Contents	Mapping with CLOs
UNIT- I **08 Hours**	**Understanding Indian School System** A. Indian School Structure, Governance, Socio- Cultural Context, Funding, Management, Autonomy and Accountability Mechanism, Support System B. School diversity issues, challenges, and needs. C. Engagement with diversity discourses, educational policies, reforms and practices and role in developing inclusive schools	**CLO- 1**
UNIT- II **07 Hours**	**Educational Management** A. Educational management: Meaning, Nature and Scope and Principles B. Functions of Educational management. C. Role and Skills of teachers in Educational Management D. Best Practices in School Management	**CLO- 2**
UNIT- III **08 Hours**	**Understanding School Leadership** A. Leadership: Meaning and Nature and Types B. School Leadership: Concept as defined and concept as practiced. C. Being a School Leader: Roles and responsibilities and challenges of school leadership in the Indian context. D. Best Practices in School Leadership	**CLO- 3**
UNIT- IV **07 Hours**	**Schools as Learning Organizations** A. Nurturing school belongingness: Engaging Students, Teachers, Staff, Parents, SMC, and Community in the formulation of a whole school development plan. B. Designing professional and collaborative learning opportunities for self and others (teachers, parents, and SMC members) and improving teaching and learning.	**CLO- 4**

Suggestive Mode of Transaction:

Perspectives on school leadership and management are a practitioner-centric course and aims to enable future teachers to be efficient school leaders. The approach to curriculum transaction therefore would include a blend of lectures, tutorials, group-work, case-based approaches, and enquiry-based learning.

• Student teachers would engage in case-based learning on topics like improving student learning, classroom observation and feedback, planning and budgeting for school improvement, leadership in diversified school contexts and such others.

• Exposure of student teachers to virtual case studies featuring leaders from a representative cross-section of Schools in India and analyze their experiences, insights, and best practices.

• Learners would reflect on their practice as pre-service interns, knowledge, skills, and understandings—and identify opportunities to apply course leanings to their school context.

Suggested Readings:

• Bush, Tony & Les, Bell (2002): The principles & Practice of educational management. London: Paul Chapman Publishing.
• Bush, Tony. (2010)Theories of Educational Leadership and Management, 4th ed., New Delhi: Sage Publications, Davies, Brent and Burnham,
• Craigs, M.W. (1995). *Dynamics of Leadership. Bombay*. Jaico Publishing House: Bombay.
• DeCenzo D.A., Robbins, S.P., & Verhulst, S.L. (2017). *Human Resource Management* (11th Ed.). Greater Noida: Magic International Pvt. Ltd.
• Fullan, M. (2001). *Leading in a culture of change*. San Francisco, CA: Jossey-Bass.
• Gandhi, M., & Fischer, L. (1983). *The essential Gandhi: His life, work, and ideas an anthology*. New York: Vintage Books.
• Hersey, P. & Blanchard, K. (1986). *Management of Organizational Behaviour: Utilizing Human Resources.* New Delhi :Prentice Hall of India Pvt.Ltd
• Kochhar. S.K. (2011).School Administration & Management Sterling Publishers Pvt.Ltd; Revised & Enlarged edition.
• Luthans, F. (1981). *Organizational Behaviour*. Tokyo: McGraw-Hill International Book
• Mohanty, J. (2007)Educational Administration, Supervision and School Management, New Delhi:Deep and Deep Publications,
• Mukhopadhyay, M. (2005). Total *quality management in education (2nd Ed.).* London: SAGE Publication.
• Mukhopadhyay, M. (2012). *Leadership for Institution Building*. Delhi: Shipra Publications.
• Preedy, M., Bennet, N & et. al. (2012). *Educational Leadership. Context, Strategy and Collaboration*. New Delhi: Sage Publications India Pvt. Ltd.
• Robbin, S., Judge, T., & Vohra, N. (2012). *Organizational Behaviour.* Delhi: Pearson.
• Sahu, R.K. (2010*). Group Dynamics and Team Building. New* Delhi: Excel Books.
• Sandhu, I.S. (2012). *Educational administration and Management.* Dorling Kindersley(India) Pvt.Ltd: New Delhi
• Shah, K. (2011) *Vinoba on Gandhi.* Varanasi: Sarva Seva Sangh Prakashan
• Sharma, S. L. (2009) Educational Management: A Unified Approach of Education, New Delhi: Global India Publications Pvt. Ltd.

Course Title: Curriculum Planning and Development

L	T	P	Cr
2	0	0	2

Course Code: BSE.402

Course Learning Outcomes (CLOs)

At the end of the course the prospective teacher-trainees will be able to;

CLO1: Explain the concept and principles of curriculum development

CLO2: Analyze the bases and different concerns of curriculum development

CLO3: Examine the components, sources and different designs of curriculum development

CLO4: Develop understanding on implementation process and role of teachers in contextualizing the curriculum

Course Content

Units/Hours	Contents	Mapping with CLOs
UNIT I	**Education and Curriculum**	**CLO1**

9 hours	A. Concept of curriculum, relationship between education and curriculum and nature of curriculum B. Basic principles of Curriculum Development C. Relationship and difference between curriculum, curriculum framework, syllabus and textbooks **Learning Activities:**	
UNIT II **6 hours**	**Developing the Curriculum** A. Foundations of Curriculum Development B. Concerns for developing the Curriculum - aims to be achieved, structure and nature of discipline, different perspectives on learning and their implications to curriculum development, environmental concerns, gender concerns, inclusiveness, technological advancement. **Learning Activities:**	**CLO2**
UNIT III **9 hours**	**Planning and Designing the Curriculum** A. Components of Curriculum Design: Objectives, Content, learning experiences, Transaction mode and Assessment B. Sources of Curriculum design, Types of curriculum design: Subject centred, learner centred, experience centred, activity centred, problem centred and core curriculum. **Learning Activities:**	**CLO3**
UNIT IV **6 hours**	**Implementation of Curriculum** A. Curriculum Implementation: Operationalizing and Contextualizing curriculum into learning situations, Converting curriculum into syllabus, Curriculum engagement activities, B. Role of teachers in operationalizing and evaluating the curriculum with special reference to: textbooks, teachers handbooks, source books, workbooks and manuals, other learning material such as kits, AV and software materials, library, laboratory, and playground **Learning Activities:**	**CLO4**

Transaction Mode

Lecture, Seminar, dialogue, peer group discussion, mobile teaching, self-learning and Collaborative learning.

Suggested Readings

- Allyn, Bacon, Beane, J. A., Conrad, E. P., & Samuel J. A., (1986). *Curriculum planning and development*. Boston: Allyn & Bacon.
- Beane, J.A. Topfer, Jr. C.F, Alessi, Jr. S.J. (1986): *Curriculum Planning and Development,* London: Allyn and Bacon, INC.
- Brady, L. (1995). *Curriculum Development*. Prentice Hall: Delhi. National Council of Educational Research and Training.
- Dewal, O.S. (2004): *National Curriculum, in J.S.Rajput (Ed.). Encyclopedia of Education*, New Delhi: NCERT
- McNeil, J.D. (1990): *Curriculum: A Comprehensive Introduction,* London: Scott, Foreman/Little
- Oliva, P. F. (2001). *Developing the curriculum* (Fifth Ed.). New York, NY: Longman
- Ornstein, A.C. &Hunkins, E (1998). *Curriculum. Foundations, Principles and Issues*.
- Rao, V. K. (2015). *Principles of curriculum*. New Delhi: APH publishing Corporation.

- Taba, H. (1962): *Curriculum Development: Theory and Practice*, New York: Harcourt Brace Jovanovich
- Tala, M. (2012). *Curriculum development: Perspectives, principles and issues*. Pearson
- Tyler, R. (1949): *Basic Principles of Curriculum and Instruction*, Chicago; university of Chicago Press

ABILITY ENHANCEMENT & VALUE ADDES COURSES

Course Title: Art Education (Performing and Visual)
Course Code: BSE.403

L	T	P	Cr
2	**0**	**0**	2

Course Learning Outcomes (CLOs)
At the end of the course the prospective teacher-trainees will be able to;
CLO1: Analyze Indian and global artistic traditions (music, visual arts) and their cultural significance.
CLO2: Create interdisciplinary art projects integrating STEM and pedagogical principles.
CLO3: Demonstrate film appreciation skills and produce educational media content.
CLO4: Design and execute art-based learning tools (puppetry, scripts) for classrooms.

Units/Hours	Contents	Mapping with CLOs
Unit I **8 hours**	**Unit 1: Indian Music Traditions** • Classical Music: Raga-Tala system in Hindustani/Carnatic traditions. • Folk Music: Regional forms (Baul, Lavani, Bihu) and their socio-cultural contexts. • Contemporary Music: Fusion trends and educational applications. **Learning Activity:** Musical Storytelling: Groups compose a 2-minute song using folk/classical elements to teach a concept.	**CLO1**
Unit II **8 hours**	**Unit 2: Visual Arts & Crafts** • Sculpture: Terracotta, bronze, and modern installations. • Folk Paintings: Warli, Madhubani, Pattachitra techniques. • Photography: Basics of composition and educational storytelling **Learning Activity:** Eco-Art Installation: Create a sculpture/painting using recycled materials with an environmental message.	**CLO2**
Unit III **7 hours**	**Unit 3: Puppetry & Scriptwriting** • Traditional Puppetry: Kathputli, Bommalattam, shadow puppetry. • Script Writing: Adapting folktales into 10-minute educational scripts. **Learning Activity:** Puppet Showcase: Perform a puppet show on a social issue (e.g., gender equality) with written scripts.	**CLO4**
Unit IV **7 hours**	**Unit 4: Interdisciplinary Art Integration** Topics: • Stages of production: Script selection, casting, rehearsals, staging. • Language of Cinema: Basic film techniques (shot composition, lighting, editing). • Analysing films as pedagogical tools (e.g., Taare Zameen Par	**CLO2** **CLO3**

	for inclusive education). • Educational Filmmaking: Storyboarding a 3-minute educational short film on social issues. Using smartphone filmmaking for classroom projects. • Community Art Projects: Murals for school walls; photography documentaries. **Learning Activity:** Phone Film Challenge: Shoot a 1-minute film on "My Ideal Classroom.	

Transaction Mode

- Interactive lectures, audio-visual demonstrations, guest sessions by musicians
- Studio-based learning, museum visits (virtual/physical), peer critiques
- Workshops with puppeteers, role-playing, storyboarding software (Canva)
- Project-based learning, film screenings with guided discussions

Suggested Readings

- Bordwell, D., & Thompson, K. (2017). *Film art: An introduction* (11th ed.). McGraw-Hill.
- Ghosh, S. (2005). *Indian puppets*. Abhinav Publications.
- Mookerjee, A. (1985). *Folk art of India*. UNESCO.
- National Council of Educational Research and Training. (2019). *Art integrated learning: A handbook for teachers*.
- Neuman, D. M. (1990). *The life of music in North India*. University of Chicago Press.
- Root-Bernstein, R. (1999). *Sparks of genius: The 13 thinking tools of the world's most creative people*. Houghton Mifflin.
- UNESCO. (2018). *Teaching folk arts in schools* [PDF]. https://ich.unesco.org

Course Title: Sports Nutrition and Fitness

Course Code: BSE.404

L	T	P	Credits
2	0	0	2

Course Learning Outcomes (CLOs)

At the end of the course the prospective teacher-trainees will be able to;

1. To explain the importance of sports, and the need and impact of sport for maintaining
2. To discuss the sports for children with disabilities and inclusion.
3. To discuss physical fitness, and the methods of teaching and organization of different types of sports,
4. To explain the importance of physical fitness, describe different components of physical fitness, and identify activities that help maintain physical fitness,
5. To recognize the importance of basic health and nutrition and healthy lifestyles and identify food items that help maintain basic health and nutrition among children of different age groups.

