CENTRAL UNIVERSITY OF PUNJAB

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

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

- A comprehensive knowledge of the aims of education, curricular goals, competencies, and learning outcomes at the secondary level.
- Procedural knowledge required by student-teachers to perform and accomplish the professional tasks associated with teaching in secondary schools
- Understanding effective pedagogical approaches for curriculum transaction.
- Skills in the assessment of student learning, including the selection of assessment methods, tools, and processes appropriate for secondary-level children.
- Understanding on learning needs of students with disability or other learning disabilities and delivering learning experiences in an inclusive and caring environment.
- 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	8	4	4	x	x	x	x	**20**
IV	4	8	4	4	x	x	x	x	**20**
V	x	8	4	4	2	2	x	x	**20**
VI	4	8	4	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	48	24	16	28	20	2	4	**168**

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 has to choose one major and one minor discipline from Physical Sciences (Physics, Chemistry and Mathematics)/from Biological Sciences (Chemistry, Botany and Zoology)

** Student has to choose one minor other than the major

***Common Courses for all students

Semester-II

Code	Name of Course	L	T	P	Credit
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)					
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 and Minors 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/ 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)					
BSE.202	Electrodynamics	3	0	0	3
BSE.203	Fundamentals Of Optics and Laser	3	0	0	3
BSE.204	Physics Practical-I	0	0	2	1
BSE.205	Physics Practical-II	0	0	2	1
Chemistry (Major)					
BSE.206	Organic Chemistry-II: (Chemistry of Oxygen and Nitrogen Containing Functional Groups	3	0	0	3
BSE.207	Physical Chemistry -II (Chemical Thermodynamics and its Applications)	3	0	0	3
BSE.208	Organic Chemistry-II (Practical-I Qualitative Analysis)	0	0	2	1
BSE.209	Physical Chemistry -II (Practical-II Thermochemistry)	0	0	2	1
Mathematics (Major)					
BSE.210	Real Analysis	4	0	0	4
BSE.211	Analytical Solid Geometry	4	0	0	4
Botany (Major)					
BSE.212	Plant Physiology	3	0	0	3
BSE.213	Plant Ecology	3	0	0	3
BSE.214	Plant Physiology (Practical-I)	0	0	2	1
BSE.215	Plant Ecology (Practical-II)	0	0	2	1
Zoology (Major)					
BSE.216	Immunology	3	0	0	3
BSE.217	Biomolecules	3	0	0	3
BSE.218	Immunology (Practical-I)	0	0	2	1
BSE.219	Biomolecules (Practical-II)	0	0	2	1
Minor (Candidate has to choose one minor other than the major)**					
Physics (Minor)					
BSE.220	Electrodynamics	3	0	0	3
BSE.221	Physics Practical-I	0	0	2	1
Chemistry (Minor)					
BSE.222	Organic Chemistry-II (Chemistry of Oxygen and Nitrogen Containing Functional Groups)	3	0	0	3
BSE.223	Organic Chemistry-II (Practical-I Qualitative Analysis)	0	0	2	1
Mathematics (Minor)					
BSE.224	Real Analysis	4	0	0	4

Botany (Minor)					
BSE.225	Plant Physiology	3	0	0	3
BSE.226	Plant Physiology (Practical-I)	0	0	2	1
Zoology (Minor)					
BSE.227	Immunology	3	0	0	3
BSE.228	Immunology (Practical-I)	0	0	2	1
Stage-Specific Content-cum-Pedagogy Courses (Any two as per the major and minor subject)					
BSE.229	Pedagogy of Physics-I	2	0	0	2
BSE.230	Pedagogy of Chemistry-I	2	0	0	2
BSE.231	Pedagogy of Mathematics-I	2	0	0	2
BSE.232	Pedagogy of Botany-I	2	0	0	2
BSE.233	Pedagogy of Zoology-I	2	0	0	2
	Total				**20**

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

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/ 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)					
BSE.252	Quantum Mechanics	3	0	0	3
BSE.253	Computational Physics	3	0	0	3
BSE.254	Physics Practical-I	0	0	2	1
BSE.255	Physics Practical-II	0	0	2	1
Chemistry (Major)					
BSE.256	Inorganic Chemistry-III (Coordination Chemistry)	3	0	0	3
BSE.257	Organic Chemistry–III Chemistry of Biomolecules	3	0	0	3
BSE.258	Inorganic Chemistry-III (Practical-I Volumetric Analysis-II)	0	0	2	1
BSE.259	Organic Chemistry III (Practical-II Quantitative Analysis)	0	0	2	1
Mathematics (Major)					
BSE.260	Statics and Vector Calculus	4	0	0	4
BSE.261	Dynamics	4	0	0	4
Botany (Major)					
BSE.262	Plant Metabolism	3	0	0	3
BSE.263	Plant Reproductive Biology	3	0	0	3

