



**New CBCS Scheme of Instruction &
Syllabi of
B.Sc.B.Ed.**

(Zoology, Botany & Chemistry)
(Effective from the academic session 2020- 2021)

Invertis Institute of Education

INVERTIS UNIVERSITY

Invertis Village, Bareilly-Lucknow NH-24,

Bareilly (U. P.) - 243123

India

The Process for Establishing the PEO's

The PEOs are established through the following process steps:

STEP 1: Vision and Mission of the Education Department are taken into consideration to interact with various stake holders, and establish the PEO's

STEP 2: The Head of the Department and other Senior Faculty prepares the draft version of PEOs and POs.

STEP 3: The draft version is discussed with stakeholders and their views are collected by the head of the department.

STEP 4: Head of the department reviews and analyzes the PEOs and POS and submits them to departmental committee.

STEP 5: The Departmental committee deliberates on the recommendations and freezes the PEOs and POs and submits them to the BOS for final approval.

The Program curriculum is designed by incorporating inputs from members of Board of Studies and Academic council and industry.

- ❖ Inputs are also obtained from alumni and other stakeholders.
- ❖ Therefore, PEOs are established, checked for consistency with the mission statement of the department.

PROGRAM OUTCOMES (POs): B.SC.B.Ed.

Program Outcomes (POs)		
PO1	Educational knowledge	Develop a conceptual understanding of the fundamental physical principles described above.
PO2	Problem analysis	Identify the relationship between the conceptual description of nature and its mathematical expression.
PO3	Interpersonal Skills	Examine the mathematical description of these principles that can be used to develop devices, structures, and technologies that are useful for mankind.
PO4	Critical thinking Skills	Use the mathematical description of these principles to develop problem solving skills that will benefit your future career.
PO5	Conduct investigations of problems	Students should be able to design, conduct, record, analyze, and explain the results of chemical experiments.
PO6	Use of Modern tools	Students should be able to use and/or identify methods by which to solve chemical problems.
PO7	Ethics	Develop understanding about teaching, pedagogy, school management and community involvement.
PO8	Individual and teamwork	Exhibit the leadership capacity and teamwork skills for decision making.
PO9	Communication skill	An ability to Demonstrate effective communication.
PO10	Subject specification	Make use of subject specific pedagogical knowledge and skills.
PO11	Holistic Development	Practice skills and approaches for enhancing understanding of subject matter knowledge to be taught in secondary schools.
PO12	Life-long learning	Build skills and abilities of communication, reflection, art, aesthetics, theatre, self expression and ICT.

CHOICE BASED CREDIT SYSTEM (CBCS)

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill based courses. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point

Average (CGPA) based on student's performance in examinations, the UGC has formulated the guidelines to be followed.

Outline of Choice Based Credit System:

1. Core Course: A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.

2. Elective Course: Generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.

2.1 Discipline Specific Elective (DSE) Course: Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).

2.2 Dissertation/Project: An elective course designed to acquire special/advanced knowledge, such as supplement study/support study to a project work, and a candidate studies such a course on his own with an advisory support by a teacher/faculty member is called dissertation/project.

2.3 Generic Elective (GE) Course: An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective. P.S.: A core course offered in a discipline/subject may be treated as an elective by other discipline/subject and vice versa and such electives may also be referred to as Generic Elective.

3. Ability Enhancement Courses (AEC)/Competency Improvement Courses/Skill Development Courses/Foundation Course: The Ability Enhancement (AE) Courses may be of two kinds: AE Compulsory Course (AECC) and AE Elective Course (AEEC). "AECC" courses are the courses based upon the content that leads to Knowledge enhancement. They ((i) Environmental Science, (ii) English/MIL Communication) are mandatory for all disciplines. AEEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.

3.1 AE Compulsory Course (AECC): Environmental Science, English Communication/MIL Communication.

3.2 AE Elective Course (AEEC): These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based instruction.

Project work/Dissertation is considered as a special course involving application of knowledge in solving / analyzing /exploring a real life situation / difficult problem. A Project/Dissertation work would be of 6 credits. A Project/Dissertation work may be given in lieu of a discipline specific elective paper.

Structure of B.Sc.B.Ed. (ZBC) CBCS

YEAR	SEMESTER	CORE COURSE	ABILITY ENHANCEMENT COMPULSORY COURSE (AECC)	SKILL ENHANCEMENT COURSE (SEC)	DISCIPLINE SPECIFIC ELECTIVES (DSE)	GENERIC ELECTIVE (GE)	
1	I	DSC 1A		SEC 1 (BED151)	DSE-1 EDUCATIONAL TECHNOLOGY		
		DSC 2A	AECC-1				
		DSC 3A					
		DSC 1A (P)					
		DSC 2A (P)					
			DSCE-1				
	II	DSC 1B	AECC-2 EPC-I			DSE-2 ICT-I	GE-1 (SG/NSS/NCC)
		DSC 2B					
		DSC 3B					
		DSC 1B (P)					
DSC 2B (P)							
		DSCE-2					
2	III	DSC-1C		SEC-2 (BED351)	DSE-3 SOCIOLOGICAL ASPECT		
		DSC-2C					
		DSC-3C					
		DSC-1C(P)					
		DSC-2C(P)					
			DSCE-3				
	IV	DSC-1D	AECC-3 EPC-II		SEC-3 (BED461)	DSE-4 CLASSROOM MANAGEMENT	
		DSC-2D					
		DSC-3D					
		DSC-1D(P)					
DSC-2D(P)							
		DSCE-4					
3	V	DSC-1E	AECC-4	SEC-4 (BED551)	DSE-5 ICT-II	GE-2 GEN. HINDI	
		DSC-2E					
		DSC-3E					
		DSC-1E(P)					
		DSC-2E(P)					
		DSCE-5					
			DSCE-6				
	VI	DSC-1F	AECC-5		SEC-5 (BED651)		GE-3 OPEN EDUCATIONAL RESOURCES
		DSC-2F					
		DSC-3F					
DSC-1F(P)							
DSC-2F(P)							
DSCE-7							
		DSCE-8					
4	VII			SEC-6 (BED771)			
	VIII	DSCE-9	AECC-6 (ENVIRONMENTAL.)	SEC-7 BED861	DSE-6 BOD081/BOD082/BOD0 83	GE-4 EDUCATIONAL ENTREPRENEURS HIP	
		DSCE-10					

		DSCE-11				
		DSCE-12				

Details of Course under B.Sc.B.Ed (ZBC)

Course	Theory+Practical	*Credits Theory+Tutorial
Core Course (28 Papers)	2X6=12	4x24=96
Core Course Practical / Tutorial* (12 Papers)		1X12=12
Discipline Specific Elective (06 Papers)		2X3=6 3X1=3 4X2=8
Generic Elective/Interdisciplinary (03 papers)		1X1=1 2X3=6
SKILL ENHANCEMENT COURSE (SEC) (06 papers)		1X2=2 2X4=8 12X1=12
Ability Enhancement Courses Ability Enhancement Compulsory Courses (4 Papers of 2 credit each) (2 Papers of 1 credit each) 1X2=2		2X4=8