Units/Hours	Contents	Mapping with CLOs
Unit I **6 Hours**	**UNIT – I: Sports** • Meaning of sports, importance of sports, types of sports. • Different stages of sports (primary and secondary). • Psychology of sports, methods of teaching different sports (indoor, outdoor, team, and individual), different sports activities (individual and team games).	**CLO1**
Unit II	**UNIT – II: Sports for Inclusion and Special Populations**	**CLO2**

8 hours	• Sports for children with disabilities and inclusion.	
Unit III **8 Hours**	**UNIT – III: Physical Fitness** • Meaning and importance of Physical fitness, components of physical fitness: Muscular Strength, Endurance, Flexibility, Body Composition, Cardiovascular Endurance. • Importance of a healthy lifestyle. • Coordination of Health and Fitness.	**CLO3** **CLO4**
Unit IV **8 Hours**	**UNIT – IV: Nutrition** • Meaning of nutrition, types of nutrition, importance of nutrition, need for nutrition, methods for teaching nutrition. • Nutrition for different age groups, nutritious food for sports personalities and common individuals, nutrition and health, nutrition and fitness. • Nutritious food in schools (midday meals), hostels.	**CLO5**

Practicum

Reflective Reading of different Sports Personalities. Collections of different types of games (Indoor, Outdoor, Individual, Team); Organizing different games (Play) for different age-groups, Organizing Group Games for cooperation, Organizing fitness programmes, Exercises at various levels. Collection of different nutritious items food. (Charts, Things, Objects, Models). Programmes organized to promote the use of nutritious food.

Mode of Transaction

The mode of transaction should be designed to ensure that should provide a balance between theoretical knowledge and practical skills. The approaches to curriculum transaction may include the following:

- Active learning encourages student teachers to participate in discussions, brainstorming sessions, and problem-solving activities that help them develop critical thinking and problem-solving skills.
- Collaborative learning involves group projects and tasks that encourage student teachers to work collaboratively and learn from each other.

Suggestive Reading Materials

- Academy of Nutrition and Dietetics. (2020). *Sports nutrition: A handbook for professionals* (6th ed.). Routledge.
- American College of Sports Medicine. (2022). *ACSM's guidelines for exercise testing and prescription* (11th ed.). Wolters Kluwer.
- Bailey, R., & MacNamara, Á. (2018). *Sporting excellence, schools and sports development: The politics of crowded policy spaces*. Sport, Education and Society, 23(4), 311-323. https://doi.org/10.1080/13573322.2016.1182012
- Coakley, J. (2021). *Sports in society: Issues and controversies* (13th ed.). McGraw-Hill Education.
- Corbin, C. B., Welk, G. J., Corbin, W. R., & Welk, K. A. (2021). *Concepts of fitness and wellness: A comprehensive lifestyle approach* (12th ed.). McGraw-Hill Education.
- DePauw, K. P., & Gavron, S. J. (2020). *Disability sport* (3rd ed.). Human Kinetics.
- Fahey, T. D., Insel, P. M., & Roth, W. T. (2021). *Fit & well: Core concepts and labs in physical fitness and wellness* (14th ed.). McGraw-Hill Education.
- Heyward, V. H., & Gibson, A. L. (2021). *Advanced fitness assessment and exercise prescription* (8th ed.). Human Kinetics.

- Hutzler, Y., & Sherrill, C. (2019). *Adapted physical activity, recreation and sport: Crossdisciplinary and lifespan* (7th ed.). McGraw-Hill.
- Mahan, L. K., & Raymond, J. L. (2020). *Krause's food & the nutrition care process* (15th ed.). Elsevier.
- Singh, A., & Uijtdewilligen, L. (2020). *Nutrition in schools: A review of policies and programs*. Journal of School Health, 90(12), 1001-1010. https://doi.org/10.1111/josh.12959
- Warburton, D. E. R., & Bredin, S. S. D. (2019). *Health benefits of physical activity: A systematic review of current systematic reviews*. Current Opinion in Cardiology, 34(5), 541-556. https://doi.org/10.1097/HCO.0000000000000641
- Weinberg, R. S., & Gould, D. (2019). *Foundations of sport and exercise psychology* (7th ed.). Human Kinetics.
- Whitney, E., & Rolfes, S. R. (2021). *Understanding nutrition* (16th ed.). Cengage Learning.
- Williams, M. H., & Rawson, E. S. (2022). *Nutrition for health, fitness & sport* (12th ed.). McGraw-Hill Education.

SCHOOL EXPERIENCES

Course Title: SCHOOL BASED RESEARCH PROJECT

L	T	P	Cr
0	0	4	2

Course Code: BSE.405

Course Learning Outcomes (CLOs)

At the end of the course the prospective teacher-trainees will be able to;

CLO1 Identify contextual problems and formulate appropriate research design,
CLO2 present contextual problems, an appropriate research design and the plan of action for undertaking school-based research,
CLO3 demonstrate the tools and techniques used for the collection of relevant data,
CLO4 summarize the analyzed data used to identify the causes,
CLO5 demonstrate the interventions used for addressing the problems,
CLO6 present the effectiveness of the intervention(s),
CLO7 share the school-based research experiences through reports and presentation.

Contents:

The student teachers during previous semesters have studied different courses in Foundations of Education, Disciplinary Courses, Stage-specific pedagogy courses, Ability Enhancement and Value-Added Courses. The required knowledge of action research and case study includes- the concept and importance of action research/case study, the steps of conducting action research/case study (objectives, methods, research design, design tools, data collection, and data analysis) and report writing.

The research problem will be taken from the day-to-day teaching-learning process of the school. Some of the significant areas may cover:

• Learning progress and outcomes in different subjects
• School-based assessment
• Learners' diversity and inclusion
• Participation in arts, games, sports

Suggestive Mode of Transaction

The following strategies will be used during the school-based research project:

• Discussions with teacher educator, school head, mentors, and peers for identification of problem and development of intervention(s).
• Finalize the school-based research project proposal outline through discussion with mentor teachers/teacher educators.

• Document analysis, interaction with all stakeholders, and field visits.
• Sharing and presentation of the outcomes of school-based research.

Suggestive Mode of Assessment
The assessment of the school-based research project will be continuous. The teacher educators, as well as mentors, will be involved in the assessment of the activities. The following rating scale may be used to assess the student teachers:

Competence	**Method of assessment**	**Assessed By**	**Credits**	**Marks**
Observation during the execution of action research	Observations	Teacher Educator	**0.5**	**12.5**
Research Report	Presentation of Report	Teacher Educators Teacher-Educators (panel of three experts)	**1.5**	**37.5**

Course Title: INTERNSHIP IN TEACHING

Course Code: BSE.406

L	**T**	**P**	**Cr**
0	**0**	**20**	**10**

Duration: Three weeks in the institute and 12 weeks in two types of schools (6 weeks in each)

Course Learning Outcomes (CLOs)

At the end of the course the prospective teacher-trainees will be able to;

CLO1 explain the overall functioning of the school.
CLO2 describe and appreciate the different roles played by a teacher in the school.
CLO3 experience the importance of teacher-student relationships for effective teaching.
CLO4 use different pedagogies learnt in real-life classrooms and create appropriate teaching-learning materials.
CLO5 develop necessary planning and execution skills to conduct school activities (assembly, celebrations, cultural programmes).
CLO6 create rapport with the stakeholders and understand their roles in the school system.
CLO7 create student portfolios and comprehensive 360-degree (holistic) progress reports.
CLO8 discuss the importance of maintaining different types of records in the school system.

Content
1. Pedagogies' different methods and strategies
2. Scheme of lessons
3. Peer lesson observation

4. Management of substitute classes
5. Various TLMs (including ICT tools) and their uses in teaching-learning.
6. Achievement test
7. Diagnostic tests
8. Analysis of the result of the achievement test
9. Assembly activities

Suggestive Mode of Transaction

• Observation
• Interaction
• Discussion
• Teaching in the classroom
• Analysis and reporting
• Collection of relevant documents and data

Activities:

Student teachers are required to undertake the following stage specific activities:

1.Meet the subject-based mentors, collect timetables of classes IX to XII and develop a scheme of lessons from the syllabus to be covered during the internship.

2. Get acquainted with the school within 2-3 days. Observe classroom teaching of school teachers.

3. Plan and transact minimum 80 lessons , including 4 stray lessons. Stray lessons are class appropriate lessons on any topic(s) to be transacted by student teachers as per their convenience to build up confidence gradually. The last 5 lessons in each pedagogy course may be transacted using lesson notes.

• Lesson plans should include the components to develop critical and reflective thinking, problem-solving, differential learning, synthesis, and application of knowledge in real-life situations.

• Lesson plans must promote education for sustainability, including equity, environment, global citizenship, pride and rootedness in Indian knowledge systems and character building.

4. Participate in post-lesson discussions with peers, mentor(s) and teacher educators.

5. Observe peer lessons and discuss with the group.

6. Conduct laboratory activities (Atal Tinkering Lab, Physics, Chemistry, Biology, Mathematics, Languages, Social Science, Computer), sports, and arts and crafts activities.

7. Participate in student support services- guidance and counselling, NCC, NSS, health and wellness programme.

8. Create teaching-learning materials, including ICT tools for opted pedagogic courses.

9. Plan assessment, prepare material and formative and summative assessment tools, and analyse the results.

10. Prepare and conduct diagnostic tests to identify learning difficulties, analyse data and prepare learning enhancement plan.

11. Experience classes as a substitute teacher.

12. Participate in library functioning and literary activities.

13. Participate in teacher development and training activities.

14. Organize school assemblies and other events (cultural, sports, yoga, and other development activities).

15. Attend Parents-Teachers Association (PTA) meetings if held during the internship.

16. Attend School Management Committee (SMC) meeting if held during the internship.

17. Study the process of parent and community engagement for the school development programme.

18. Prepare a sample student portfolio,

19. Write a reflective diary daily and prepare a report of each activity.

Suggestive Mode of Assessment:

The activities conducted / skills acquired during the internship by the student teachers will be assessed as per the following scheme:

Competence	**Method of assessment**	**Assessed By**	**Credits**	**Marks**

Observation of classroom practices	• Observation of a Minimum of 6 lessons of School Teachers • Observation of a Minimum of 10 lessons of Peers	Teacher- Educator	Non evaluative	----
Unit planning, Lesson Planning & Transaction	80 lessons transaction for the pedagogical subject * Unit plans and lesson plans * Minimum 4 Innovative lesson plans in the pedagogy subjects (Eg: Storytelling, Drama based, Arts and crafts, Use of Technology)	Teacher-Educator, School Mentor	**6.0**	**150**
Assessment Planning and execution	Preparation of report on assessment plan in each lesson transacted i.e., within lesson transaction and lesson end activities. Preparation of a Blue Print (For the Pedagogical course/s) and preparation of Assessment tools Conduct of Unit Test & analysis of results (for the Pedagogical course) Development of plan for learning enhancement of students related to subject (for the Pedagogical course)	Teacher- Educator, School-Mentor	**1.5**	**37.5**
Participation/Organization of assembly and other school-level activities, PTM & SMC Meetings	Observation & Interaction	School Mentor	**0.5**	**12.5**
Preparation of Logbook/Teachers diary Min 10 lessons for the pedagogical subjects	Review	Teacher- Educator, School Mentor	**0.5**	**12.5**
Overall feedback on student-teacher performance by School	Observation and Interaction	School Head	**0.5**	**12.5**
Head				
Test lesson (one in each of the pedagogical subject	Presentation	Teacher Educator	**1.0**	**25**

Stakeholders Responsibilities

Role of Head of ITEP Institution

• Identification of the adequate number of internship schools
• Signing the MoU with the schools
• Sharing of mutual expectations of ITEP institutions and the participating schools
• Identification of the internship programme coordinator

• Monitor the progress of the entire School Experience Programme

Role of Teacher-Educators of the ITEP Institution

• Guide the student teachers in preparing lessons and activities, assessment, observation of lessons on peer teaching, action research, and case studies conducting school activities preparation and report writing on Teaching Learning Materials.