BSE.264	Plant Metabolism (Practical-I)	0	0	2	1
BSE.265	Plant Reproductive Biology (Practical-II)	0	0	2	1
Zoology (Major)					
BSE.266	Developmental Biology	3	0	0	3
BSE.267	Human Genetics	3	0	0	3
BSE.268	Developmental Biology -(Practical-I)	0	0	2	1
BSE.269	Human Genetics-(Practical-II)	0	0	2	1
Minor (Candidate has to choose one minor other than the major)**					
Physics (Minor)					
BSE.270	Quantum Mechanics	3	0	0	3
BSE.271	Physics Practical-I	0	0	2	1
Chemistry (Minor)					
BSE.272	Inorganic Chemistry-III Coordination Chemistry	3	0	0	3
BSE.273	Inorganic Chemistry-III (Practical-I Volumetric Analysis-II)	0	0	2	1
Mathematics (Minor)					
BSE.274	Statics and Vector Calculus	4	0	0	4
Botany (Minor)					
BSE.275	Plant Reproductive Biology	3	0	0	3
BSE.276	Plant Reproductive Biology (Practical-II)	0	0	2	1
Zoology (Minor)					
BSE.277	Developmental Biology	3	0	0	3
BSE.278	Developmental Biology -(Practical-I)	0	0	2	1
Stage-Specific Content-cum-Pedagogy Courses (Any two as per the major and minor subject)					
BSE.279	Pedagogy of Physics-II	2	0	0	2
BSE.280	Pedagogy of Chemistry-II	2	0	0	2
BSE.281	Pedagogy of Mathematics-II	2	0	0	2
BSE.282	Pedagogy of Botany-I	2	0	0	2
BSE.283	Pedagogy of Zoology-I	2	0	0	2
	Total				**20**

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

Semester-V

Code	Name of Course	L	T	P	Credit
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)					
BSE.301	Solid State Physics and Spectroscopy	3	0	0	3
BSE.302	Electronics (Analog & Digital)	3	0	0	3
BSE.303	Physics Practical-I	0	0	2	1
BSE.304	Physics Practical-II	0	0	2	1

Chemistry (Major)					
BSE.305	Inorganic Chemistry-IV (Organometallic and Reaction Mechanisms)	3	0	0	3
BSE.306	Physical Chemistry-II (Quantum Chemistry)	3	0	0	3
BSE.307	Inorganic Chemistry-IV (Practical-I Gravimetric Analysis)	0	0	2	1
BSE.308	Physical Chemistry III: (Practical-II)	0	0	2	1
Mathematics (Major)					
BSE.309	Linear Algebra	4	0	0	4
BSE.310	Number Theory	3	1	0	4
Botany (Major)					
BSE.311	Mycology and Pathology	3	0	0	3
BSE.312	Plant Genetics and Breeding	3	0	0	3
BSE.313	Mycology and Pathology (Practical-I)	0	0	2	1
BSE.314	Plant Genetics and Breeding (Practical-I)	0	0	2	1
Zoology (Major)					
BSE.315	Concepts of Evolution and Systematics	3	0	0	3
BSE.316	Animal physiology	3	0	0	3
BSE.317	Evolution and Systematics (Practical-I)	0	0	2	1
BSE.318	Animal Physiology-(Practical-II)	0	0	2	1
Minor (Candidate has to choose one minor other than the major)**					
Physics (Minor)					
BSE.319	Solid State Physics and Spectroscopy	3	0	0	3
BSE.320	Physics Practical-I	0	0	2	1
Chemistry (Minor)					
BSE.321	Inorganic Chemistry–IV Organometallic and Reaction Mechanisms	3	0	0	3
BSE.322	In Organic Chemistry-IV (Practical-I Gravimetric Analysis)	0	0	2	1
Mathematics (Minor)					
BSE.323	Linear Algebra	4	0	0	4
Botany (Minor)					
BSE.324	Mycology and Pathology	3	0	0	3
BSE.325	Mycology and Pathology (Practical-I)	0	0	2	1
Zoology (Minor)					
BSE.326	Concepts of Evolution and Systematics	3	0	0	3
BSE.327	Evolution and Systematics-(Practical-I)	0	0	2	1
Stage-Specific Content-cum-Pedagogy Courses (Any two as per the major and minor subject)					
BSE.328	Pedagogy of Physics-III	2	0	0	2
BSE.329	Pedagogy of Chemistry-III	2	0	0	2
BSE.330	Pedagogy of Mathematics-III	2	0	0	2
BSE.331	Pedagogy of Botany-I	2	0	0	2
BSE.332	Pedagogy of Zoology-I	2	0	0	2
Ability Enhancement & Value- Added Courses * **					
BSE.333	ICT in Education	1	0	1	**2**
School Experiences***					
BSE.334	Pre-Internship Practice (Demonstration Lessons and Peer Teaching)	0	0	4	**2**