TOTAL	176
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I-SEMESTER										
S.N o.	Course code	Course Title	Category	L	T	P	CA	EE	TOTAL	CREDIT
1	BEB109	Zoology I	DSC-1A	3	1	0	30	70	100	4
2	BEB110	Botany I	DSC-2A	3	1	0	30	70	100	4
3	BEB106	Chemistry I	DSC-3A	3	1	0	30	70	100	4
4	BEB153	Life Science Lab – I	DSC-1A(P)	0	0	2	10	15	25	1
5	BEB151	Chemistry Lab – I	DSC 3A(P)	0	0	2	10	15	25	1
6	BED101	Childhood and Growing Up	DSCE-1	3	1	0	30	70	100	4
7	BED102	English language and communication	AECC-1	2	0	0	15	35	50	2
8	BED103	Educational Technology	DSE-1	2	1	0	15	35	50	2
9	BED151	Practicum I: Psychology practical	SEC-1	0	0	2	10	15	25	1
			Total	16	5	6	180	395	575	23
II-SEMESTER										
S.N O.	Course code	Course Title	Category	L	T	P	CA	EE	TOTAL	CREDIT
1	BEB209	Zoology II	DSC-1B	3	1	0	30	70	100	4
2	BEB210	Botany II	DSC-2B	3	1	0	30	70	100	4
3	BEB206	Chemistry II	DSC-3B	3	1	0	30	70	100	4
4	BEB253	Life Science Lab – II	DSC-1B(P)	0	0	2	10	15	25	1
5	BEB251	Chemistry Lab – II	DSC-3B(P)	0	0	2	10	15	25	1
6	BED201	Contemporary India And Education	DSCE-2	3	1	0	30	70	100	4
7	BED203	ICT in Education-I	DSE-2	2	1	0	15	35	50	2
8	BED261	EPC – I: Reading and Reflecting on Texts	AECC-2	2	1	0	15	35	50	2
9	BED251	SCOUT AND GUIDE CAMP/ NSS/NCC	GE-1	0	0	2	10	15	25	1
			Total	16	6	6	180	395	575	23

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III-SEMESTER										
S.N O.	Course code	Course Title	Category	L	T	P	CA	EE	TOTAL	CREDIT
1	BEB309	Zoology III	DSC-1C	3	1	0	30	70	100	4
2	BEB310	Botany III	DSC-2C	3	1	0	30	70	100	4
3	BEB306	Chemistry III	DSC-3C	3	1	0	30	70	100	4
4	BEB353	Life Science Lab – III	DSC-1C(P)	0	0	2	10	15	25	1
5	BEB351	Chemistry Lab – III	DSC-3C(P)	0	0	2	10	15	25	1
6	BED301	Development of Education System in India	DSCE-3	3	1	0	30	70	100	4
7	BED302	Sociological Aspect of Education	DSE-3	2	1	0	25	50	75	3
8	BED351	CULTURAL ACTIVITIES, SPORTS AND YOGA	SEC-2	0	0	2	10	15	25	1
			TOTAL	14	5	6	175	375	550	22
IV-SEMESTER										
S.NO.	Course code	Course Title	Category	L	T	P	CA	EE	TOTAL	CREDIT
1	BEB409	Zoology IV	DSC-1D	3	1	0	30	70	100	4
2	BEB410	Botany IV	DSC-2D	3	1	0	30	70	100	4
3	BEB406	Chemistry IV	DSC-3D	3	1	0	30	70	100	4
4	BEB453	Life Science Lab – IV	DSC-1D(P)	0	0	2	10	15	25	1
5	BEB451	Chemistry Lab-IV	DSC-3D(P)	0	0	2	10	15	25	1
6	BED401	Teaching, Learning and Assessment	DSCE-4	3	1	0	30	70	100	4
7	BED402	Classroom Management	DSE-4	3	1	0	30	70	100	4
8	BED461	EPC – II: Educational Excursion / Art and Craft Workshop	AECC-3	0	0	2	10	15	25	1
9	BED471	School Internship – I for School Observation (Two Week)	SEC-3	0	0	0	0	50	50	2
			Total	15	5	6	180	445	625	25

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V-SEMESTER										
S.N O.	Course code	Course Title	Category	L	T	P	CA	EE	TOTAL	CREDIT
1	BEB509	Zoology –V	DSC-1E	3	1	0	30	70	100	4
2	BEB510	Botany -V	DSC-1E	3	1	0	30	70	100	4
3	BEB506	Chemistry-V	DSC-2E	3	1	0	30	70	100	4
4	BEB553	Life science Lab V	DSC-1E(P)	0	0	2	10	15	25	1
5	BEB551	Chemistry Lab-V	DSC-2E(P)	0	0	2	10	15	25	1
6	BED503	Pedagogy of Physical Science	DSCE-5	2	0	0	15	35	50	2
7	BED505	Pedagogy of Biological Science	DSCE-6	2	0	0	15	35	50	2
8	BED506	ICT in Education-II	DSE-5	2	1	0	15	35	50	2
9	BED504	GENERAL HINDI	GE-2	2	0	0	15	35	50	2
10	BED551	Practicum IV : Micro Teaching, Preparation of Teaching Aid & Construction of Achievement/ Diagnostic Test	SEC-4	0	0	4	15	35	50	2
11	BED561	EPC-III Drama and Art in Education	AECC-4	0	0	2	10	15	25	1
			TOTAL	17	4	10	195	430	625	25
VI-SEMESTER										
S.N O.	Course code	Course Title	Category	L	T	P	CA	EE	TOTAL	CREDIT
1	BEB609	Zoology VI	DSC-1F	3	1	0	30	70	100	4
2	BEB610	Botany VI	DSC-1F	3	1	0	30	70	100	4
3	BEB606	Chemistry VI	DSC-2F	3	1	0	30	70	100	4
4	BEB653	Life Science Lab VI	DSC-1F(P)	0	0	2	10	15	25	1
5	BEB651	Chemistry lab VI	DSC-2F(P)	0	0	2	10	15	25	1
6	BED603	Pedagogy of Physical Science –II	DSCE-7	2	0	0	15	35	50	2
7	BED605	Pedagogy of biological Science-II	DSCE-8	2	0	0	15	35	50	2
8	BED606	Open Educational Resources	GE-3	2	0	0	15	35	50	2
9	BED671	School Internship – II for Practice Teaching (Two Week)	AECC-5	0	0	0	0	50	50	2
10	BED651	Practicum V : Workshop on Preparation for Teaching & Simulation Teaching	SEC-5	0	0	2	50	0	50	2
			TOTAL	17	3	4	205	395	600	24

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Semester VII

Sr. No.	CODE	Course Title	CATEGORY	L	T	P	CA	EE	TOTAL	CREDIT
1	BED771	SEC	SEC-6	0	0	0	50	250	300	12
TOTAL				0	0	0	50	250	300	12

Semester VIII

Sr. No.	CODE	Course Title	CATEGORY	L	T	P	CA	EE	TOTAL	CREDIT
1	BED801	Inclusive Education	DSCE-9	3	1	0	30	70	100	4
2	BEB803	Gender, School & Society	DSCE-10	2	0	0	15	35	50	2
3	BEB804	Educational Measurement & Evaluation	DSCE-11	3	1	0	30	70	100	4
4	BED805	Curriculum Development	DSCE-12	2	0	0	15	35	50	2
5	BOD081/BOD082 /BOD083	DSE-6	DSE-6	3	1	0	30	70	100	4
6	BED802	Environment Education	AECC-6	2	0	0	15	35	50	2
7	BED861	SEC-7	SEC-7	0	0	2	0	0	50	2
8	BED806	EDUCATIONAL ENTERPRENUERSHIP	GE-4	2	0	0	15	35	50	2
TOTAL				17	3	2	150	350	550	22