• Conduct pre- and post-lesson discussions regularly.

• Assess the transaction of lessons for the complete duration of the lesson in the rating proforma developed by the teacher education institute and give feedback/remarks to the student teachers for lesson improvement.

• Submission of monitoring and supervision reports to the institute in time.

• Discuss with the student teachers frequently and organize a phase-end meeting of the student teachers and mentors to assess the progress and performance of the student teachers.

Role of School Head

• To introduce the student teachers to the students and staff of the school in the assembly on the first day.

• To facilitate student teachers to take classes as per stage requirements- Foundational, Preparatory, Middle, and Secondary.

• Ensure the alignment of the timetable, scheme of lessons and plan of activities/assignments of the student teachers to be carried out during the programme in the school.

• Countersign on the attendance register maintained by the group leader/ mentor of the school.

• Ensure that all facilities and provisions are available to the student teachers to teach their lessons and carry out their assignments smoothly.

• Grant of leave applications of the student teachers in exceptional circumstances.

• Involve student teachers in different activities of the school.

• Facilitate phase-end meetings of the student teachers and the mentors to assess the progress and removal of difficulties.

• Countersign/ certify the report/ documents of the activities/ assignments conducted by the student teachers towards the end of the internship programme.

• Provide input about student-teacher performance.

• Provide suggestions for improvement of the programme to the ITEP institution.

Role of Mentors

• Guide student teachers to prepare detailed lesson plans, brief lesson notes and plans of activities/ assignments to be conducted by them in school.

• Review the lesson plan before a student-teacher transacts the lesson in the class.

• Observe the classes of student teachers.

• Assess each lesson on the prescribed proforma and write remarks in the lesson plan book provided by the student teachers.

• Give feedback continuously to the student teachers for their improvement in their teaching and other curricular activities.

• Conduct post-lesson discussions regularly.

• Countersign in the peer-teaching observation schedules after their observations in the classroom.

• Organize frequent meetings with the student teachers and supervisors to discuss the progress, difficulties faced, and experience gained by student teachers.

Role of Student-Teacher

• Report to the school head of the participating school at least one day before the start of the internship placement.

• Seek information about the classes, timetable, and topics to teach in stage-specific pedagogic courses from the mentors on the first day of the internship programme.

• Mark your attendance as per the school practice.

• Plan all the assignments/ activities with the help of the mentor/ supervisors.

• Seek cooperation from mentors and supervisors in case of difficulty.

• Prepare the lesson plan and get approval from the mentor/ supervisor before transacting every lesson.

• Take classes according to the timetable of the participating school.

• Take substitute classes and participate in other school duties assigned by the school.
• Follow the conduct and dress code of the participating school.
• Get prior leave approval from the head of the participating school in case of emergency.
• Maintain a diary and regularly list all the innovations, challenges faced and reflections for improvement.
• Check with your mentor before attempting learning activities that depart from routine classroom procedures.
• Carry out the activities you plan for school students according to your approved plans.
• Maintain cordial relationships with the students and staff of the school.
• Refrain from making negative comments about the school or the school's personnel, especially when talking with fellow student teachers.
• Submit student teaching profiles, one each, to the supervisor and mentor who supervises your teaching.
• Before the completion of the internship programme, make sure to return all textbooks and materials to the school.

SEMESTER-VIII

FOUNDATIONS OF EDUCATION

Course Title: Philosophical & Sociological Perspectives of Education – II
Course Code: BSE.451

L	T	P	Credits
4	0	0	4

Course Learning Outcomes (CLOs)
At the end of the course the prospective teacher-trainees will be able to;
Learning Outcomes

1. Demonstrate a foundational understanding of key sociological concepts relevant to education.
2. Analyze the interconnectedness of socialization, social change, culture, and equality within educational settings, considering their impact on student learning and development.
3. Examine the role of schools in fostering social progress by critically analyzing their potential to promote social mobility, equity, and civic engagement.
4. Discuss the significance of academic freedom within an educational context, exploring its implications for student learning, intellectual growth, and the overall progress of children.
5. Critically analyze the evolving nature of values in contemporary society and their implications for education, exploring how schools can cultivate ethical, responsible, and socially conscious individuals.

Units/Hours	Contents	Mapping with CLOs
Unit I **12 Hours**	**Introduction to Sociology of Education** • Introduction to sociology: Meaning, definition, nature and scope of Sociology • Meaning, definition, nature and scope of Sociology of Education • Relationship between Sociology and Education • Sociology and its Implications to Education **Learning Activities:** Group discussion and Seminar	**CLO1**
Unit II **17 hours**	**Socialization, Social Change, Culture and Equality** • Socialization: Meaning, Process and methods of Socialization and Agencies. • Social Change: Meaning and factors effecting on education. • Culture: Meaning, Characteristics of Culture and Relation between Culture and Education. • Equality of Educational Opportunities. **Learning Activities:** Individual presentation and panel discussion	**CLO2**
Unit III **16 Hours**	**School and Social Progress** • Conservative functions of school. • Progressive functions of school • Neutral functions of school • Indoctrination, academic freedom, liberty of teacher, and freedom of learner and learning • Academic freedom and progress of children **Learning Activities:** Dialogue on different concepts	**CLO3** **CLO4**
Unit IV **16 Hours**	**Values in the Emerging Social Context** • Perspectives on Values: The Emerging Social Context in India. Some Important Values	**CLO5**

	• Value Conflicts in Schools • Education and Values • Transforming Values through Education: The Curriculum, The School and Classroom Environment, The Teaching-Learning Process, and Evaluation/Assessment • Humanism and Humanistic value training. **Learning Activities:** Group discussion and Seminar	

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- Bhattacharya, S. (2006). *Sociological foundations of education*. New Delhi: Atlantic
- Bhattacharya, S. (2008*). Foundation of education*. New Delhi: Atlantic Publishers and Distributors.
- Brubacher, John. S. (1939). *Modern philosophies of education*. New York, USA: McGraw Hill Book Company. Inc.
- Butler J. Donald (1957). F*our philosophies and their practice in education and religion*. New York, USA: Harper & Row.
- Dearden R. F. (1984). *Theory and practice in education*. Routledge K Kegan & Paul.
- Deshpande, S. (2004). *Contemporary India: A Sociological View*. New Delhi:Penguin Education Commission 1964-66. New Delhi: MHRD.
- Dewey, J. (1977): *Democracy and education: An introduction to the philosophy of education*. New York: Macmillan.
- Dwivedi, K. (2014). *Education thoughts and thinkers*. New Delhi: Shree Publishers and Distributors.
- Kneller, G. F. (1964). *Introduction to philosophy of education*. New York, USA: John Wiley and Sons, Inc.
- Kumar, A. (2015*). Philosophical perspective of education*. New Delhi: A.P.H. Publishing Corporation.
- Nayak, B.K. (2003), *Text book of foundation of education.* Cuttack, Odisha: Kitab Mhal.
- NCERT (2014). Basics in Education. New Delhi: National Council of Educational Research and Training.
- Ozman, H. A., & Craver, S. M. (2011). *Philosophical foundations of education*. Boston, USA: Allyn & Bacon.
- Sharma, Y.S. (2004). *Foundations in Sociology of Education*, New Delhi: Anushka Publications.
- Siddiqui, M. H. (2014). *Philosophical & sociological foundations of education*. New Delhi: APH Publishing Corporation.
- Taneja, V. R. (2000). *Educational thought and practice*. New Delhi: Sterling.

Course Title: Education Policy Analysis

L	T	P	Credits
2	0	0	2

Course Code: BSE.452

Course Learning Outcomes (CLOs)

At the end of the course the prospective teacher-trainees will be able to;

1. To understand and Analyze Educational Policies

2. To critically evaluate the historical development, goals, and frameworks of educational policies in India
3. To identify challenges in implementing educational policies and propose solutions.
4. To explain the mechanisms and strategies for implementing educational policies.

Units/Hours	Contents	Mapping with CLOs
Unit I **6 Hours**	**UNIT – I: Planning an Educational Policy** • Meaning and significance of `Policy on Education • Purpose and Dimensions of an Educational Policy at local and Global level. • Philosophical and Sociological Perspective of planning an Educational Policy. • Basic steps involved in planning. • Fundamental principles for analyzing an Educational Policy.	**CLO1** **CLO2**
Unit II **8 hours**	**UNIT – II: Educational Policies in India** • Constitutional provision for Policy on Education. • Historical development of Educational Policies in India. • Critical analysis of Policies on Education since Independence: 1968, 1986 (Modified in 1992), NEP 2020	**CLO1**
Unit III **8 Hours**	**UNIT – III: Implementation of an Educational Policy** • Mechanism of Policy Implementation. • Strategies to Implement an Educational Policy. • Programme of action and implementation: conceptual clarification and significance	**CLO4**
Unit IV **8 Hours**	**Unit –IV Issues and challenges of Educational Policy** • Issue of modifying an Educational Policy. • Challenges for Implementation. • Role of different Organization / Groups: Legislature/ Judiciary/ Political Will and Parties/ Voluntary Organizations/ Non-governmental organizations (NGOs)/ Pressure Groups/ Public.	**CLO3**

Practicum

1. Reviewing and presenting report on NEP, 2020 in reference to Policy Implementation.
2. To present a critical review of the Programme of Action (1987).
3. Preparing a list of challenges to implement the present new National Education Policy, 2020 in our States.
4. Preparing a list of Measures to be taken or taken to implement National Education Policy, 2020 in our

State.

Mode of Transaction

The course content transaction will include the following:

1. Planned lectures infused with multimedia /power-point presentations.
2. 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.
3. Hands on experience of engaging with diverse communities, children and schools.

Suggestive Reading Materials

- Agarwal, Y. (2001). *Educational policy in India: 1992 and review 2001*. Shipra Publications.
- Bray, M., & Varghese, N. V. (2011). *Directions in educational planning: International experiences and perspectives*. UNESCO International Institute for Educational Planning.
- Carnoy, M. (1999). *Globalization and educational reform: What planners need to know*. UNESCO International Institute for Educational Planning.
- Chabbott, C. (2003). *Constructing education for development: International organizations and education for all*. Routledge.
- Government of India. (2020). *National Education Policy 2020*. Ministry of Human Resource Development. https://www.education.gov.in/sites/upload_files/mhrd/files/NEP_Final_English_0.pdf
- Kumar, K. (2005). *Political agenda of education: A study of colonialist and nationalist ideas* (2nd ed.). Sage Publications.
- Naik, J. P. (1975). *Equality, quality and quantity: The elusive triangle in Indian education*. Allied Publishers.
- Rani, P. G. (2006). *Education policy in India: Retrospect and prospect*. Discovery Publishing House.
- Tilak, J. B. G. (2003). *Education, society, and development: National and international perspectives*. APH Publishing.
- Tilak, J. B. G. (2018). *Education and development in India: Critical issues in public policy and development*. Palgrave Macmillan.