	Total				**20**

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

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/ 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)					
BSE.353	Thermal and Statistical Physics	3	0	0	3
BSE.354	Nuclear and Particle Physics	3	0	0	3
BSE.355	Physics-I Lab.	0	0	2	1
BSE.356	Physics-II Lab.	0	0	2	1
Chemistry (Major)					
BSE.357	Organic Chemistry- IV (Chemistry of Heterocyclic Compounds and Natural Products)	3	0	0	3
BSE.358	Physical Chemistry-IV (Electrochemistry, Phase equilibria & Properties of Solutions)	3	0	0	3
BSE.359	Organic Chemistry-IV: (Practical-I Preparation of Organic Compounds)	0	0	2	1
BSE.360	Physical Chemistry -IV: (Practical-II)	0	0	2	1
Mathematics (Major)					
BSE.361	Complex Analysis	4	0	0	4
BSE.362	Numerical Analysis	4	0	0	4
Botany (Major)					
BSE.363	Plant Tissue Culture	3	0	0	3
BSE.364	Plant Molecular Biology	3	0	0	3
BSE.365	Plant Tissue Culture (Practical-I)	0	0	2	1
BSE.366	Plant Molecular Biology (Practical-II)	0	0	2	1
Zoology (Major)					
BSE.367	Principles of Ecology & Wild Life Management	3	0	0	3
BSE.368	Applied Zoology (Non chordates)	3	0	0	3
BSE.369	Ecology & Wildlife-(Practical-I)	0	0	2	1
BSE.370	Applied Zoology-(Practical-II)	0	0	2	1
Minor (Candidate has to choose one minor other than the major)**					
Physics (Minor)					
BSE.371	Thermal and Statistical Physics	3	0	0	3
BSE.372	Physics-I Lab	0	0	2	1
Chemistry (Minor)					

BSE.373	Spectral Technique	3	0	0	3
BSE.374	Spectral Technique (Practical-I)	0	0	2	1
Mathematics (Minor)					
BSE.375	Numerical Analysis	4	0	0	4
Botany (Minor)					
BSE.376	Plant Tissue Culture	3	0	0	3
BSE.377	Plant Tissue Culture (Practical-I)	0	0	2	1
Zoology (Minor)					
BSE.378	Economic Zoology	3	0	0	3
BSE.379	Economic Zoology (Practical-I)	0	0	2	1
Stage-Specific Content-cum-Pedagogy Courses (Any two as per the major and minor subject)					
BSE.380	Pedagogy of Physics-IV	2	0	0	2
BSE.381	Pedagogy of Chemistry-IV	2	0	0	2
BSE.382	Pedagogy of Mathematics-IV	2	0	0	2
BSE.383	Pedagogy of Botany-I	2	0	0	2
BSE.384	Pedagogy of Zoology-I	2	0	0	2
Ability Enhancement & Value- Added Courses * **					
BSE.385	Mathematical & Quantitative Reasoning***	2	0	0	**2**
School Experiences* **					
BSE.386	School Observation (Field Practice) ***	0	0	0	**2**
	Total				**20**

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

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 (Textbooks, material development etc.) Stage Specific	2	0	0	2
Ability Enhancement & Value- Added Courses * **					
BSE.403	Art Education (Performing and Visual)-II	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	0	**10**
	Total				**20**

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	2	2
BSE.467	Creating Teaching Learning Material/ Work Experience	0	0	2	2
	Community Engagement and Service				
BSE.468	Community Engagement and Services (Participation in NSS-related Activities, New India Literacy Programme)	0	0	2	2
	Total				**20**

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

Disciplinary/ Interdisciplinary Courses (Major and Minor)			**Stage-Specific Content-cum-Pedagogy Courses, Ability Enhancement & Value- Added Courses**	
	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/Coordinator of the program.			
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 and one examiner appointed by the HoD/Coordinator of the program.				