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Core Courses-1

S.NO.	SUBJECT	
	THEORY	PRACTICAL
1	Basics of inorganic Chemistry I	Life Science Lab – I
2	Non-Chordate and Cell Biology	Chemistry Lab- I
3	Diversity of Viruses, Bacteria, Algae, Lichens, & Fungi	Life Science Lab – II
4	Basics of Organic Chemistry II	Chemistry Lab – II
5	Evolution, Developmental Biology and Environmental II	Life Science Lab – III
6	Diversity of Bryophytes, Pteridophytes, Gymnosperms & Angiosperms	Chemistry Lab – III
7	Basics of Inorganic Chemistry III	Life Science Lab – IV
8	Chordate and Comparative Anatomy & Histology	Inorganic Chemistry Lab – IV
9	Physiology, Molecular Biology, Plant Biotechnology of Plants	Life Science Lab – V
10	Basics of Organic Chemistry IV	Organic Chemistry Lab – V
11	Biochemistry, Endocrinology and Animal Behaviour	Life Science Lab – VI
12	Economic Botany and Plant Anatomy	Chemistry Lab – VI
13	Basics of Physical Chemistry	
14	Economic Zoology, Microbiology and Immunology	
15	Cytogenetic, Plant Pathology	
16	Basics of Physical Chemistry I	
17	Physiology & Toxicology, Genetics and Biotechnology	
18	Plant Resource Utilization, Palynology and Biostatistics	

Core Courses-2

S.NO.	SUBJECT
1	Childhood and Development
2	Contemporary India And Education
3	Development of Education System in India
4	Teaching, Learning and Assessment
5	Pedagogy of Physical Science-I
6	Pedagogy of mathematical Science-I
7	Pedagogy of Physical Science-II
8	Pedagogy of mathematical Science-II
9	Inclusive Education
10	Educational measurement & Evaluation
11	Curriculum Development
12	Gender, School & Society

DISCIPLINE SPECIFIC ELECTIVES

S.NO.	SUBJECT
1	Educational Technology
	ICT in Education-I
2	Sociological aspects of Education
	Classroom Management
3	Special Education
	Guidance & Counselling
4	Value Education
	ICT in Education-II
	Assessment for Learning
5	Basic knowledge of computer : System & Generations
	Programmed Instruction
6	Language and communication
	Organizational Administration
7	Action research
	Gender School and society
8	Life skill education
	Childhood and growing up
	Early Childhood and education

Generic Electives (Any four)

S.NO.	SUBJECTS
1	SCOUT AND GUIDE/NSS/NCC
	GENERAL STUDIES
	OPEN EDUCATIONAL RESOURCES
	NATIONAL CONCERN AND EDUCATION
2	Educational entrepreneurship
	VOCATIONAL EDUCATION
	CONSTITUTION OF WORLD
	GEOGRAPHY OF WORLD
	LANGUAGE AND LINGUISTIC
	GENERAL HINDI
3	TEXT AND PERFORMANCE
	GENDER AND HUMAN RIGHTS
	CONTEMPORARY INDIA: WOMEN AND EMPOWERMENT
	ACADEMIC WRITING AND COMPOSITION
	COMPUTER LANGUAGE

ABILITY ENHANCEMENT COMPULSORY COURSE

S.NO.	SUBJECTS
1	English language and communication
	EPC – I : Reading & Reflecting on Texts
2	ENVIRONMENT
	EPC – II : Educational Excursion / Art & Craft workshop
3	School Internship (2 Week)
	EPC – III : Drama & Art in Education
4	English Language & Communication
	EPC - VI :Understanding The Self including Workshop on Self Development
5	Logical Reasoning
	EPC - V : Preparation & Presentation through ICT

SKILL ENHANCEMENT COURSE

S.NO.	SUBJECTS
1	Practicum I : Psychology Practical
3	Practicum III : Cultural Activities, Sports & Yoga
4	School Internship - I for School Observation (2 Week)
5	Practicum IV :Micro Teaching, Preparation of Teaching Aid & Construction of Achievement/ Diagnostic Test
6	Practicum V : Workshop on Preparation for Teaching & Simulation Teaching
7	School Internship (16 weeks including 2 week School and Community Awareness Program)

Ability Enhancement Elective Course (Any two)

S.NO.	SUBJECTS
1	English Language Teaching
2	Soft Skills
3	Translation Studies
4	Creative Writing
5	Technical Writing
6	Film Studies
7	Business Communication

Semester: V

Basics of Physical Chemistry-I

Course Code: BEB506

Contact Hours: 60

Credit: 04 (L-3, T-1, P-0)

MM: 100

After going through the course the teacher trainee will be able to –

- master a broad knowledge in the field of physical chemistry which he will later apply to other topics in higher levels.
- apply their knowledge of Kinetic theory of gases in the explanation of deviations of real gases behavior from ideality.
- describe the various properties of the substances in gaseous, liquid and solid state.
- apply their theoretical knowledge in the explanation of the properties and also demonstrate it practically through experiments.
- explain the principal laws of thermodynamics and how these dictate the behavior of chemical substances and the difference between various forms of energy.
- understand the objective of their chemical experiments, properly carry out the experiments, and appropriately record and analyze the results

Course Outline:

Unit I: Gaseous state

- Kinetic molecular theory of gases: postulates, kinetic gas equation; derivation of gas laws.
- Maxwell distribution and its use in evaluating molecular velocities (average, root mean square and most probable) and average kinetic energy,
- Collision diameter; collision frequency; mean free path and viscosity of gases, including their temperature and pressure dependence, relation between mean free path and coefficient of viscosity,
- Deviations from ideal gas behaviour, Causes of deviation from ideal behaviour. compressibility factor (Z), Effect of temperature on deviations.
- Van der Waals equation of state, its derivation and application in explaining real gas behaviour, continuity of states, Joule Thomson effect.

Unit II: Liquid state

- Physical properties of liquids; vapour pressure, surface tension and coefficient of viscosity and their determination.
- Temperature variation of viscosity of liquids and comparison with that of gases.
- pH scale, common ion effect; dissociation constants of mono-, di- and tri- protic acids.
- Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts

Unit III: Ionic equilibria

- Buffer solutions; derivation of Henderson equation and its applications; buffer capacity, buffer action and applications of buffers in analytical chemistry and biochemical processes in the human body.
- Solubility and solubility product of sparingly soluble salts
- Theory of acid – base indicators; selection of indicators and their limitations.

Unit IV: Thermodynamics - I

- Thermodynamic terms, laws of thermodynamics.
- First law: relation between heat capacities, calculations of q , w , U and H for reversible, irreversible and free expansion of gases (ideal and van der Waals) under isothermal and adiabatic conditions.
- Second Law: Concept of entropy; carnot cycle; statement of the second law of thermodynamics; molecular and statistical interpretation of entropy. Calculation of entropy change for reversible and irreversible processes.