ANY ONE ELECTIVE FROM THE FOLLOWING OFFERED COURSES (FROM BSE.453 TO BSE.463) AS PER THE CHOICE OF STUDENT-TEACHERS

Course Title: Adolescence Education

L	T	P	Credits
4	0	0	4

Course Code: BSE.453

Course Learning Outcomes (CLOs)

At the end of the course the prospective teacher-trainees will be able to;

CLO1: Develop sensitivity, and interpret adolescence and adolescence education

CLO2: Develop life skills for matters related to reproductive health, sex and sexuality and communicate effectively on these issues

CLO3: Examine the role of local as well as international agencies towards Adolescent Educational Programme

CLO4: Inculcate a healthy attitude towards sex and sexuality, respect for the opposite gender and an understanding of responsible sexual behavior

CLO5: Develop pedagogical skills for Adolescence Education Programmes

Units/ Hours	**Contents**	**Mapping with CLOs**
UNIT I **14 hours**	**Adolescence and Adolescence Education** A. Understanding Adolescence: intellectual, emotional, social, and physiological aspects of Adolescence, issues and challenges during Adolescence, myths and realities. B. Adolescence Education: concept, nature, and significance of Adolescence Education in Indian context, aims and objectives of Adolescence Education. C. Role of school, family, media, and community as social agencies in Adolescence Education. D. Challenges of Adolescence Education. **Learning Activities:** Case studies, report preparation on the specific educational needs of adolescents	**CLO 1** **CLO 4**
UNIT II **15 hours**	**Life Skills and Adolescence Education** A. Concept, nature, and significance of Life Skills for Adolescence Education. B. Relationship between Life Skills and Adolescence Education. C. Core Life Skills and their significance. D. Understanding sexual and reproductive health. E. STIs and HIV/AIDS: causes, prevention, cure, and skills of coping. **Learning Activities:** Role play, sensitization of community regarding the STIs and HIV by executing Nukkad Natak, Rallies etc.	**CLO 1** **CLO 2** **CLO 4**
UNIT III **15 hours**	**Adolescence Education Programme in India (AEP)** A. Historical Development of Adolescence Education Programme in India. B. Goals and Significance of Adolescence Education Programme in India. C. Role of Teachers in Adolescence Education in India (AEP). D. Challenges to Educational Programmes in India. E. Myths / Misconceptions **Learning Activities:** Group discussion, Individual presentation, Panel discussion	**CLO 3**
UNIT IV **16 hours**	**Pedagogical Issues** A. Challenges of teaching adolescence education: understanding student's behavior, dealing with personal self-constraints, socio-cultural issues, class-room issues and challenges, material production, methodology	**CLO 4** **CLO5**

	B. Preparation of teachers C. Approaches to adolescence education: case studies and critical incidents, brainstorming, role-playing, gaming, value clarifications, question box, discussions and debates, puppet shows, role reversal, video shows. **Learning Activities:** Discussion, think-pair-share, Debate, Seminar	

Transaction Mode

Lecture, Seminar, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning, Cooperative Learning and Role Play

Suggested Readings

Alan, S., & Gavin, B. (2017). *An introduction to development psychology*. John Wiley & Sons.

Choudhary, G. B. (2014). *Adolescence education*. Delhi: PHI publisher.

Nagarajun, N. (2010). *Adolescence and family life education*. New Delhi: Shipra education.

Santrock, J. W. (2011). *Adolescence*. New Delhi: Mcgraw Hill Education India Pvt Ltd.

Course Title: Education for Mental Health

Course Code: BSE.454

L	T	P	Credits
4	0	0	4

Course Learning Outcomes (CLOs)

At the end of the course the prospective teacher-trainees will be able to;

CLO1: Explain the concept of mental health, mental hygiene, mental health disorders and healthy personality
CLO2: analyze the causes of stress and process of stress management and its significance

CLO3: analyze the needs and importance of global mental health education programme

CLO4: Critically examine the role of teachers and parents to maintain the good mental health of children

CLO5: Suggest prevention and promotional measures to maintain good mental health of society

Units/ Hours	Contents	Mapping with CLOs
UNIT I **14 hours**	**Mental Health** A. Meaning and determinants of Mental Health. B. Mental Health Vs Mental Hygiene. C. Mental disorders: Characteristics and Types. D. Causes of poor Mental Health. E. Myths Vs Facts about Mental Health. F. Legal perspectives of Mental Health in India. G. Concept of Healthy Personality **Learning Activities**: Discussion, seminar, Panel discussion, dialogues	**CLO 1**

UNIT II **16 hours**	**Stress, Stress Management and Adjustment** A. Stress: meaning, nature and symptoms, types of stress, social and psychological perspectives, remedial measures. B. Stress management and adjustment: meaning and significance of stress management and adjustment, prevention and promotion, role of parents, peer group and teachers. **Learning Activities:** identification of the symptoms of stress and mal-adjustment with the help of criteria of DSM-V, ICD-11	**CLO 2** **CLO 5**
UNIT III **14 hours**	**Mental Health Education Programme** A. Meaning and significance of Mental Health Education Programme. B. Dimensions of Mental Health Education Programme in India. C. Historical development of Mental Health Education Programmes in India. D. Local and Global Perspective of Mental Health Education Programme. E. Characteristics of a good Mental Health Education Programme. F. Role of Educational Institutions. **Learning Activities:** Group discussion, Individual presentation and preparation of report	**CLO 3** **CLO 5**
UNIT IV **16 hours**	**Pedagogical Issues** A. Lifestyles of teachers and parents • Mental health concerns of teachers and parents • Material availability/ production B. Guidance and Counselling Programme: • Concept, need and techniques. • Teacher as a counselor C. Designing and evaluating Mental Health Programmes **Learning Activities:** Sensitization of different educational stakeholders regarding mental health by execution of Nukkad Natak, Rallies, plays etc.	**CLO 4** **CLO 5**

Transaction Mode

Lecture, Seminar, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning, Cooperative Learning and Role Play

Suggested Readings

- Bahadur, M. (1995). Mental health in theory and practice. Hoshiarpur, V.V.R.I.
- Bonny, M. E. (1960). Mental health in education. Boston: Allyn and Bacon lnc.
- Capuzzi, D., & Gross, D. R. (1975). Introduction to counseling. London: Allynand Bacon.
- Carroll, H. A. (1975). Mental hygiene: The dynamic of adjustment (3rd Ed.). Chicago Press.
- Coleman, J. C. (1968). Abnormal psychology and modern life. Bombay: D.B.Company.
- Crow, L. D., Crow, &Alince. (1952). Mental hygiene, New York: MeGraw Hill Book Company lnc.
- Naik, D. (2007). Fundamentals of guidance and counselling. New Delhi: Adhyayan Publishers
- and Distributors.
- Nayak, A. K. (2014). Guidance and counselling. New Delhi: A.P.H. Publishing Corporation.

- Sharma, R. N., & Sharma, R. (2013). Guidance and counselling in India. New Delhi: Atlantic Publishers and Distributors (P) Ltd.
- Sinha, A.K., &Dutt. (1982). The concept of mental health in India and western psychologies. Kurukshetra: Vishal Publications.

Course Title: Education for Sustainable Development
Course Code: BSE.455

L	T	P	Cr
4	0	0	4

Course Learning Outcomes:
At the end of the course the prospective teacher-trainees will be able to;

CLO1: Understand the concept of sustainable development and the relationship between education and sustainability.
CLO2: Analyze the Sustainable Development Goals (SDGs) and their implications for education systems globally.
CLO3: Evaluate the role of educational institutions and pedagogical strategies in achieving SDG 4 (Quality Education).
CLO4: Critically assess policies related to sustainable development and education.
CLO5: Develop and implement various strategies for integrating sustainable development into curricula and educational practices.

Units/ Hours	Contents	Mapping with CLOs
UNIT I 14 Hours	**Education and Sustainable Development** - Meaning, relationship, goals, and significance of education for sustainable development (ESD), Characteristics of ESD. - Historical perspective of ESD. - Decolonizing knowledge for sustainable development. - Challenges in education for sustainable development. **Learning Activity:** Case Study Analysis- Students will analyze a case study of a country/institution implementing ESD programs, identifying challenges and strategies for integrating sustainability in education.	**CLO1**
UNIT II 16 Hours	**Sustainable Development Goals (SDGs)** - Meaning, nature, and significance of SDGs. - Overview of the 17 SDGs: UNESCO agenda. - SDGs and social transformation as universal commitments. - Education as a human right to achieve sustainable development. - Role of educational institutions and challenges in achieving SDGs. **Learning Activity:** SDG Mapping Activity-In groups, students will map the 17 SDGs to educational strategies and present how each can be achieved through education.	**CLO2**
UNIT III 15 Hours	**SDG-4: Quality Education for All (15 Hours)** - Meaning, nature, and significance of SDG-4 (Quality Education). - The NEP 2020 on SDG-4: Sustainable lifestyle, gender equality, peace promotion, global citizenship, mental health, and justice in society. - Pedagogical issues related to SDG-4.	**CLO3**

	Learning Activity: To present critical review on NEP, 2020 in the context of SDGs.	
UNIT IV 15 Hours	**Policy work & Strategies for Integrating Sustainability in Education** -Understanding the policy-making process in sustainable development. - Policy analysis and its implications for education. - Approaches to incorporating sustainability in curricula. - Case studies on successful sustainable education models. - Pedagogical tools and methods for teaching sustainability.	**CLO4 CLO5**

Suggestive Mode of Transaction

The suggestive mode of transaction for the Education for Sustainable Development course includes a blend of traditional lectures, case studies, small group discussion, panel interactions, small theme-based seminars, and project-based learning. Collaborative online learning and reflective journals will encourage continuous engagement, while role plays and workshops promote active application of concepts.

Suggestive Reading Materials

- Corcoran, P. B., & Wals, A. E. J. (Eds.). (2004). *Higher education and the challenge of sustainability: Problematics, promise, and practice*. Springer.
- Filho, W. L., & Kovaleva, M. (2018). *Handbook of sustainability science and research*. Springer.
- Ghosh, S. K. (2014). *Education for sustainable development in India: Approaches, strategies, and challenges*. Routledge India.
- Huckle, J., & Sterling, S. (Eds.). (2014). *Education for sustainable development: A guide for educators*. Routledge.
- Sachs, J. D. (2015). *The age of sustainable development*. Columbia University Press.
- Tilbury, D. (2011). *Education for sustainable development: An expert review of processes and learning*. UNESCO.
- UNESCO. (2017). *Education for sustainable development goals: Learning objectives*. UNESCO Publishing.

Suggested websites/links:

- https://en.unesco.org/themes/education-sustainable-development
- https://sdgs.un.org/goals
- https://www.un.org/sustainabledevelopment/education/
- https://www.iisd.org/
- https://www.earthcharter.org/
- https://www.globalgoals.org/
- https://www.sustainabledevelopment.un.org/
- https://www.wwf.org/
- https://www.thegef.org/

Course Title: Emerging Technology in Education
Course Code: BSE.456

L	T	P	Cr
4	0	0	4

Course Learning Outcomes:
At the end of the course the prospective teacher-trainees will be able to;

CLO1: Understand the relationship between education and technology and its significance in modern educational settings.
CLO2: Identify and evaluate various ICT tools and their applications in education.
CLO3: Scrutnize approaches for integrating technology into pedagogy and subject-specific teaching.
CLO4: Develop instructional content and e-learning resources using various multimedia and online tools.

Units/Hours	Contents	Mapping with CLOs
UNIT I **15 Hours**	**Education and Technology** - Relationship between Education and Technology. - Concept of Technology in Education. - Historical development of technology use in education. - Principles of using technology in education. - Emerging trends in educational technology. **Learning Activity:** Create a concept map linking the relationship between education and technology.	**CLO1**
UNIT II **15 Hours**	**Information and Communication Technology** - Meaning, nature, and types of ICT. - Fundamentals of ICT. - ICT tools and applications in education. - Social, economic, and ethical issues associated with ICT use **Learning Activity:** Debate on Social, Economic, and Ethical Issues in ICT	**CLO2**
UNIT III **15 Hours**	**Technology in Education and Pedagogy** - Integration of technology in teaching and learning. - Subject-specific ICT tools for creating and facilitating learning. - Use of technology for children with special needs: Tools and processes. - ICT for assessment and management. **Learning Activity:** Explore different ICT tools (e.g., Google Classroom, Moodle, Zoom, Padlet) and present a report on their features, uses in education, advantages and limitations.	**CLO3**
UNIT IV **15 Hours**	**Instructional Design and E-content** - Instructional design: principles, models, and stages. - E-learning courseware design. - Designing instructional media and creating interactive content. - Creating multimedia content: Audio, video editing, and animation basics. **Learning Activity:** Conduct a hands-on workshop where students will create multimedia content on a chosen topic using tools like Adobe Spark, Canva, etc., to enhance their presentation skills.	**CLO4**

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations, group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, focus group discussion, surveys, short term project work, etc.