SEMESTER-I

Course Title: Evolution of Indian Education

L	T	P	Cr
4	0	0	4

Course Code: BSE.101

Course Learning Outcomes:

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 ofIndian 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 **15 Hours**	Colonial Education in India: Macaulay Minutes, Woods Despatch, Contribution of Indian thinkers: Mahatma Gandhi, Sri Aurobindo, Rabindranath Tagore,	**CLO2 & CLO3**
UNIT IV **15 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	**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.

Suggestive Reading Materials

- Bhatia and Narang: Philosophical & Sociological Foundations Education DoabaHouse, New Delhi, 1992.
- Dash, B.N: Foundations of Education, Kalyani Publishers

- 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 KSKPublishers, Delhi, 2006
- Sodhi, T.S. Philosophical and Sociological Foundations of Education, BawaPublications, 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 students 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)	**CLO2C**

	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)	
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 students will be able to;

CLO1 comprehend scalar and vector fields - gradient of a scalar function

CLO2 analyse 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 SkewHermitian 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 - Inverse of Matrix by CH Theorem - Diagonalization of 2x2 Real Symmetric Matrices.	**CLO3**

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: Physical 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: Physical 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 students 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 analyse the implications of Lewis theory, Valence bond theory

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.	**CLO 1**
UNIT-II **11hours**	**Ionic Compounds-I:** a. 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, **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.	**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.	**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 (SO_2, PCl_5, SO_3), Molecular orbital theory (LCAO method),	**CLO4**

	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).	

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. F. C. Shriver, P. W. Atkins and C. H. Langford, Inorganic Chemistry, ELBS Oxford, 1991.
- J. E. Huheey, E.A. Keiter, R. L. Keiter, Inorganic Chemistry, 4th Ed, Pearson Education, Singapore, 1999.
- J. D. Lee, Concise Inorganic Chemistry, ELBS, Oxford 1994.
- 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.
- 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, Macmillan.
- Inorganic Chemistry, W.W. Porterfield Addison-Wesley.
- Inorganic Chemistry, A.G. Sharpe, ELBS.

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 students will be able to;

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

CLO2 develop basic knowledge and understanding of organic reaction mechanisms, reactive intermediates, methods of formation and reactions of alkanes, cycloalkanes, alkenes, alkynes, aromatic compounds, alkyl halides and their derivatives.

Units/Hours	Contents	Mapping with Course Learning Outcome
UNIT-I **11hours**	**Basics of Organic Chemistry** a. Organic Compounds: Classification, and Nomenclature, Hybridization, Shapes of molecules, Influence of hybridization on bond properties. b. Electronic Displacements: Inductive, Electromeric, resonance and Mesomeric effects, hyper conjugation and their applications; Dipole moment; Organic acids and bases; their relative strength.. c. 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. d. 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. **e.** 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** a. Carbon-Carbon sigma bonds: Chemistry of alkanes: Formation of alkanes, Wurtz Reaction, Wurtz-Fittig Reactions, Free radical substitutions: Halogenation -relative reactivity and selectivity. b. 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. c. 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. d. 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. **e.** Reactions of alkynes: Acidity, Electrophilic and Nucleophilic additions. Hydration to formcarbonyl compounds, Alkylation of terminal alkynes.	**CLO2**
UNIT-III **11hours**	**Chemistry of Aromatic Hydrocarbons** a. 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. **b.** Polynuclear Hydrocarbons: Reactions of naphthalene phenanthrene and anthracene Structure, Preparation and structure elucidation and important derivatives of naphthalene and anthracene; Polynuclear hydrocarbons.	**CLO1**
UNIT-IV **12 hours**	**Chemistry of Halogenated Hydrocarbons** a. 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. **b.** 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

- Morrison, R. N. & 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).
- Finar, I. L. *Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products)*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education.
- Eliel, E. L. &Wilen, S. H. *Stereochemistry of Organic Compounds*, Wiley: London, 1994.

- 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.
- 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.
- Fundamentals of Organic Chemistry, Solomons, John Wiley.
- Introduction to Organic Chemistry, Sireitwieser, Heathcock and Kosover, Macmilan.