Unit V: Thermodynamics - II

- Partial molar quantities, dependence thermodynamic parameters on composition; Gibbs-Duhem equation, chemical potential of ideal mixtures, change in thermodynamic functions in mixing of ideal gases.
- Free Energy Functions-Gibbs and Helmholtz energy; variation of S , G , A with T , V , P ; Free energy change and spontaneity
Gibbs-Helmholtz equation; Maxwell relations; thermodynamic equation of state.
- Effect of temperature (Kirchoff's equations) and pressure on enthalpy of reactions. Adiabatic flame temperature, explosion temperature.
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- **Suggested Reading:**
- Atkins, P. W. & Paula, J. de, Atkin's Physical Chemistry, 8th Ed., Oxford University Press (2006).
- P. C. Rakshit, Physical Chemistry, 5th Edition (1988), 4th Reprint (1997), Sarat Book House, Calcutta
- K.J. Laidler and J.M. Meiser, 3rd Edition, Houghton Mifflin Comp., New York, International Edition (1999).
- B.R. Puri, L.R. Sharma and M.S. Pathania, 37th Edition (1998), Shoban Lal Nagin Chand & Co., Jalandhar

ZOOLOGY V
Economic Zoology, Microbiology and Immunology

Course Code: BEB509
Contact Hours: 60

Credit: 04 (L-3, T-1, P-0)
MM: 100

Course Outline:

Course Objectives:

1. To introduce variety of approaches to the study the economic zoology, microbiology immunology and getting basic idea about the relationships among animals and to their environment.
2. To understand the major principles of evolutionary theory, and ranges from the origins of life, through the evolution of specific characters of simple animals.
3. To learn about the origins of advanced characters among Economic zoology, microbiology and immunology.
4. To explore diversity of chordates ranging from protochordates to vertebrates.
5. To learn about the evolutionary significance of the economic zoology.
6. To explore basic characters of vertebrates and their adaptations to the different Environmental conditions.

UNIT I: Apiculture- Different species of Apis, culture method, honey bee products – bee-wax and their uses, chemical composition of honey. **Sericulture-** Different types of silkworms, Sericulture and extraction of silk.

UNIT II: Pisciculture and aquaculture- induced spawning, culture of Indian major carp, exotic carp, ornamental fish culture, fish spoilage and preservation- Freezing, canning, salting, smoking; Prawn culture; Pearl culture.

UNIT III: General characteristics, structure and types of viruses; Life cycle of bacteriophage; Diseases caused by Protozoans: Entamoeba histolytica, Plasmodium species, Trypanosoma.

UNIT IV: Bacteria: structure, nutrition and reproduction. Genetic recombination in bacteria: transformation, conjugation & transduction.

UNIT V: Cells and organs of the immune system; Innate and acquired immunity; Anatomical barriers.

UNIT VI: Antigens and their characteristics, Antibody: structure and types, functions of antibody.

UNIT VII: T-cell – structure, receptor and maturation (signal hypothesis excluded); B-cell – activation and differentiation. MHC: Structure and Function.

Course Outcomes:

After completing the course, the students will be able to:

1. Understand the cell division, chromosome segregation and chromosome structure.
2. Understand the structure of nucleic acids, gene expression, mutation, selection and migration.
3. Understand the gene expression and gene regulation in Eukaryotes.
4. Explore the applications of gene mutation, repair and breeding methods in plants
5. Understand nuclear genome organization as well as genes and gene numbers.

Suggested readings:

A manual of Freshwater Aquaculture – E. Santhanam, N. Sukumaran• & P. Natarajan (Oxford IBH) Aquaculture: Principle and practice – T. V. R. Pillay (Wiley Int)

- Economic Zoology – G. S. Shukla• & V. B. Upadhyay (Rastogi) Microbiology: An Introduction – G. J. Tortora, B. R. Funke and C. L. Case (Pearson)
- Principles of Microbiology – G. Sumbali and R. S. Mehrotra (TATA McGraw Hill)
- Microbiology – M. J. Pelczar Jr., E. C. S. Chan
- & N.R. Krieg (TATA McGraw Hill) Text book of Basic and Clinical Immunology – S. Gangal
- & S. Sontakke (University Pr.

BOTANY 5

BEB 510: Cellbiology and Molecular Biology

Course Code: BEB510

Contact Hours: 60

Credit: 04 (L-3, T-1, P-0)

MM: 100

Course objectives

1. Students will understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles
2. Students will understand how these cellular components are used to generate and utilize energy in cells
3. Students will understand the cellular components underlying mitotic cell division.
4. Students will apply their knowledge of cell biology to selected examples of changes or losses in cell function. These can include responses to environmental or physiological changes, or alterations of cell function brought about by mutation.

UNIT I: Techniques in Biology: Principles of microscopy, light microscopy; phase contrast microscopy; fluorescence microscopy, confocal microscopy; sample preparation for light microscopy; Electron Microscopy (EM)- Scanning Electron Microscopy (SEM) and Transmission Electron Microscope (TEM); sample preparation for electron microscopy; X-ray diffraction analysis.

UNIT II: Cellular system: The Cell, cell division: Mitosis and Meiosis; Prokaryotic and Eukaryotic cells, cell size and shape, eukaryotic cell components; functions of membranes, models of membrane structure, fluidity of membranes, membrane proteins and their functions, permeability of the membranes, cell wall. Nucleus, Mitochondria, Chloroplast, ER, Golgi bodies, Lysosomes, Peroxisomes, Glyoxisomes; mitochondria and chloroplast DNA, semiautonomous nature and symbiont hypothesis; biogenesis.

UNIT III: Genetic material: Miescher to Watson and Crick- historic perspective, Griffith's and Avery's transformation experiments, Hershey-Chase bacteriophage experiment, DNA structure, types of DNA, types of genetic material. DNA replication (Prokaryotes and eukaryotes): bidirectional replication, semi-conservative, semi discontinuous RNA priming, θ (theta) mode of replication, replication of linear, dsDNA, replicating the 5' end of linear chromosome including replication enzymes, Protein Synthesis.

UNIT IV: Recombinant DNA Techniques: Blotting techniques; Northern, Southern and Western Blotting, DNA Fingerprinting; Molecular DNA markers i.e. RAPD, RFLP, SNPs; DNA sequencing, PCR and Reverse Transcriptase-PCR. Hybridoma and monoclonal antibodies, ELISA and Immunodetection, Molecular diagnosis of human disease, Human gene Therapy. **Suggested Readings**

- a. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons. Inc.
- b. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, Philadelphia.
- c. Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
- d. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009. The World of the Cell. 7th edition.
- e. Pearson Benjamin Cummings Publishing, San Francisco. Plummer, DI. (1996). An Introduction to Practical Biochemistry. Tata McGraw- (lilt Publishing Co. Ltd. New Delhi. 3rd edition.
- f. Glick, Bit, Pasternak (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington

Course outcomes

- Gain knowledge about “Cell Science.
- Understand Cell wall Plasma membrane, Cell organelles and cell division.
- Learn the scope and importance of molecular biology.
- Understand the biochemical nature of nucleic acids, their role in living systems, experimental evidences to prove DNA as a genetic material.
- Understand the process of synthesis of proteins and role of genetic code in polypeptide formation

Chemistry Lab - V

Course Code: BEB551

Contact Hours: 30

Credit: 01 (L-0, T-0, P-2)

MM: 50

Course Outline:

1. To determine the Viscosity of given liquid at room temperature by using Ostwald's viscometer.
2. Determine the strength of given solution of HCl with standard NaOH solution.
3. To determine the concentration of given CuSO₄ solution calorimetrically.
4. To determine the heat of solution of given hydrated salt by solubility.
5. To determine the ionization constant of a weak acid conductometrically.
6. Determination of water equivalent of a calorimeter.