Suggestive Reading Materials

- Anderson, T. (2011). *The theory and practice of online learning (2nd ed.)*. Athabasca University Press.
- Jonassen, D. H. (2000). *Computers as mindtools for schools: Engaging critical thinking (2nd ed.).* Prentice Hall.
- Kirkwood, A., & Price, L. (2014). *Technology and learning: A review of the literature*. The Higher Education Academy.
- Nayak, P., & Sahoo, S. (2016). *Information and communication technology in education*. Tata McGraw-Hill Education.
- Prakash, A. (2011). *Educational technology: A practical approach*. R. Lall Book Depot.
- Puentedura, R. R. (2009). *Transformation, technology, and education. Educational Leadership*, 67(4), 22-26.
- Roblyer, M. D., & Doering, A. H. (2013). *Integrating educational technology into teaching (6th ed.).* Pearson Education.
- Sharma, R. (2009). *Technology in education: A practical approach*. Kanishka Publishers.

Suggested websites/links:

- https://en.unesco.org/themes/education-sustainable-development
- https://www.iste.org/
- https://www.edutopia.org/technology-integration
- https://www.oercommons.org/
- http://nroer.gov.in/
- https://edtechreview.in/
- https://www.coursera.org/
- https://www.open.ac.uk/about/teaching-and-learning-technology
- https://elearningindustry.com/
- https://www.nmc.org/

Course Title: Gender Education

Course Code: BSE.457

L	T	P	Credits
4	0	0	4

Course Learning Outcomes (CLOs)

At the end of the course the prospective teacher-trainees will be able to;

CLO1: Explain key concepts like gender, transgender, gender bias, gender stereotype, empowerment, gender parity, equity and equality and patriarchy

CLO2: Analyze gender issues in school, curriculum, and textual materials across disciplines

CLO3: Address issues related to sexuality, sexual violence, and abuse

CLO4: Examine school environment, curriculum, and pedagogy with reference to gender related issues

Units/ Hours	Contents	Mapping with CLOs
UNIT I **15 hours**	**Gender and Education** A. Meaning, relationship, and significance of studying. B. Conceptual clarity of related terms: Gender, gender perspective, sexuality, patriarchy, masculinity, feminist, gender bias, transgender, gender stereotyping and empowerment. C. Gender as the basis in school education.	**CLO 1** **CLO 2**

	D. Constitutional Provisions with special reference to equity and equality, rights of girls. E. Education and women's empowerment. F. Shifting from women's studies to Gender Studies. **Learning Activities:** Discussion, Debate, dialogues, seminar	
UNIT II **14 hours**	**Learning Gender Roles** A. Social and Cultural Perspectives of Gender Identity: role of family and school, media, and other formal and informal organizations/ agencies B. Socialization and learning gender roles. C. Gender stereotyping/Role models. D. Preventing Measures: role of school and home **Learning Activities:** Case study, role play	**CLO 2**
UNIT III **17 hours**	**Gender, Sexuality, Sexual Violence and Abuse** A. Development of sexuality and its impact on children with reference to gender, body image, role-models. C. Child sexual abuse from pre-primary stage to secondary stage: providing accurate information on child sexual abuse, helping, and identifying signs of sexual abuse in children. D. Providing dos and don'ts about sexual abuse. E. Legal perspective: Laws for safety and Security of girls and women, Implementation of the POCSO Act. **Learning Activities:** Execution of play, Nukkad Natak and Rallies for sensitizing educational stakeholders regarding the various aspects of sexual harassment	**CLO 3**
UNIT IV **14 hours**	**Pedagogical Issues** A. Creating gender friendly classrooms and school environment. B. Analyzing Curriculum from gender perspective: learning outcomes, textual material, teaching-learning processes, language used, teaching aids, assessment strategies. C. ICT pedagogy for gender sensitive school curriculum. D. Challenges for pedagogical issues. **Learning Activities:** Preparation and submission of report on the theme discussed	**CLO 4**

Transaction Mode

Lecture, Seminar, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning, Cooperative Learning and Role Play

Suggested Readings

- MacNaughton, G. (2013). *Rethinking gender in early childhood education.* SAGE Publications Ltd.
- Cole, M. (2023). *Education, equality and human rights: issues of gender, race, sexuality, disability and social class*. New York: Routledge.
- Dandapat, A. K. (2015). *Education gender stereotyping and development*. New Delhi: Shipra publications.
- Kumar, N. (2011). *The politics of gender community and modernity: Essays on education in India.* New Delhi: Oxford University Press.

- Ro, H. K., Frank, F., Elizabeth, R. (2022). *Gender equity in stem in higher education: International perspectives on policy institutional culture and individual choice.* New York: Routledge.
- Chakraborty, S. (2015). *Gender identity and role in India: Issues and Challenges.* Jaipur: Aavishkar publishers.

L	T	P	Credits
4	0	0	4

Course Title: Guidance and Counselling

Course Code: BSE.458

Course Learning Outcomes (CLOs)

At the end of the course the prospective teacher-trainees will be able to;

CLO1: Explain the basic meaning, need and significance of Guidance and Counseling in the context of education

CLO2: Differentiate between Guidance and Counselling with special reference to the purpose and strategies

CLO3: Apply various tools and techniques for developing insight to the multiple aspects of students' life

CLO4: Critically analyze the issues and challenges of the process of guidance and counselling

Units/ Hours	Contents	Mapping with CLOs
UNIT I **14 hours**	**Guidance** A. Meaning, need, nature and scope of Guidance. B. Brief historical background of Guidance movement in India. C. Individual and Group Guidance. D. Basic assumptions and principles of Guidance. F. Essential information for Effective Guidance. G. Vocational Guidance and Role of teachers. **Learning Activities:** Construction of report on the guidance needs of the junior students	**CLO 1** **CLO 2**
UNIT II **16 hours**	**Counselling** A. Meaning, importance, areas, and types of Counselling. B. Approaches to Counseling: directive, non-directive and eclectic. C. Process of Counseling: initiating counseling, preparation, and intake procedures, establishing rapport, termination of and response to initial interview. D. Establishing Structure: attending behaviour, observation, non-verbal behaviour, listening, verbal patterns and communication responses, silence, use of questions, transference and countertransference, regarding and respect in counseling relationships, involuntary clients, client expectation. E. Role of family and community. **Learning Activities:** Seminar and Presentations	**CLO 1** **CLO 2**
UNIT III **14 hours**	**Tools and Techniques to Collect Data** A. Psychological Testing and Diagnosis: Need and Nature. B. Counseling Interview: Essential aspects, basis procedures, problems, and their handling. C. Personality Assessment: Historical perspective D. Material administration, scoring, interpretation, and evaluation of frequently used personality inventories/ questionnaire and projective tests. E. Case Study: Need and Importance. **Learning Activities:** Conduction of case study**,** Administration and	**CLO 3**

	interpretation of tools of personality	
UNIT IV **16 hours**	**Issues Related to Guidance and Counselling** A. Factors affecting Guidance and Counselling. B. Ethical issues in Guidance and Counseling. C. Limitation of diagnosis with special reference to Counselling. D. Challenges to organize Guidance and Counselling programmes in schools. E. Counselling and Guidance of persons with learning disabilities, visual and hearing impairment. **Learning Activities:** Preparation and submission of report on school guidance programme	**CLO 4**

Transaction Mode

Lecture, Seminar, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning, Cooperative Learning and Role Play

Suggested Readings

- Gibson, R. L., & Mitchell, M. H. (2008). Introduction to counselling and guidance. New Jersey: Pearson Prentice Hall.
- Gupta, S. (2013). Guidance and career counselling. New Delhi: APH Publishing Corporation.
- Johnson, D. W., & Johnson, R. T. (1994). Learning together. Connecticut: Greenwood Press.
- Jothiet. (2009). Guidance and counselling. New Delhi: Centrum Press.
- Naik, D. (2007). Fundamentals of guidance and counselling. New Delhi: Adhyayan Publishers and Distributors.
- Nayak, A. K. (2014). Guidance and counselling. New Delhi: APH Publishing Corporation.
- Pal, O. (2011). Educational and vocational guidance and counselling. New Delhi: APH Publishing Corporation.
- Pandey, V. C. (2011). Educational Guidance and Counselling. Isha Books: New Delhi.
- Pratap, N. (2014). Educational and vocational guidance and counselling. Random Publications. New Delhi.
- Sharma, R. N., & Sharma, R. (2013). Guidance and counselling in India. New Delhi: Atlantic Publishers and Distributors (P) Ltd.
- Siddiqui, M. H. (2015). Guidance and counselling. New Delhi: APH Publishing Corporation.
- Srivastva, S. K. (2011). Career counselling and Planning. Atlantic Publishers. New Delhi.
- Verma, L.N. (2013). Educational psychology –experimentation in problems and methods in teaching. Jaipur: Rawat Publications.

Course Title: Human Rights Education

L	T	P	Cr
4	0	0	4

Course Code: BAE.459

Course Learning Outcomes:

At the end of the course the prospective teacher-trainees will be able to;

1. To identify contemporary human rights and human rights education.
2. To advocate for the promotion and protection of human rights locally and globally.
3. To explore the substantive knowledge of policies concerning human rights in the field of human rights education.
4. To apply human rights principles to real-world scenarios and advocate for human rights in local and global contexts.
5. To promote human rights education and awareness through active engagement in their communities.

Units/Hours	Contents	Mapping

		with CLOs
Unit 1 **20 hours**	**Introduction to Human Rights and Human Rights Education:** Historical development of Human rights: From ancient civilizations to modern Human rights. Human rights: concept, meaning and definition, nature and significance, relationship between rights and duties. Introduction to Human rights education with reference to philosophical, psychological, political, and sociological perspective. Categories of Human rights: o Civil and political rights. o Economic, social, and cultural rights. o Collective and development rights. ***Learning Activities:*** Group Discussion, Document Analysis, Case Study, Quizzes.	**CL01**
Unit 2 **10 hours**	**Constitution, Human Rights and Social Justice:** Fundamental rights and duties, relationship between them, Directive principles of state policies, international human rights and the Indian constitution. Gender equality and women's rights. Understanding human rights of children, minorities, Dalits, differently abled and homosexuals. ***Learning Activities:*** Discussion, Simulation, Group Presentation.	**CL02**
Unit 3 **15 hours**	**Concerns in Human Rights and Human Rights Education:** Technology, privacy, and digital rights. Environmental rights and climate change. Human rights in the age of artificial intelligence. Methods of Human rights as pedagogy. Revisiting of Indian constitution with reference to Human rights. Critical review of Human right in globalized world. ***Learning Activities:*** Debate, Discussion, Extempore.	**CL03**
Unit 4 **15 hours**	**School Education and Human Rights Perspective:** Human rights perspective in curriculum. Human rights perspective in teaching-learning processes. Human rights perspectives in assessment. Human right perspective and school ethos and culture. National education policies and human rights. ***Learning Activities:*** Group Discussion, Panel Discussion, Poster Presentation.	**CL04** **CL05**

Suggestive Mode of Transaction

The course content transaction will include the following:
Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, focus group discussion, surveys, short term project work, etc.