CHEMISTRY (MAJOR)

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

Course Code: BSE.108

L	T	P	Cr
0	0	2	1

Course Learning Outcomes

At the end of the course the students 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** a. Estimation of carbonate and hydroxide present together in mixture. b. Estimation of carbonate and bicarbonate present together in a mixture. **c.** Estimation of free alkali present in different soaps/detergents	**CLO2**
UNIT-III	**Oxidation-Reduction Titrimetric**	**CLO3**

	a. Estimation of Fe (II) and oxalic acid using standardized KMnO4 solution. b. Estimation of oxalic acid and sodium oxalate in a given mixture. **c.** Estimation of Fe (II) with $K_2Cr_2O_7$ using internal (diphenylamine, anthranilic acid) and external indicator.	
UNIT-IV	**Iodo / Iodimetric Titrations** a. Estimation of Cu (II) and using $K_2Cr_2O_7$ sodium thiosulphate solution (Iodimetrically). b. Estimation of (a) arsenite and (b) antimony in tartar-emetic iodimetrically **c.** Estimation of available chlorine in bleaching powder iodometrically	**CLO4**

Suggested Reading:

- Mendham, J., A. I. Vogel's *Quantitative Chemical Analysis 6th Ed.*, Pearson, 2009.
- Vogel's Qualitative Inorganic Analysis, revised, Svehla, Orient Longman.
- Experimental Inorganic Chemistry, W.G. Palmer, Cambridge. Standard Methods of Chemical. Analysis, W.W. Scott: The Technical Press.
- 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: Organic Chemistry-I (Simple Techniques in Synthesis-Practical-II)

Course Code: BSE.109

L	T	P	Cr
0	0	2	1

Course Learning Outcomes

At the end of the course the students will be able to;

CLO1 To familiarize the students with the basic techniques like m.p., boiling point, purification of compounds by crystallization, distillation and chromatographic techniques.

CLO2 Enable them to determine the presence of nitrogen, halogens and sulphur in organic compounds.

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

- Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry,* Pearson Education (2009)
- K.B. Dutta: Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd., New Delhi (2002).
- H.S. Hall and S.R. Knight: Higher Algebra, H.M. Publications, 1994.
- Chandrika Parsad: Text book on Algebra and Theory of Equations, PothishalaPvt. Ltd., Allahabad.
- 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 students 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, blended learning, demonstration, laboratory method

Suggested Readings

- K.B. Dutta: Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd., New Delhi (2002).

- H.S. Hall and S.R. Knight: Higher Algebra, H.M. Publications, 1994.
- Chandrika Parsad: Text book on Algebra and Theory of Equations, Pothishala Pvt. Ltd., Allahabad.
- 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 students 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**	a. Real number system and its properties, lub, glb of sets of real numbers, limit of a function, Basic properties of limits. b. 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**	a. Successive differentiation, Leibnitz theorem. b. 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:

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

BOTANY (MAJOR)

Course Title: Microbiology and Phycology

Course Code: BSE.112

L	T	P	Cr
3	0	0	3

Course Learning Outcomes

At the end of the course the students 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	CLO2

	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).	
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; 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.	CLO3
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 students 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*,	**CLO2**

	structure and reproduction in *Lycopodium, Selaginella, Equisetum, Pteris and Marsilea.*	
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 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	**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:

- 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)

Course Code: BSE.115

L	T	P	Cr
0	0	2	1

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

Course Code: BSE.116

L	T	P	credit
3	0	0	3

Course Learning Outcomes (CLO)

After completion of the course students 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. Jordan, E.L and P.S. Verma.(2009). Invertebrate Zoology, S.Chand and Co. Ltd. New Delhi.
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. Kotpal, R.L. (2021). Zoology Invertebrates. Rastogi Publications, Meerut.
4. Nair, N.C., N. Arumugam, N. Soundarapandian, T. Murugan and S. Leelavathy.(2010). A textbook of Invertebrates. Saras Publication, Nagercoil.
5. Rastogi V.B. (2021). Invertebrate Zoology. KedarNath Ram Nath , Meerut.
6. Lal S.S. (2019). Practical Zoology Invertebrates. Rastogi Publications, Meerut.
7. Anderson D.T. (1999) Invertebrate Zoology, Oxford University Press
8. Edward E. Ruppert, Robert D. Barnes (1994). Invertebrate Zoology; Saunders College Pub.