Note: Experiments may be added/deleted subject to availability of time and facilities

Zoology Lab –V

Course Code: BEB553
Hours: 60

Credit: 02 (L-0, T-0, P-4) Contact
MM: 50

Course Outline:

Lab based on Zoology

- (a) Permanent Preparation of: Euglena, Paramecium and rectal protozoans from frog.
- (b) Stool examination for different intestinal parasites.
- (c) Study of prepared slides/ specimens of Entamoeba, Giardia, Leishmania, Trypanosoma, Plasmodium, Fasciola, Cotugnia, Taenia, Rallietina, Polystoma Paramphistomum, Schistosoma, Echinococcus, Dipylidium, Enterobius, Ascaris and Ancylostoma;
- (d) Permanent Preparation of Cimex (bed bug)/ Pediculus (Louse), Haematopinus (cattle louse), fresh water annelids, arthropods; and soil arthropods.
- (e) Larval stages of helminths and arthropods
- (f) Permanent preparation of ticks/ mites, abdominal gills of aquatid insects viz. Chironomus larva, dragonfly and mayfly nymphs, prepar. Permanent mount of wings, mouth parts and developmental stages of mosquito and house fly. ation of antenna of housefly.
- (g) Collection and identification of pests.
- (h) Life history of silkworm, honeybee and lac insect.
- (i) Different types of important edible fishes of India.
- (j) Comments upon the structure and application of analytical instruments o Colorimeter o Spectrophotometer o Ultracentrifuge o ESR and NMR spectrometer o Microtome

BOTANY LAB-5

Course Code: BEB553
Contact Hours: 60

Credit: 02 (L-0, T-0, P-4)
MM: 50

Practicals:

1. To study prokaryotic cells (bacteria), viruses, eukaryotic cells.
2. To study the structure of plant cell through temporary mounts.
3. Study of mitosis and meiosis (temporary mounts and permanent slides).
4. Biochemical tests of carbohydrates.
6. Study of plasmolysis and deplasmolysis.
7. Measure the cell size (either length or breadth/diameter) by micrometry.
8. Study the structure of nuclear pore complex by photograph (from Gerald Karp), Study of special chromosomes (Polytene&Lampbrush) either by slides or photographs.
9. Study of molecular techniques: PCR, Blotting techniques, AGE and PAGE.

Course Outcomes:

- Gain knowledge about “Cell Science.
- Understand Cell wall Plasma membrane, Cell organelles and cell division.
- Learn the scope and importance of molecular biology.
- Understand the biochemical nature of nucleic acids, their role in living systems, experimental evidences to prove DNA as a genetic material.

Understand the process of synthesis of proteins and role of genetic code in polypeptide formation

Pedagogy of Physical Science: Part - I

Course Code: BED503

Credit: 02 (L-2, T-0, P-0)

Contact Hours: 30

MM: 50

After going through the course the teacher trainee will be able:

- To develop insight on the meaning and nature of Science
- To develop lesson planning skills in the contents of Science with respect to its branches
- To understand the process of different models of teaching □To determine aims and objectives in the contents area of Science. □To state specific objectives in behavioural terms.
- To diagnose basic causes for difficulties in learning mathematics.

Course Outline

Unit I: Nature, Aims and objectives:

- Science as a domain of enquiry, Science as an interdisciplinary area of learning. Facts, concepts, principles, law and theories – their characteristics in content of Science.
- Contribution of Eminent Scientist; Isaac Newton, Dalton, Albert Einstein, Graham bell, J.C. Bose, C.V. Raman, Vikram Sarabhai, H.J. Bhabha, AP.J. Abdul Kalam.
- Aims and objectives of Science teaching at upper primary and secondary level school. Justification for including Science as a subject of study in school curriculum.
- General objectives, specific objectives, classification of learning objective; cognitive, affective and psychomotor.
- Writing objectives in behavioural terms in content areas of science.

Unit II: Teaching Models, Strategies and Learning resources:

- Meaning and definition of teaching models, fundamental elements of teaching models, types of teaching models; behavior modification and constructivist.
- Microteaching, Simulated teaching, team teaching, PLA technique, project based learning, cooperative learning, Application of ICT in the Science Classroom
- Identification and use of learning resources in science from immediate environment, Science kit, teaching aids; audio, visual, audio-visual.
- Preparation and use of learning aids contextually. Principles of selection and steps for effective use of teaching aids,
- Use of ICT experiences in learning science, text book, work book and its characteristics, and other non print learning materials used in science at school level.

Unit III: Assessment and Evaluation:

- Construction of test items (unit test) to assess simple factual knowledge, higher thinking and application abilities;
- Use of observation techniques, Student-Teacher Profile, recording and evaluating procedures to assess the performance of students' activities, projects, laboratory skills;
- Group assessment; self and peer assessment; assessment of worksheets; students' journals;
- Use of rubrics in assessment. Portfolio assessment. Teacher's reflections in the process.

Suggested Reading:

- Bennett, Jeffrey: on teaching Science (print/e-book) Big Kid Science Publication □Bloom, B.S.: Taxnomy of educational objectives, Mckay Co. New Delhi.
- Carin A and B R Sund: Teaching Science through Discovery, Charles E. Merrill Books Inc., Columbus Ohio.
- Chandra, T.: Principles of teaching, Anmol Publication, New Delhi

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Chauhan S. S.: Innovation in teaching, Vikas Publication, New Delhi

- Das, R.C.: Science teaching in schools, Sterling Publication, New Delhi
- Judith Bennett: Teaching and Learning Science: A guide to recent research and its applications, Continuum, London.
- Kulshrestha, S.P.: Teaching of Physical Science, R. Lal Book Depot, Meerut □Nathan S Washton: Teaching Science Creatively, Saunders Company, London.
- Norman Herr: The source book for teaching Science (e-book/print) Wiley Publication
- Novak D J and D Bob Gowin: Learning how to learn, Press Syndicate of the University of Cambridge, Ohio.
- Pandey, Shashi Kiran: Science teaching, Vani Prakashan, New Delhi
- Pathak, R.P.: Teaching skills, Pearson Publication, New Delhi
- Ralph Martin, Colleen Sexton, Kay Wagner, Jack Gerlovich: Science for All Children: Methods for Constructing Understanding, Allyn and Bacon, London.
- Rawat, D.C.: Teaching of Science, Vinod Pustak, Agra
- Robin Millar: Doing Science: Images of Science in Science Education, The Falmer Press, London.
- School Science Review, The Association for School Education, College Lane, Hatfield, Hertfordshire, AL 109 AA, UK.
- Siddiqui, N.N. & Siddiqui, M.N.: Teaching of Science, Doaba House, New Delhi □Singh, R.: Teaching methods in schools, Commonwealth Publication, Delhi.
- Sood, J.K.: Teaching of Physical Science, Agarwal Publication, Agra
- Steve Alsop, Keith Hicks: Teaching Science: A Handbook for Primary and Secondary School Teachers, Kogan Page, New Delhi.
- Yadav, M.S.: Objective Science, Anmol Publication, New Delhi