Suggested Readings: -

- Dikshit, R.C. (1998). *Human rights and the law, universal and Indian*. Deep and Deep.
- Freeman, M. (2003). *Human rights: An interdisciplinary approach*. Cambridge.

- Ishay, M.R. (2008). *The history of human rights: From ancient times to the globalization era.* University of California Press.
- Joshi, S. C. (2011). *Global trends in human rights education.* Akansha Publishing.
- McCowan, T. (2018). *Education as a human right: principles for a universal entitlement to learning.* Bloomsbury Academic India.
- Vatsala, P. (2019). *Human rights education: Issues and challenges.* Atlantic Publishers and Distributors.

Course Title: Peace Education
Course Code: BSE.460

L	T	P	Credits
4	0	0	4

Course Learning Outcomes (CLOs)
At the end of the course the prospective teacher-trainees will be able to;
Learning Outcomes
After the completion of this course students will be able to:

1. To acquire a holistic and critical understanding of the theoretical and practical bases of peace education
2. To identifying the best ways to follow peace in life
3. To show ability to select and use appropriate method of resolving conflict
4. To become critical learners and reflective peace practitioners
5. To appreciate the foundations of just and peaceful societies
6. To understand and practice the positive action and non-violent conflict resolution in society, enhance students' intellectual flexibility, creativity & problem-solving capacities.

Units/Hours	Contents	Mapping with CLOs
Unit I **12 Hours**	**Peace Education: Nature and Significance** • Peace and Peace Education: Meaning, need, dimensions and goal of Peace Education. • Philosophical, sociological, and psychological perspectives of Peace Education. • Types of Peace: Positive, negative, inner, social and with nature. • Conflict-Resolution and Peace Education. • Relationship between Development and Peace building. • Challenges to Peace Education.	**CLO1** **CLO2** **CLO3**
Unit II **18 hours**	**Towards the Global Culture of Peace** • Approaches to Peace Education • Role of Social and Religious Foundations in Peace building. • Role of local and International Agencies in the Peace building process.	**CLO1** **CLO2**
Unit III **16 Hours**	**Thoughts on Peace and Harmony** • Ancient Indian views • UNO role for Global Peace Education. • Study of following thinkers in context of global Peace and Harmony: J. Krishnamurti, Dalai Lama.	**CLO3** **CLO4**
Unit IV **16 Hours**	**Pedagogical Issues for Peace Education** • Comparative and historical perspective on school knowledge and peace.	**CLO5** **CLO6**

	• Teachers' perceptions of the effects of young people's war experiences and pandemic. • Critical analysis of school curriculum at school level in the light of peace building process. • Challenges of Pedagogical issues of Peace Education.	

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.

Suggested Readings

- Balasooriya, A.S. (1994a). Teaching Peace to Children. Maharagama, Sri Lanka: National Institute of Education.
- Balasooriya, A.S. (1994b). Management of Conflict in Schools. Maharagama, Sri Lanka: National Institute of Education.
- Balasooriya, A.S. (1995). Education for Peace: Learning Activities, Maharagama, Sri Lanka: National Institute of Education.
- Balasooriya, A.S. (2000a). World Peace through School Manuscript. Maharagama, Sri Lanka: National Institute of Education.
- Bey T.M. and G.Y. Turner (1995). Making School a Place of Peace. London: Sage.
- Brown, G. (1971). Human Teaching for Human Learning. New York, Viking.
- Canfeid, J. (1975). 101 Ways to Enhance Self-concept in the Classroom. Engle Cliffs: Prentice Hall.
- Delors, J. (1996). Learning the Treasure within: Report of International Commission on Education for the 21st Century. Paris: UNESCO.
- Dewy, J. (1916). Democracy and Education, London: The Free Press.
- Dhand, H. (2000). Teaching Human Rights: A Handbook for Teacher Educators. Bhopal: Asian Institute of Human Rights Education.
- Fountain, S. (1988). Learning Together – Global Education. New York: Stanley Thrones Publishers Ltd, New York University.
- Fountain, S. (1999). Education for Peace in UNICEF. New York: Working Paper Education Section, Programme Division, UNICEF.
- Galtung, J. and D. Ikeda (1995). Choose Peace. London: Pluto Press.
- Government of India (1949). Report of the University Education Commission, (1948-49). New Delhi: Ministry of Education, Government of India.
- Government of India (1953). Report of the Secondary Education Commission, (1952-53). New Delhi: Ministry of Education, Government of India.
- Government of India (1966). Report of the Education Commission 1964-66 on "Education and National Development". New Delhi: Ministry of Education, Government of India.
- Government of India (1993). Learning without Burden. New Delhi: Ministry of Human Resources Development (MHRD), Department of Education, Government of India.
- Government of India. (1986). Report of the National Policy on Education (1986). New Delhi, Ministry of Human Resources Development, Government of India.
- Handa, M.L. (1983). Manifesto for a Peaceful World Order: A Gandhian Perspective. New Delhi: Gandhi Bhavan.

- Harris, I. and C. McCauley (2000). Report on the International Workshop on Education for Peace. Israel: University of Haifa.
- Harris, I. M. (1988). Education for Peace. London: McFarland and Company.
- Herzog, S. (1982). Joy in the Classroom. Boulder Creek, California: University of the Tree Press.
- Hicks, D. (1985). Education for Peace: Issues, Dilemmas and Alternatives. Lancaster: St. Martin's College.
- Hodder and P. Pruzman (1988). The Friendly Classroom for a Small Planet. Progra Fellowship of Reconcilation. London: New Society Publishers.
- Hutchinson, F. P. (1996). Educating beyond Violent Futures. London: Routledge.
- International Institute for Democracy and Electoral Assistance (IDEA) (2003). Reconciliation After Violent Conflict: A Handbook. Sweden: International Institute for Democracy and Electoral Assistance.
- Joseph, A and K. Sharma (eds) (2003). Terror Counter-terror. New Delhi: Kali for Women.
- Kreidler, W.I. (1991). Creative Conflict Resolution: More than 200 Activities for Keeping Peace in the Classro. Foreman, Scott, Glenview.
- Maria, D. (2003). 'Value Education for Peace', The CTE Journal, 2 (3): 25.
- National Council of Educational Research and Training (NCERT) (2000). National Curriculum Framework for School Education. New Delhi: NCERT.
- Okamoto, M. (1984). "Peace Research and Education for Peace". What is Education for Peace in the New Light of Peace Research?" Gandhi Marg, 6 (July-August): 220.
- Pandey, S. (2004). Education for Peace: Self Instructional Package for Teacher Educators.
- Pike, G. and D. Seiby (1993). Global Teacher–Global Learner: Public Report on Basic Education in India.
- Reardo, B. A. (1997). Tolerance—The Threshold of Peace. Paris: UNESCO.
- Schmidt, F. and A. Friedman (1983). Creative Conflict Solving for Kids. London: Stoughton Ltd.
- UNESCO (1998). Learning to Live together in Peace and Harmony. A UNESCO APNIEVE Source Book for Teacher Education and Tertiary Level Education. Bangkok, Thailand: UNESCO Principal Regional Office for Asia and the Pacific.
- UNESCO (2001). Learning the Way of Peace. A Teachers' Guide to Education for Peace. New Delhi: UNESCO.
- UNICEF (1994). I Dream of Peace. New York: Harper Collins.
- UNICEF (1996). Education from Conflict Resolution Project: Final Progress Report to the U.K. Committee for UNICEF. Colombo, Sri Lanka: UNICEF
- UNESCO. (2001). Learning the Way to Peace. A Teachers Guide to Education for Peace. New Delhi: UNESCO.

Course Title: Sports and Fitness Education
Course Code: BSE.461

L	T	P	Credits
4	0	0	4

Course Learning Outcomes (CLOs)

At the end of the course the prospective teacher-trainees will be able to;

1. Demonstrate an understanding of the historical evolution, conceptual foundations, and global perspectives of Health and Physical Education, including its integration into school curricula and its relationship with other disciplines.
2. Analyze the concept, dimensions, and determinants of health, evaluate common health problems, and explain the role of nutrition, physical activities, and yoga in maintaining and improving health.
3. Apply the principles of physical fitness, demonstrate fundamental sports skills, and evaluate the impact of games, sports, and rhythmic activities on overall health and well-being.
4. Critically assess health policies, programmes, and school health initiatives, and evaluate the role of yoga and legal frameworks like POCSO in promoting health and well-being.
5.

Units/Hours	Contents	Mapping with CLOs
Unit I **12 Hours**	**Evolution of Health and Physical Education** • Health and Physical Education: Conceptual Clarity (locally as well as globally), importance and aims. • Place in School Curriculum: Historical Development as a subject, Objectives with special reference to Indian Education and its relationship with other subjects. • Status of Health and Physical Education: From primary to secondary education in a global perspective, ayurvedic and yogic concept of Health Education, legal perspective of Health and Health Education in India.	**CLO1**
Unit II **19 hours**	**Health Education** • Concept, dimensions, and determinants of health with special to India. • Psycho-social concerns of children and adolescents including differently able children. • Understanding the body system and its functions • Common health problems and diseases: causes, prevention and cure, immunization and first aid. • Impact of Physical activities, games, sports and yoga on different body systems. • Food and nutrition, nutrients and their functions.	**CLO2**
Unit III **16 Hours**	**Games and Fitness** • Physical fitness and its components: athletics (general physical fitness exercises), games (lead-up games, relays, and major games), Rhythmic activities, gymnastics, and their impact on health. • Development of physical fitness: Postures and Importance of relaxation, Fitness tests; Resources and services for games and sports and Health. • Fundamentals skills of sports: Sports for recreation and competition, Sports awards and scholarships, sport person ship, Indigenous and self-defense activities. • School and family, health services, policies and major health and physical education- related programmes, blood banks, role of media. • Safety and security. • First Aid: Need and Principles.	**CLO3**
Unit IV **16 Hours**	**Policies, Programmes and Assessment** • Policies, programmes, and services for addressing health needs. • School Health Programme: school health	**CLO4**

	services, health promoting schools, global school health initiatives. • Yoga: Meaning, initiation, historicity, classification, streams, and schools of yoga, Need and importance and role of yoga for healthy life and living, Yoga as Psychotherapy. • POCSO (Protection of Children from Sexual Offences Act, 2012), PWD 2016, the Integrated Child Protection Scheme. • Assessment of health performance testing in games and sports, reporting of health condition and performance of child in the sport fields.	

Practicum

1. Recognizing important indicators of health and wellbeing of children and mental health.
2. Undertaking a survey, understanding local food related matters, and understanding the importance of the right to food.
3. Analyzing NEP, 2020 with reference to Games Oriented Education.
4. Planning activities for development of physical fitness.
5. Organization of games and sports tournaments
6. Learning and performing basic yogic activities, asanas, and pranayama, Kriyas and Meditation. Celebration of yoga day, yoga week.
7. Arranging reflective Dialogues on Serials and related videos.
8. Preparation of inventories on myths on exercises and different types of food.
9. Preparation of First Aid kit.
10. A critical review of YOGA-SUTRA.

Mode of Transaction

The course content transaction will include the following:

1. Planned lectures infused with multimedia /power-point presentations.
2. 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.
3. Hands on experience of engaging with diverse communities, children, and schools.

Suggestive Reading Materials

- American Heart Association. (2021). *First aid, CPR, and AED training manual* (7th ed.). American Heart Association.
- American Red Cross. (2021). *First aid/CPR/AED participant's manual*. American Red Cross.
- Bucher, C. A., & Thaxton, N. A. (2019). *Foundations of physical education, exercise science, and sport* (20th ed.). McGraw-Hill Education.
- Corbin, C. B., & Lindsey, R. (2020). *Fitness for life* (7th ed.). Human Kinetics.
- Government of India. (2012). *Protection of Children from Sexual Offences (POCSO) Act, 2012*. Ministry of Women and Child Development.
- Government of India. (2020). *National Education Policy 2020*. Ministry of Human Resource Development. https://www.education.gov.in/sites/upload_files/mhrd/files/NEP_Final_English_0.pdf
- International Yoga Day. (2021). *Yoga for health and well-being: A practical guide*. United Nations. https://www.un.org/en/observances/yoga-day
- Iyengar, B. K. S. (2019). *Light on yoga: The bible of modern yoga*. HarperCollins.