Course Title: Cytology and Genetics

Course Code: BSE.117

L	T	P	Cr
3	0	0	3

Course Learning Outcomes:

After the completion of the course the students 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 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	**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

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

Course Code: BSE.118

L	T	P	Cr
0	0	2	1

Course Learning Outcomes (CLO)

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

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 students 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**	**CLO1**

	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)	
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 Physical Practical-I

Course Code: BSE.121

L	T	P	Cr
0	0	2	1

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 students 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	**The Covalent Bond:**	

12 hours	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:

- D. F. C. Shriver, P. W. Atkins and C. H. Langford, Inorganic Chemistry, ELBS Oxford, 1991.
- J. E. Huheey, E.A. Keiter, R. L. Keiter, Inorganic Chemistry, 4th Ed, Pearson Education, Singapore, 1999.
- J. D. Lee, Concise Inorganic Chemistry, ELBS, Oxford 1994.
- 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.
- 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, Macmillan.
- Inorganic Chemistry, W.W. Porterfield Addison-Wesley.
- Inorganic Chemistry, A.G. Sharpe, ELBS.

CHEMISTRY (MINOR)

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

Course Code: BSE.123

L	T	P	Cr
0	0	2	1

Course Learning Outcomes:

At the end of the course the students will be able;

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
5 hours	**Titrimetric Analysis** Calibration and use of apparatus Preparation of solutions of different Molarity/Normality of titrants	**CLO1**
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**
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**
	Iodo / Iodimetric Titrations	

5 hours	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:

- Mendham, J., A. I. Vogel's *Quantitative Chemical Analysis 6th Ed.,* Pearson, 2009.
- Vogel's Qualitative Inorganic Analysis, revised, Svehla, Orient Longman.
- Experimental Inorganic Chemistry, W.G. Palmer, Cambridge. Standard Methods of Chemical. Analysis, W.W. Scott: The Technical Press.
- 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 (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 students will be able

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 understand congruence of quadratic forms and matrices.

Units/Hours	Contents	Mapping 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:

- K.B. Dutta: Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd., New Delhi (2002).
- H.S. Hall and S.R. Knight: Higher Algebra, H.M. Publications, 1994.
- Chandrika Parsad: Text book on Algebra and Theory of Equations, Pothishala Pvt. Ltd., Allahabad.
- 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 students 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; 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	CLO3

	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,

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)

After completion of the course students 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. Jordan, E.L and P.S. Verma.(2009). Invertebrate Zoology, S.Chand and Co. Ltd. New Delhi.
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. Kotpal, R.L. (2021). Zoology Invertebrates. Rastogi Publications, Meerut.
4. Nair, N.C., N. Arumugam, N. Soundarapandian, T. Murugan and S. Leelavathy.(2010). A textbook of Invertebrates. Saras Publication, Nagercoil.
5. Rastogi V.B. (2021). Invertebrate Zoology. KedarNath Ram Nath , Meerut.
6. Lal S.S. (2019). Practical Zoology Invertebrates. Rastogi Publications, Meerut.
7. Anderson D.T. (1999) Invertebrate Zoology, Oxford University Press
8. Edward E. Ruppert, Robert D. Barnes (1994). Invertebrate Zoology; Saunders College Pub.

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

Course Code:BSE.128

L	T	P	Credit
0	0	2	1

Course Learning Outcomes (CLO)

After completion of the course students 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 I*. 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 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

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 l	**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 l	**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 l	**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 परिचित होंगे**l	**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 पब्लिशर्स 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 students 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 students 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 7 Hours	Theatre Puppets designing Practical aspects of Play production process	CLO 2

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 and one examiner as will be appointed by the HoD/Coordinator of the programme.	

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 students will be able to

CLO1: Understand ancient Indian knowledge, traditions and its culture while developing an appreciation for it.
CLO2: Analyse traditional and contemporary art forms 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: Develop an understanding of growth of Indian economy from stone Age to the Gupta period of Indian history

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**
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, religious literature, Indian poetry, folk literature, Indian fiction	**CLO2**
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; Lessons for modern-day India	**CLO3**
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 and proliferation of new occupations; growth of writing). Internal & external trade and commerce, including trade routes, Understanding Arthashastra: Ideas & Criticism; Locating relevance of ancient Indian economic thought in modern-day Indian Economy.	**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

SESSIONAL WORK:

- Make an assignment on scope and relevance of Ancient Indian knowledge, traditions and culture for modern day Indian society.

- Visit a school and make a report on actual practicability of traditional Indian pieces of music, visual arts, folk arts at different levels of education.
- Visit a school and organise a competition on Indian poetry and folk literature at secondary level and prepare a report for this.