Pedagogy of Biological Science: Part - I

Course Code: BED505

Credit: 02 (L-2, T-0, P-0)

Contact Hours: 30

MM: 50

After going through the course the teacher trainee will be able:

- To develop insight on the meaning and nature of biological science for determining aims and strategies of teaching-learning;
 - To appreciate various approaches of teaching-learning of biological science
 - To explore the process skill in science and role of laboratory in teaching– learning
 - To use effectively different activities / experiments / demonstrations / laboratory experiences for teaching – learning of biological science;
 - To review the contributions of Biologists to the knowledge domain of Biological Science.
 - To develop learning materials on selected units/themes that facilitate learning of biology in the classroom
- Course Outline:**

Unit I: Nature, Scope, Aims and Objectives of Biological Science:

- Meaning and branches of biological science. Nature of knowledge in Biological Science- empirical, experiential, knowledge categories: Biological concepts, facts, principles, generalizations and theories.
- Contributions of Indian and International Biologists to the knowledge domain of biological science. Origin of life and evolution, biodiversity, observations and experiments in biological sciences; Interdisciplinary linkages of biological sciences and society.
- Justification for including Biological Science as a subject of study in school curriculum.
- Aims and objectives of Science teaching at upper primary and secondary level school. General objectives, specific objectives, Need for stating objectives, classification of learning objective - cognitive (revised taxonomy);
- Writing objectives in behavioural terms in content areas of Biological Science. Developing scientific attitude, scientific temper and environmental values through the processes of learning Biology.

Unit II: Approaches, Strategies and Teaching Aids:

- Process of constructing knowledge: Scientific method (Observation, enquiry, hypothesis, experimentation, data collection, generalization).
- Communication in biological sciences; Problem solving, investigatory approach, concept mapping, collaborative learning, cooperative learning, Project based learning, experiential learning, Simulation, micro-teaching.
- Preparation and use of learning aids contextually. Principles of selection and steps for effective use of teaching aids. Using ICT in learning biology, websites on biology, interactive websites, online learning, and preparation of projects on Biology units.
- Audio-visual materials: charts, models, aquaria, terraria, school garden, museum, herbarium, supplementary books, handbooks, laboratory guides, science kits, etc. Self-learning materials and planning of worksheets.
- Field trips, National parks, study tours and community as a resource sites for learning biology.

Unit III: Assessment of and for Learning Biological Science:

- Performance-based assessment; Developing indicators for performance assessment in biological sciences; Learner's record of observations; Field diary, herbarium and collection of materials;
- Oral presentation of learner's work in biological science, Portfolio; Assessment of project work experimental work in biology; Assessment of participation in collaborative learning;

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Construction of different types of test items to assess content specific- simple factual knowledge, higher order thinking and application abilities; preparation of blue print/table of specifications; Planning for a Unit test in Biology;

- Exploring content areas in biological science not assessed in formal examination system and their evaluation through various curricular channels;

Suggested Reading:

- Agarwal D.D.: Modern Methods of Teaching Biology, New Delhi: Sorup and Sons, 2002
- Aggarwal, D. D. (2008). Modern Method of Teaching Biology, Karanpaper Books. New Delhi
- Devereux, Jane (2000): Primary Science – Developing subject knowledge, Sage publications Inc, London.
- Esler, K. William & Mark. K. Esler (2001): Teaching Elementary Science (8th edition) Wadsworth group, Thomas learning, Printed in the USA.
- Heiss, E.D. Obourn E.S and Hoffmann C W (1961): Modern Science teaching by Macmillan publication, New York.
- Jakab, Cheryl (1990): Exploring together (Revised Edition) – A science course for Primary schools, Phoenix Education Private Limited.
- Jennings T (1986): The young scientist investigates- Teacher’s Book of Practical work, Oxford University Press, Oxford.
- Judith Beunet (2003): Teaching and Learning Science – A guide to recent research and its applications
- K.Yadav “Teaching of Life Sciences”
- Keith skamp (ed) (2004): Teaching primary science constructively -2nd edition, Thomson, by Nelson Australia Private Ltd.
- Mangal S. K.: Teaching of science, New Delhi: Arya Book Depot, 1992
- Mason M & Ruth T. Peters: Teacher guide for Life sciences, Published by D. Van Nostrand Company, Inc, New york.
- Miller and Blaydes “Methods and Materials for Teaching Biological Sciences.
- Mohan, Radha (2004): Innovative Science Teaching, Prentice Hall of India, New Delhi
- NCERT: Teaching of Science in Secondary Schools. New Delhi: NCERT, 1982
- New UNESCO Source Book for teaching science, UNESCO, Paris, Richardson, J.S. Science teaching in secondary schools; New York; prentice hall.
- Novak. D.J & D. Bob Gowin (1984): Learning how to Learn, published by the press syndicate of the University of Cambridge, Printed in the USA.
- Robin Millan (1984): Doing Science: Images of Science in Science education, the Falmer Press, London.
- Saunders, N.H. (1962) The teaching of General science in Tropical secondary schools; London; Oxford University press.
- Sharma, R.C. (2006). Modern Science Teaching. New Delhi: Dhanpat Rai Publications.
- State text Books for classes VIII to X.
- Steve Alsop, Keith Hicks (2007): Teaching Science: A Handbook for Primary and Secondary school teachers, Kogan Page, N. Delhi
- Synik, K.M: Living in the Environment – A source book for Environment al Education, UNESCO.
- Turner, T & W. Dimarco (1988); learning to teach science in the secondary school – a companion to school experience, Published by Routledge, USA.
- Yadav Seema and Singh A.K.: Teaching of Life Science, New Delhi: Dominant Publications
- Yadav, M.S. (2003) Teaching of Science. New Delhi: Anmol Publications

ICT in Education- II

Course Code: BED506

Credit: 02 (L-2, T-0, P-0)

Contact Hours: 30

MM: 50

After going through the course the teacher trainee will be able to:

- Acquire familiarity with different modes of computer-based learning.
- Explain the different approaches of ICT integration in education
- Plan and use various ICTs for project based/problem based, constructivist learning environment
- Appreciate the scope of ICT for improving the personal productivity and professional competencies
- Develop skills in using various web 2.0 and e-learning tools
- Appreciate the use ICT in improving educational administration

Course Outline:

Unit I: Visualizing Technology-Supported Learning Situations

- Preparation of learning schemes and planning interactive use of audio-visual programme,
- Development of PPT slide show for classroom use, Use of available software or CDs with LCD projection for subject learning interactions
- Educational use of web 2.0 technologies: e-mail, wiki, blog, podcasting, streaming, chat, social bookmarking, social networking, groups and forum, creation of 'Blogs',
- Web quest and virtual field trips: concept, process and use in the classroom