- Jain, N. (2016). *Sports and physical education: New trends and innovations*. Khel Sahitya Kendra.
- Lumpkin, A. (2020). *Introduction to physical education, exercise science, and sport studies* (11th ed.). McGraw-Hill Education.
- National Institute of Mental Health and Neurosciences. (2020). *Mental health and well-being: A guide for schools*. NIMHANS.
- Pangrazi, R. P., & Beighle, A. (2019). *Dynamic physical education for elementary school children* (19th ed.). Pearson.
- Park, K. (2021). *Park's textbook of preventive and social medicine* (26th ed.). Banarsidas Bhanot.
- Sharma, R. (2017). *Health and physical education: A teachers' guide for elementary school*. Pearson Education.
- Singh, A. (2015). *Yoga and ayurveda: Self-healing and self-realization*. Motilal Banarsidass.
- Srilakshmi, B. (2018). *Nutrition science* (6th ed.). New Age International Publishers.
- Swami Satyananda Saraswati. (2008). *Asana Pranayama Mudra Bandha*. Yoga Publications Trust.
- World Food Programme. (2021). *The state of school feeding worldwide 2020*. WFP. https://www.wfp.org/publications/state-school-feeding-worldwide-2020
- World Health Organization. (2018). *Global action plan on physical activity 2018–2030: More active people for a healthier world*. WHO. https://www.who.int/publications/i/item/9789241514187
- World Health Organization. (2020). *Health education: Theoretical concepts, effective strategies, and core competencies*. WHO. https://www.who.int/publications/i/item/9789240012136

Course Title: Tribal Education
Course Code: BSE.462

L	T	P	Credits
4	0	0	4

Course Learning Outcomes (CLOs)
At the end of the course the prospective teacher-trainees will be able to;

1. Explain the socio-cultural, historical, and economic context of tribal communities and their impact on education.
2. Design inclusive and culturally responsive curricula and pedagogical strategies for tribal students.
3. Analyze the role of policies, programs, and community participation in promoting tribal education.
4. Evaluate the challenges and barriers to education in tribal communities and propose solutions.
5. Apply knowledge of indigenous knowledge systems and multilingual education to enhance learning outcomes.
6. Reflect on the role of teachers and technology in addressing the unique needs of tribal students.

Units/Hours	Contents	Mapping with CLOs
Unit I **12 Hours**	**Understanding Tribal Communities and Education** • Concept and characteristics of tribal communities in India. • Historical and socio-cultural context of tribal education. • Challenges in tribal education: Access, equity, and quality. • Constitutional provisions and policies for tribal education (e.g., Article 46, PESA Act, Forest Rights Act). • Role of NGOs and government initiatives in tribal education.	**CLO1**
Unit II **16 hours**	**Curriculum and Pedagogy for Tribal Education** • Designing inclusive and culturally responsive curricula for tribal students.	**CLO2** **CLO6** **CLO5**

	• Multilingual education and the role of tribal languages in learning. • Pedagogical strategies for addressing diverse learning needs. • Integrating indigenous knowledge systems into formal education. • Use of technology and ICT in tribal education.	
Unit III **16 Hours**	**Socio-Economic and Psychological Aspects of Tribal Education** • Socio-economic barriers to education in tribal communities. • Gender issues in tribal education. • Psychological and emotional needs of tribal students. • Role of community participation in promoting education. • Health, nutrition, and their impact on learning outcomes.	**CLO1** **CLO3**
Unit IV **16 Hours**	**Policies, Programs, and Evaluation in Tribal Education** • National and state-level policies for tribal education (e.g., Eklavya Model Residential Schools, Ashram Schools). • Evaluation and assessment strategies for tribal students. • Role of teachers and teacher training for tribal education. • Case studies of successful tribal education models. • Future directions and innovations in tribal education.	**CLO4**

Practicum

1. Conduct a field visit to a tribal community and prepare a report on their educational challenges and opportunities.
2. Develop a culturally responsive lesson plan for a tribal classroom.
3. Organize a workshop on the importance of multilingual education in tribal areas.
4. Create a case study on a successful tribal education model or program.
5. Design a community engagement program to promote education in tribal areas.
6. Prepare a presentation on the role of technology in tribal education.
7. Analyze and critique a policy document related to tribal education (e.g., NEP 2020, Eklavya Model Residential Schools).

Mode of Transaction

- Lectures and Discussions: Interactive sessions to discuss theoretical concepts and case studies.
- Field Visits: Visits to tribal communities and schools to observe and understand ground realities.
- Workshops and Seminars: Hands-on workshops on curriculum design, pedagogy, and community engagement.
- Group Projects: Collaborative projects to develop culturally responsive teaching materials.
- Technology Integration: Use of ICT tools for teaching and learning.
- Reflective Journals: Encouraging students to maintain journals to reflect on their learning and experiences.

Suggestive Reading Materials

- Ambasht, N. K., & Mooij, J. (2010). *Education for all: Mid-decade assessment*. National University of Educational Planning and Administration.

- Bhatia, K. (2018). *Tribal education in India: Challenges and prospects*. Sage Publications.
- Government of India. (2020). *National Education Policy 2020*. Ministry of Education. https://www.education.gov.in/sites/upload_files/mhrd/files/NEP_Final_English_0.pdf
- Mohanty, A. K. (2010). *Languages, inequality, and marginalization: Implications of the double divide in Indian multilingualism*. International Journal of the Sociology of Language, 205, 131–154.
- NCERT. (2006). *Position paper on education of tribal children*. National Council of Educational Research and Training.
- Rao, N. (2017). *Education and empowerment of marginalized groups in India: Policies and practices*. Sage Publications.
- Sarangapani, P. M., & Winch, C. (2010). *Handbook of education in India: Debates, practices, and policies*. Routledge.
- Singh, Y. K. (2016). *Education for tribal development*. APH Publishing.
- World Bank. (2011). *India: Vocational education and training*. World Bank Publications.
- Xaxa, V. (2014). *Report of the high-level committee on socio-economic, health, and educational status of tribal communities of India*. Ministry of Tribal Affairs, Government of India.

Course Title: Economics of Education
Course Code: BAE.463

L	T	P	Cr
4	0	0	4

Course Learning Outcomes:
At the end of the course the prospective teacher-trainees will be able to;
CLO1: Understand the Foundations of Economics of Education
CLO2: Analyze the Economic Aspects of Educational Planning
CLO3: Evaluate the Indian Education System in Terms of Equity and Quality
CLO4: Assess Higher, Vocational, and Professional Education Policies

UNIT/Hours	Contents	Mapping with CLOs
UNIT I 15 Hours	**Introduction of Economics Education:** • Definition, objectives, scope, and nature of Economics of Education. • Effects of education on economic growth. • Investment in human capital and rate of return to education. • Relationship between health and education outcomes.	CLO I
UNIT II 15 Hours	**Educational Economy and Planning:** • Public goods, merit goods, and mixed goods in education. • Subsidization and social choice in education. • Demand and supply of education; determinants of education. • Market failure in the education sector. • Educational planning and financing. • Public-Private Partnership (PPP) in education	CLO 2
UNIT III 15 Hours	**Indian Education System equality and quality:** • Education and socioeconomic inequalities. • Overview of India's education sector: Literacy rates, school participation, quality measures. • Educational organization and policies for equality. • Quality of education and evaluation methods.	CLO3
UNIT IV Hours	**Higher, Vocational and Professional Education and Policies:** • Higher, professional, and vocational education: Equity, access,	CLO 4

	and incentives. • Education loans, unemployment, and skill development. • Common Education System. • Key government initiatives: Sarva Shiksha Abhiyan (SSA), Right to Education (RTE), National Education Policy (NEP) 2020. • Education and the knowledge economy.	

Suggestive Mode of Transaction

The course content transaction will include the following;

Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, focus group discussion, surveys, short term project work, etc.

Sessional Work:

Prepare a report on Basic Economic Problems prevailed in India.

Recommended Books:

Akerlof, G. A., & Kranton, R. E. (2002). Identity and schooling: Some lessons for the economics of education. *Journal of economic literature*, *40*(4), 1167-1201.

ABILITY ENHANCEMENT & VALUE-ADDED COURSES

Course Title: Yoga and Understanding Self

Course Code: BSE. 464

L	T	P	Credits
2	0	0	2

Course Learning Outcomes (CLOs)

Learning Outcomes

At the end of the course the prospective teacher-trainees will be able to;

1. Explain the concept, philosophy, and historical development of Yoga, and evaluate its relevance and importance for healthy living in modern times.
2. Analyze the different streams/schools of Yoga and construct Yoga practices for holistic development.
3. Apply the traditional and modern principles of Yoga to understand the holistic nature of the human body and individual needs.
4. Demonstrate the practices of meditation and pranayama, and integrate Yoga as a way of life for achieving peace, harmony, health, and self-understanding.

Units/Hours	Contents	Mapping with CLOs
Unit I **6 Hours**	**UNIT – I: Philosophy and Historical Perspective of Yoga** • Concept and Meaning of Yoga, Philosophy of Yoga. • Brief history and development of Yoga (Classical Yoga, Post-Classical Yoga, and Modern Period). • Importance of Yoga for healthy living, Yoga and its relevance in modern times, Traditions in Yoga.	**CLO1**
Unit II **8 hours**	**UNIT – II: Schools of Yoga** • Different streams/schools of Yoga (Gnana, Bhakthi, Karma). • Construction of Yoga Practice for all-round development.	**CLO2**
Unit III **8 Hours**	**UNIT – III: Principles of Yoga** • Principles of Yoga: Ahimsa, Satya, Asteya, Brahmacharya, Aparigraha, Shoucha, Santhosha,	**CLO3**

	Tapas, Swadhyaya, and Isvara Paridhana. • Modern Principles: Human Body as a holistic entity, Individuals and their needs, Dhāraṇa & Dhyāna, etc.	
Unit IV **8 Hours**	**UNIT – IV: Meditation, Pranayama, and Yoga as a Way of Life** • Meditation: Its Importance, Types, and Process. • Pranayama: Its Importance, Types, and Process. • Yoga as a Way of Life for Peace, Harmony, Health, Love, and Happiness. • Yoga in Indian Philosophy for understanding self. • The importance of meditation and reflective practices in becoming an effective teacher, unique self-empowering, and the quality and state of an individual's mind in healing.	**CLO4**

Practicum

1. Practice of Basic Yoga Asanas/ Kriyas.

Mode of Transaction

Reflective reading of different Yoga practicing Personalities, Learning by doing, Relaxation Techniques for imparting concentration, Understanding Self and personality development.