Suggested Readings:

- P. Sethuraman, Ancient Indian Wisdom: Spiritual Heritage
- Amit Jha, Traditional Knowledge System in India
- Satishchandra Chatterjee, An Introduction to Indian Philosophy

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 students will be able to;
CLO1 To develop the skills on the electrostatics techniques for calculating potential
CLO2 To enrich their theoretical knowledge on the electric field in the matter
CLO3 To comprehend the knowledge on the magnetostatics

CLO4 To 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**	**CLO1**

	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)	
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 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 students 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	**CLO2**

	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)	
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 (Sections:11.1 to 11.9, 11.12 to 11.13 of Mechanics by J.C Upadhyaya)	**CLO3**
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

Credit-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 Physical Practical-II

Course Code: BSE.154

L	T	P	Cr
0	0	2	1

Credit-1

7. Potentiometer-measurement of resistance

8. Potentiometer-calibration of ammeter

9. Ballistic Galvanometer- BG constant using HMS-then find Bh.

10. B.G.-Comparison of capacities Desauty's method.

11. Spectrometer- i-d curve

12. 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 students will be able;

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,	**CLO 2** **CLO 3**

	N_2O_4 and N_2O_5, oxo acids of nitrogen and phosphorous, phosphazenes and cyclophosphazenes.	
UNIT-IV **12 hours**	a.Group VI (Oxygen Group): Structure and allotropy of the elements. Oxides of sulfur (structure of SO_2 and SO_3) oxoacids of sulfur halides of sulfur, selenium and tellurium, compounds of Sulfur and nitrogen (S_4N_4). b.Group VII: Oxides of halogens (OF_2, O_2F_2, Cl_2O, ClO_2, Cl_2O_6, BrO_2, I_2O_5) (structures), Preparation, reaction and structure interhalogen compounds. (ClF_3, BrF_3, I_2, Cl_5, IF_5, IF_7) Polyhalides, basic properties of halogens. Zero Group: Clatharate compounds, preparation, structure and bonding of noble gas compounds (XeF_2, XeF_4, XeF_6, XeO_3, XeO_2F_2, XeO_4).	**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:

- 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.

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 students will be able;

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 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).	**CLO1** **CLO2**
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,	**CLO1** **CLO2**

	qualitative idea of point and space groups, seven crystal systems and fourteen Bravais lattices.	
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:

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.	**CLO1** **CLO2**

	• 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).	**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:

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 students will be able;

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 solutions, Extraneous loci.	CLO3
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 students will be able;

CLO1 to 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 to understand Quadrature and Rectification.
CLO4 to 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 students 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; shoot chimeras; structure of dicot and monocot leaf, kranz anatomy; development of Leaf.	CLO1
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	CLO3

	wood; Early and late wood, tyloses; dendrochronology. periderm, development and composition of periderm; rhytidome and lenticels.	
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

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 students 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 and Company.

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)

Course Code: BSE.164

L	T	P	Cr
0	0	2	1

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	credit
3	0	0	3

Course Code: BSE.165

Course Learning Outcomes (CLO)

After completion of the course students 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 aortic arches. • Kidney and associated urogenital ducts	**CLO1**
Unit- II **10 hours**	• Habit and habitat, structure, reproduction (excluding development) and affinities to following types: - • Hemichordate: Balanoglossus • 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: Biochemistry and Physiology

L	T	P	Credit
3	0	0	3

Course Code -BSE.166

Course Learning Outcomes (CLO)

After completion of instruction students 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	CLO2

	inhibition; Regulation of enzyme action, inhibition and allosteric Isozymes; Cofactors	
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)

Course Code: BSE.167

L	T	P	Credit
0	0	2	1

Course Learning Outcomes (CLO)

After completion of instruction students 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)

Course Code: BSE.168

L	T	P	Credit
0	0	2	1

Course learning Outcomes:

The student at the completion of the course 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 students will be able to;
CLO1 To develop the skills on the electrostatics techniques for calculating potential
CLO2 To enrich their theoretical knowledge on the electric field in the matter
CLO3 To comprehend the knowledge on the magnetostatics

CLO4 To 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	**CLO1**

	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)	
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 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

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 students will be able;

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 **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. 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:

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 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. • 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	**CLO1** **CLO2** **CLO 3**

	• 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 students will be able;

CLO1 To understand Order and degree of differential equation, Linear and non-linear differential equations.
CLO2 To solve problems on applications of differential equations of first order and first degree.
CLO3 To solve Differential equations of first order and higher degree solvable for x, y and p.
CLO4 To 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, Pfaffian differential equation.	CLO1

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 students 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)

Course Code: BSE.175

L	T	P	Cr
0	0	2	1

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

Course Code: BSE.176

L	T	P	Cr
3	0	0	3

Course Learning Outcomes (CLO)

After completion of the course students 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)

L	T	P	Credit
0	0	2	1

Course Code: BSE.177

Course Learning Outcomes (CLO)

After completion of instruction students 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 students will be able to;

L	T	P	Cr
4	0	0	4

CLO1 Demonstrate knowledge and capacity for effective listening, speaking, reading, writing and critical thinking.

CLO2 Recognize the link between language and cognition and using linguistic knowledge and skills for effective communication of ideas and thoughts.

CLO3 Build inter-personal relationships and enhance social skills.

Units/Hours	Contents	Mapping with CLOs
Unit I **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.	**CLO1** **CLO2** **CLO3**
Unit II **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.	**CLO1** **CLO2** **CLO3**
Unit III **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.	**CLO1** **CLO2** **CLO3**

	Parts of speech, sentences-simple, complex, and compound, semantics and pragmatics, lexical semantics, Coining new words, speech acts.	
Unit IV **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 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.	**CLO1** **CLO2** **CLO3** **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

Sessional Work:

To organize a quiz competition in schools on reading, writing and speaking skills among learners at different levels.

Make a presentation on relevance of Bi/ Multi-lingualism in India in context of its culture and society

Suggested Readings:

- English Grammar in use by Raymond Murphy, Cambridge University Press.
- English Pronouncing Dictionary by Jones, Daniel, Cambridge University Press.
- English Phonetics and Phonology: A Practical Course by Roach, Peter, Cambridge University Press.
- Modern Linguistics: An Introduction by Verma, S.K. & N. Krishnaswamy, Oxford University Press.

(Language 2)
Punjabi

Course Title: ਪੰਜਾਬੀ ਭਾਸ਼ਾ, ਵਿਹਾਰਕ ਵਿਆਕਰਣ ਅਤੇ ਸਭਿਆਚਾਰ

L	T	P	Credits
4	0	0	4

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

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

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 l	**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 l	**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 l	**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 परिचित होंगेl**	**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 पब्लिशर्स 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 students 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, Education in teaching, Attitude, Aptitude, Experience and Exposure c. The Charismatic teacher, the communicator teacher, the missionary teacher, the competent practitioner, the	**CLO1** **CLO2**

	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 (5th 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

Course Code: BSE.182

L	T	P	Cr
2	0	0	2

Course Learning Outcomes:

At the end of the course the students will be able;

CLO1: To understand Ancient Indian knowledge, traditions and culture in context of Indian culture and society.

CLO2: To analyse various schools of philosophy and their relevance in modern day India.

CLO3: To summarise Indian culture in context of its food and sports traditions.

CLO4: To develop an understanding of Indian contribution to the World in the fields of arithmetic, logic and astronomy.

Units/Hours	Contents	Mapping with CLOs
UNIT I **6 Hours**	**Introduction of Knowledge of India:** Definition & Scope of knowledge of India. Need and relevance of our ancient knowledge, tradition and culture	**CLO1**
UNIT II **10 Hours**	**Philosophy, Ethics & Values: Schools of Philosophy:** Vaishesika, Nyaya, Samkhya, Yoga, Purva Mimansa and Vedanta or Uttara Mimansa-Educational Implications, Ethics, values, morality, and social dilemma (including self-leadership) and their relevance in today's time.	**CLO2**
UNIT III **8 Hours**	**Food:** (regional cuisines, ayurvedic diet, food and festival, vegetarianism, Jainism in food, food and hospitality, and globalization). **Clothes:** (traditional Indian clothing, textile arts, religious costumes, clothing status, clothing, gender, globalization in clothing). **Sports** (traditional Indian sports, martial arts, sports, and gender, sports &	**CLO3**

	globalization): The lifestyle of Yoga; adapting ancient lifestyle – A path towards longevity.	
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. Technology in the economy: agriculture, transportation, etc.	**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

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:

- P. Sethuraman, Ancient Indian Wisdom: Spiritual Heritage
- Amit Jha, Traditional Knowledge System in India
- Satishchandra Chatterjee , An Introduction to Indian Philosophy