Suggested Reading Materials

- Desikachar, T. K. V. (2020). *The heart of yoga: Developing a personal practice*. Inner Traditions.
- Easwaran, E. (2018). *The Bhagavad Gita: A new translation*. Nilgiri Press.
- Feuerstein, G. (2020). *The philosophy of classical yoga*. Inner Traditions.
- Iyengar, B. K. S. (2019). *Light on yoga: The bible of modern yoga*. HarperCollins.
- Iyengar, B. K. S. (2019). *Yoga: The path to holistic health*. DK Publishing.
- Kabat-Zinn, J. (2018). *Wherever you go, there you are: Mindfulness meditation in everyday life*. Hachette Books.
- Lidell, L. (2021). *The book of yoga: The complete step-by-step guide*. Ebury Press.
- Saraswati, S. N. (2021). *Four chapters on freedom: Commentary on the yoga sutras of Patanjali*. Yoga Publications Trust.
- Saraswati, S. N. (2021). *Yoga education for children*. Yoga Publications Trust.
- Saraswati, S. S. (2021). *Asana Pranayama Mudra Bandha*. Yoga Publications Trust.
- Saraswati, S. S. (2021). *Asana Pranayama Mudra Bandha*. Yoga Publications Trust.
- Saraswati, S. S. (2021). *Prana and Pranayama*. Yoga Publications Trust.
- Satchidananda, S. (2020). *The yoga sutras of Patanjali: Commentary on the Raja yoga sutras*. Integral Yoga Publications.
- Singleton, M. (2010). *Yoga body: The origins of modern posture practice*. Oxford University Press.
- Sivananda, S. (2020). *The science of yoga: The yoga-sutras of Patanjali*. Divine Life Society.
- Stephens, M. (2020). *Teaching yoga: Essential foundations and techniques*. North Atlantic Books.
- Swami Rama. (2021). *Meditation and its practice*. Himalayan Institute Press.
- Swami Satyananda Saraswati. (2020). *A systematic course in the ancient tantric techniques of yoga and kriya*. Yoga Publications Trust.
- Taimni, I. K. (2021). *The science of yoga: The yoga-sutras of Patanjali in Sanskrit with transliteration, translation, and commentary*. Theosophical Publishing House.
- Vivekananda, S. (2019). *Raja yoga: Conquering the internal nature*. Advaita Ashrama.

Course Title: Citizenship Education, Sustainability and Environmental Education

L	T	P	Cr
2	0	0	2

Course Code: BSE. 465

At the end of the course the prospective teacher-trainees will be able to;

CLO-1 Describe the citizen education and its need for present society.

CLO-2 Develop a sense of national consciousness, unity and development

CLO-3 Explain the concept of Vasudhaiva kutumbakam and Global citizenship.

CLO-4 Explain the concept of sustainability in all fields of Human activities and approaches to achieving sustainable development in its dimensions.

CLO-5 Awareness and Plan for Environmental awareness and Education.

Units/Hours	Contents	Mapping with CLOs
UNIT- I **08 Hours**	**Citizen Education** A. Concept of citizenship and citizenship education. B. Aims of and approaches to citizenship education. C. Good Citizen Behavior in Indian Context D. Fundamental duties and National Responsibilities	**CLO- 1**
UNIT- II **07 Hours**	**Global Citizenship** A. Concept of Global Citizenship and Global Citizenship Education. B. Aims of and approaches to global citizenship education. C. Concept of Vasudhaiva Kutumbakam, its importance in development of a holistic perspective towards local and global communities. D. Values and Responsibilities in our Community	**CLO- 2** **CLO-3**
UNIT- III **08 Hours**	**Sustainability** A. Concept of 'Sustainability' in all fields of human activities. B. Approaches to achieving sustainable development in its three dimensions – economic, social, and environmental. C. Sustainable development goals. D. Sustainable management of natural resources. E. School- and community-based activities.	**CLO- 4**
UNIT- IV **07 Hours**	**Environmental Education** A. Environmental issues. B. Actions required for mitigating the effects of climate change, reducing environmental degradation, pollution etc. C. Approaches to delivering Environmental Education D. Role of Mass Media and Technology in delivering environmental education. E. Roles Governmental and Non-Governmental Organizations in promoting Environmental Education. F. School and community-based Environmental Education activities.	**CLO- 5**

Suggestive Mode of Transaction

The course content transaction will include the following; Planned lectures infused with multimedia/PowerPoint presentations. Small group discussion, panel interactions, small theme-based seminars, cooperative teaching, and team teaching, focus group discussion, surveys, short term project work, etc.

Sessional Work: (any one)

1. Prepare a report on SDG 11 (**Sustainable Cities and Communities**: Develop cities and communities that are inclusive, safe, resilient and sustainable).
2. Visit local sustainable initiatives such as organic farms, recycling centers or green Building.

Suggestive Reading Materinls

Dalal- Clnyton,B..& Bess.S. (2fi12). *Sustainable developmental l strategies. A resource Book.* Routledge.

Davies.I., Grammes,T..& Kuno.i-1. (2017). Citizenship education and character education. *JSSE-Journal of Social sciences Education.*

Ellis.M.(2015). *The critical global educator. Global citizen education as sustainable development. Routledgge.*

Gupta A. & Mishra A. (2020). Vasudliaiv Kutumbakam: Relevance of India's Ancient Thinking to Contemporary Strategic Reality. (1st ed.). (2020). NewDelhi. India: Arynn Books International.

Hussen.A. (2012). Principles of environmental economics and sustainability: An integrated economics and ecological approach. Routledge

Palmar J. (2002). Environmental Education in the 21st century: Theory, Practice, Progress and Promise. Routledge

Smith,G.A.. &Sobel.D. (2014). *Place-and community based Education in school.* Routledge.

Tarurm& Torres (2016). *Global citizen education and the crisis of multiculturalism: A comparative prospective. Bloomsbury Publishing*

SCHOOL EXPERIENCES

Course Title: POST INTERNSHIP (REVIEW AND ANALYSIS)
Course Code: BSE.466

L	T	P	Cr
0	0	4	2

About the Course

After successful completion of internship programme in 7th semester, student teachers compile the learnings, discuss with peers about their experiences, reflect on the experiences, refine the artifacts developed during internship and prepare comprehensive internship report during post internship in 8th semester.

Course Learning Outcomes (CLOs)

At the end of the course the prospective teacher-trainees will be able to;

CLO1 develop comprehensive understanding of the school ecosystem,
CLO2 describe their learning from internship with the peers and teacher educators,
CLO3 reflect on school internship sharing learning experiences on each activity undertaken.

Suggestive Mode of Transaction

- Discussion
- Presentation, Gallery walks and Exhibition.
- Report Writing

Activities:

Experience Sharing and Reflective Learning

- Presentation of reflective journal summary
- My Learning Journey: by each student-teacher
- Gallery walks (Exhibition): TLMs, display of participation in school activities (photos/stories) and other artefacts created during the internship by student teachers.
- Sharing of best practices (PPTs, Videos.)
- Survey and collect the local stories and rhymes from the parents and community (in the

context of the foundational stage)
• Holding a training workshop for the parents and community and encouraging them to act as volunteers.

Submission of Internship Report

• Reflective Journal
• Lesson Plans and TLMs
• Observation records (Teacher Educator, Mentor, school heads, Teachers, Parents)
• Assessment records and Student Portfolio
• Action research report/case study
• Comprehensive internship report.

Mode of Assessment

Competence	**Method of assessment**	**Assessed By**	**Credits**	**Marks**
Artefacts created during the internship. My Learning Journey	Exhibition & Presentation	Teacher-Educator	**1**	**25**
Comprehensive Internship Report	Review	Teacher-Educator	**1**	**25**

Course Title: CREATING TEACHING- LEARNING MATERIAL
Course Code: BSE.467

L	**T**	**P**	**Cr**
0	**0**	**4**	**2**

Course Learning Outcomes (CLOs)

At the end of the course the prospective teacher-trainees will be able to;

CLO1 assess the need for Teaching Learning Materials and prepare innovative TLM,
CLO2 develop an understanding of the importance of work experience and competencies of a local crafts person, artisans and entrepreneurs.

Activities to be conducted.

The following are a few suggestive activities:
• Orientation workshop on work experience and development of learning resources
• Field visit for interaction with local artisans, craftspeople, and entrepreneurs.
• Observe Traditional work practices and their integration into Local Technologies and Ideas.
• Analysis of available local specific, indigenous learning resources, including toys and their use in the learning-teaching process
• Development of at least two low-cost learning resources as per the local contexts (foundational/preparatory/middle/secondary) and presentation/exhibition
• Prepare the manual of TLM highlighting the objectives that will be achieved by its use, the material used, the process of its development and its use during classroom transaction.

Suggestive Mode of transaction

• Workshop
• Group discussion
• Field visits and interaction
• Analysis of existing local-specific learning resources, toys
• Exhibition of TLM and presentation of reflective reports on the use of learning resources, including toys.

Mode of Assessment

Competence	Method of assessment	Assessed By	Credits	Marks
TLM developed	Presentation /Exhibition	Teacher Educators (panel of three experts including an external expert)	**1.5**	**37.5**
Manual	Presentation	Teacher Educator	**0.5**	**12.5**

COMMUNITY ENGAGEMENT AND SERVICES

Course Title: Community Engagement and Services
Course Code: BSE.468

L	T	P	Cr
0	**0**	**4**	**2**

Course Learning Outcomes (CLOs)

On successful completion of the 'Community Engagement and Service' programme, the student teacher should be able to:

• recognize the socio-economic issues in the community and identify initiatives that could help solve problems faced by the community,

• demonstrate an awareness of the functions of the community, and the measures required for enlisting community participation in school-related activities,

• undertake initiatives that are required to make the community aware of the importance of education, issues associated with schooling, gender inequity, health & wellness of children, illiteracy among youth and adults in the community etc.,

• organize activities such as *street plays, advocacy activities, door-to-door campaigns, and prabhat-pheris* etc. to mobilize community participation in development initiatives,

• organize interactions between schools and local communities for generating solutions to problems such as dropout and learning deficits,

• facilitate partnerships between local communities to enhance participation of the community in school-related activities such as PTA meetings,

• demonstrate positive feelings towards the local community and appreciate traditional knowledge and practices,

• Recognize the values of public service and active citizenship.

Approach to curriculum transaction

The student teachers will be provided opportunities to have exposure to community life for **ten days** in total,
-two days in Preparation for Community Engagement & Service in the institution,
-seven days working with the community, and the last day in the institution for sharing their experiences and reflections.
-The activities may be conducted in groups or individually as appropriate.

Days 1-2: Preparation for community services (In the institution)

• Orientation of student teachers on Community Engagement & Services through discussion and group activities.

• Workshop for developing tools for different activities during the programme.

Days 3-9: Engagement with the community (Mandatory onsite stay with the community)

Students will be divided into smaller groups; They would participate in the planned activities with defined roles for seven days on a rotation basis. These activities include:

• participation of student teachers in activities undertaken under the National Service Scheme (NSS), New India Literacy Programme, Student mentoring initiatives, etc.
• Survey of community resources for supporting school activities.
• Study of the situation regarding school dropout and the reason thereof (Stage wise).
• Survey of specific settlement to assess the situation about non-literates in the settlement,
including identification of 4-5 non-literate youth and adults who will be supported by student teachers to become literate,
• Training of local youth in First Aid and other relevant interventions,
• Assessment of the situation about Health and wellness of children in a locality,
• Visit and interact with local artisans and craftsperson.
The above activities typically will include working with the community, collecting data, playing local games, community awareness programmes like nukkad natak, rallies, organizing and participating in the cultural programmes with the community members etc.

The student teachers shall conduct different pre-scheduled activities throughout the day. Morning sessions will be used for activities with the community and data collection. The afternoon session will be devoted to data analysis and preparation of the report, and participation in games & sports activities. Evening session will involve cultural activities with community members.

Day 10: Feedback session and Reflection (In the Institution)
• Sharing experiences and discussion on activities carried out.
• Presentation and submission of report on the activities carried out.
• Evaluation of the activities by collecting feedback on the effectiveness of the campaign from the mentor and the students.
• Reflection of experience (individual/group) of organizing community service

Mode of Assessment

Competence	**Method of assessment**	**Assessed By**	**Credits**	**Marks**
Involvement and active participation in activities relating to Community Engagement and Service	Observation by teacher educator, teacher and community members	Teacher educator, teacher and community members	**1.5**	**37.5**
Group Report & Reflections	Presentation by student teachers	Teacher Educator	**0.5**	**12.5**