Unit II: ICT for Assessment, Management and Professional Development

- Electronic assessment portfolio – concept, types, tools and e-portfolio rubrics
- ICT for educational administration, ICT for personal and professional development: tools and opportunities
- Assistive technology for special needs and inclusion: tools and process
- Teleconferencing and Video-Conferencing, EDUSAT: The Indian experiment, web conferencing- tools and techniques
- Open Educational Resources – Meaning and importance, various OER initiatives, creative common licensing

Unit III: Innovations in Educational Technology:

- Video Lesson, Talk Back Experiment,
- CAI, Interactive Video and Language Laboratory
- Use of Internet and social networking sites for teaching learning process
- E-learning: concept, types, characteristics, advantages and limitations. Mobile technology for learning.
- E-Classroom: Concept, Organizing E-Classroom.
- Learning and Learning Management Systems (LMS)

Suggested Readings

- Abbot, C. (2001). ICT: Changing Education. Routledge Falmer.
- Florian, L., & Hegarty J. (2004). ICT and Special Educational Needs: A Tool for Inclusion. Open University Press, Maidenhead. Suggested Reading
- Kozma, R.B. (2003). Technology, Innovation, and Educational Change: A Global Perspective: A Report of the Second Information Technology in Education Study, Module 2. International Society for Technology in Education.

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- Barton, R. (2004). Teaching Secondary Science with ICT. McGraw Hill International
- Cabmbridge, D. (2010). E-Portfolios for Lifelong Learning and Assessment. John Wiley and Sons
- Costantino, P.M., DeLorenzo, M.N., Kobrinski, E.J. (2006). Developing a professional teaching portfolio: a guide for success. Pearson 150
- Imison, T., Taylor, P.H. (2001). Managing ICT in the Secondary Schools. Heinemann: Oxford
- Montgomery, K., Wiley, D. A. (2004). Creating E-portfolio using PowerPoint- A Guide for Educators. Sage: New Delhi
- Sanders Donald, H. (1998). Computers Today. McGraw Hill Book Company: New Delhi
- Sarkar, S.K. & Gupta, A. K. (1998). Elements of Computer Science. S. Chand & Company: New Delhi
- Semenov, Alexy (2005). Information and Communication Technologies in Schools. A handbook for Teachers. UNESCO
- Mishra, S.(Ed.) (2009). STRIDE Hand Book 08: E-learning. IGNOU: New Delhi. Available at http://webserver.ignou.ac.in/institute/STRIDE_Hb8_webCD/STRIDE_Hb8_index.html

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Practicum - IV

(Preparation of Teaching Aid, Micro Teaching & Construction of Achievement / Diagnostic Test)

Course Code: BED551

Credit: 02 (L-2, T-0, P-4)

Contact Hours: 60

MM: 50 Course

Outline:

1. Preparation of Teaching Aid.
2. Preparation and presentation of 25 micro teaching lesson plans (minimum 5 skills for each teaching subject).
3. Construction of achievement / diagnostic test.
4. Viva – voce.

Note: For successful completion of the course participation in all activities of practicum is compulsory.

EPC – III: Drama and Art in Education

Course Code: BED561

Credit: 01 (L-0, T-0, P-2)

Contact Hours: 30

MM: 50

After going through the course the teacher trainee will be able –

- To develop aesthetic sensibilities and learn the use of art in teaching-learning.
- To integrate curricular and co-curricular activities for overall development of learners.
- To understand basics of different art forms and impact of art forms on the human mind.
- To enhance awareness of the rich cultural heritage, artists and artisans.
- To understand drama and art as a form of self-expression for enhancing creativity.
- To enhance skills for integrating different art-forms across school curriculum at secondary level.

Course Outline

Unit I: Appreciation of Arts & Crafts

- Meaning and concepts of arts and crafts and their significance at secondary level of school education. Difference between ‘Education in Arts’ and ‘Arts in Education’.
- Aesthetics & principles of art appreciation. Importance and role of arts in deepening children’s perceptual ability, reflection and expression.
- Dimensions of Indian art & craft traditions and its relevance in education.
- Indian contemporary arts and artists: visual arts, performing arts. Indian festivals and their artistic significance in education.

Unit II: Visual Arts in Education

- Nature and importance of visual arts in education.
- Different forms of visual presentations and their artistic features (drawings, paintings, portraits, photography, graphic designs, cartoons, illustrations, origami, clay modeling, printmaking, etc.)
□Philosophical and sociological implications of visual arts.
- Criticism and evaluation of art works; understanding of art trends from the Western and Eastern viewpoints.

Unit III: Performing Arts in Education

- Nature and importance of performing arts in education.
- History and overview of various disciplines in dance, music and theatre.
- Identification of different performing art forms and artists (dance, music, theatre, puppetry, etc.)
- Drama as critical pedagogy. Different drama forms and theatre techniques useful in education (such as hot seating).

Practical Activities:

Experimentation with Visual Arts and Crafts

- Experimentation with different materials of visual art, such as pastel /poster colours, pen and ink, rangoli materials, clay, photographs, cartoons, clipart, etc.
- Exploration and experimentation with different methods of visual arts like painting, printing, sketching, photography, collage making, clay modelling, origami, etc.
- Paper framing and display of art work.

Exercise with Performing Arts

- Listening/viewing and exploring Regional art forms of music, dance, theatre and puppetry.
- Viewing/listening to live and recorded performances of classical and Regional art forms; and their appraisal.
- Participation and performance in any one of the Performing Arts keeping in mind the integrated educational approach.

- Designing and management of stage-setting for a performance/presentation (properties, costume, makeup, set design, lighting etc.).

Assignments (any two):

- Preparation of a report on local culture and art forms, interpretation of art works, movies and other media.
- Theme-based projects from any one of the curricular areas covering its social, economic, cultural and scientific aspects integrating various arts & craft forms;
- Documentation of the processes of any one art or craft form with the pedagogical basis (such as weaving or printing of textiles, making of musical instruments, folk performances in the community, etc. – how the artist design their products, manage their resources, including raw materials, its marketing, problems they face)
- Student-teacher should prepare at least five lesson plans in their respective streams of subjects (Science/Maths/Social Sciences/Languages etc.) while integrating different art forms.

Suggested Reading:

- Atkinson, D. (2002). Art in education: Identity and practice. Dordrecht: Kluwer Academic Publishers. ISBN: 1-4020-1084-8 (HB) 1-4020-1085-0 (PB)
- Smith, R.A. and Simpson, A. (1991). Aesthetics and arts education. Urbana-Champaign: University of Illinois Press. ISBN: 0-252-01752-8 (HB), 0-252-06141-1 (PB)
- Gardner, H. (1990). Art education and human development. Los Angeles: Getty Publications. ISBN: 978-0-89236-179-3, 978-0-252-06141-7
- Purohit, V. (1988). Arts of transitional India: Twentieth century, 2 Volumes. Bombay: Popular Prakashan Pvt. Ltd. ISBN: 0-86132-138-3
- Mathur, S. (2007). India by design: Colonial history and cultural display. London: University of California Press Ltd. ISBN: 978-0-520-23417-8 (HB), 978-0-520-25231-8 (PB)
- Chapman, L.H. (1978). Approaches to art in education. New York: Harcourt College Publishers. ISBN: 0155028960, 9780155028968
- Eca, T. and Mason, R. (2008). International dialogues about visual culture, education and art. Bristol: Intellect Books. ISBN: 978-1-84150-167-3, e-ISBN: 978-1-84150-227-4
- McCutchen, B.P. (2006). Teaching dance as art in education. USA: Sheridan Books (Website: humankinetics.com). ISBN: 9780-07360-5188-0 (HB)
- Efland, A. (1990). A history of art education: Intellectual and social currents in teaching the visual arts. New York: Teachers College Press, Columbia University. ISBN: 0-8077-2978-7 (HB), 0-8077-2977-9 (PB)
- Thompson, C.M. (1995). The visual arts and early childhood learning. Reston, Virginia: National Art Education Association. ISBN: 0937652806, 9780937652800
- Lowen, S. (2005). The performing arts in India: Development & spread across the globe. Gurgaon: Shubhi Publications. ISBN: 81-87226-94-3, 978-81-87226-94-9
- Wade, B. C. (1983). Performing arts in India: Essays on music, dance, and drama (Volume 21 of monograph series). Barkley: Center for South and Southeast Asia Studies, University of California.
- Banerjee, U.K. (2006). Indian performing arts: A mosaic (3rd Ed.). New Delhi: Harman Publishing House. ISBN: 8186622756, 9788186622759
- Kothari, S. (2003). New directions in Indian dance(India). Mumbai: Marg Publications (National Centre for the Performing Arts). ISBN: 81-85026-62-9

Semester: VI

Basics of Physical Chemistry- II
BEB606

Contact Hours: 60

After going through the course the teacher trainee will be able to –

- demonstrate fundamental electrochemical processes and principles important for the applications of electrochemistry in research, industry and chemical analysis.
- draw and extract information from phase diagrams.
- explain phase equilibria exhibited by pure, binary and ternary systems.
- demonstrate knowledge of concepts and principles of adsorption.
- explain types of rates of chemical reactions and effect of catalyst on reaction rate.
- demonstrate the knowledge of kinetics of a reaction and conductance measurements and apply it to the identify the reaction mechanism

Course Outline:

Unit I: Electrochemistry

- Arrhenius theory of electrolytic dissociation. Kohlrausch law of independent migration of ions.
- Applications of conductance measurement: (i) degree of dissociation of weak electrolytes, (ii) ionic product of water (iii) solubility and solubility product of sparingly soluble salts, (iv) conductometric titrations, and (v) hydrolysis constants of salts.
- Chemical cells, reversible and irreversible cells with examples.
- Electromotive force of a cell and its measurement, Nernst equation; Standard electrode (reduction) potential and its application to different kinds of half-cells

Unit II: Solution and Colligative Properties

- Dilute solutions, Raoult's and Henry's Laws and their applications.
- Lowering of vapour pressure by a non-volatile solute, determination of molar masses from vapour pressure lowering,
- Osmosis and Osmotic pressure, the laws of osmotic pressure, isotonic solution, Van't Hoff equation for osmotic pressure of dilute ideal solution.
- Elevation of boiling point by a non-volatile solute and determination of Molar masses, □Depression of freezing point by a non-volatile solute and determination of Molar masses.

Unit III: Chemical Kinetics

- *Kinetics*: Order and molecularity of a reaction, rate laws in terms of the advancement of a reaction, differential and integrated form of rate expressions up to second order reactions, experimental methods of the determination of rate laws,
- Temperature dependence of reaction rates; Arrhenius equation; activation energy.
- Collision theory of reaction rates, qualitative treatment of the theory of absolute reaction rates.

Unit IV: Colloids & Surface Phenomenon

- Classification: Lyophobic and lyophilic sols, electrical double layer, electrophoresis, origin of charge on colloidal particles, Zeta potential, protective colloids, gold number, applications.
- Heat of adsorption, Freundlich adsorption isotherm, physical adsorption and chemisorption, Langmuir's theory.

Suggested Reading:

- Atkins, P. W. & Paula, J. de, Atkin's Physical Chemistry, 8th Ed., Oxford University Press (2006).
- P. C. Rakshit, Physical Chemistry, 5th Edition (1988), 4th Reprint (1997), Sarat Book House, Calcutta

Credit: 04 (L-3, T-1, P-0)

MM: 100

- K.J. Laider and J.M. Meiser, 3rd Edition, Houghton Mifflin Comp., New York, International Edition (1999)
- B.R. Puri, L.R. Sharma and M.S. Pathania, 37th Edition (1998), Shoban Lal Nagin Chand & Co., Jalandhar

ZOOLOGY

Physiology & Toxicology, Genetics and Biotechnology

Course Code: BEB 609

Contact Hours: 60

Credit: 04 (L-3, T-1, P-0)

MM: 100

Course Objective

1. To introduce the different anatomical feature of animals and its significance.
2. To learn the comparative account of anatomy of vertebrates.
3. To explore the evolutionary background of different physiological advancement in different animal groups.
4. To study the anatomical adaptations of animals in relation to their habit and habitat.
5. To learn the workability of major organs and organ systems of animals.
6. To study the basic principles of genetics and biotechnology.

Course Outline:

UNIT I Excretion: Structure of nephron, Physiology of Urine formation; Muscle: Types, Neuron - Structure and function, Origin and conduction of nerve impulse, Synapse and synaptic transmission.

UNIT II: Classification of toxicants, Dose-effect and dose response relationship; Biological and chemical factors that influence toxicity; Toxic agents and their effects: Pesticides and Heavy Metals; Determination of LC50 and LD50 Values, Bioaccumulation and biomagnifications.

UNIT III: Mendel's experiments and principles of inheritance, test and back cross; multiple alleles in man (ABO blood group); Linkage: complete and incomplete linkage; Crossing over: three-point mapping method, significance of crossing over; Sex linked inheritance.

UNIT IV: Mutation: types of mutation, types of mutagen-physical & chemical. Molecular basis of mutation(transition, transversion, base pair substitution, & frame shift mutation).

UNIT V: General characteristics of the cloning vectors used in genetic engineering, plasmid vectors viz PER 322, pUC plasmids, M13 vectors, lamda vectors, cosmids, phagemids. Restriction enzymes used in recombinant DNA Technology endonucleases, ligases and other enzyme useful in gene cloning.

UNIT VI: Use of biotech in genetic engineering (concept and recombinant DNA technology) and its application in agriculture & medical areas.

Suggested readings

Principles of Animal Physiology- C. D. Moyes and P. M.

- Principles of Anatomy and Physiology- G. J. Tortora and B. H. Derrickson
- Animal Physiology – Adaptation
- & Environment – K. Schmidt-Neilson (Cambridge University Press) Text Book of Medical Physiology – A. C. Guyton (Holt Saunders)
- Fundamentals of Toxicology- P. K. Gupta
- Toxicology- V.C Kapoor• Text book of Genetics- Veerbala Rastogi
- Genetics – Gardener
- Principles of Genetics- Snustad, D.P. and Simmons, M.J. (John Wiley & Sons Inc.) Concepts of Genetics –W. S. Klug and M. K. Cummings (Pearson)• Genetics – V. B. Rastogi (Kedarnath Ramnath)• Genetic Engineering – P. S. Verm• & V. K. Agarwal (S. Chand) Molecular Biology.

Credit: 04 (L-3, T-1, P-0)

MM: 100

Course Outcomes:

After completing the course, the students will be able to:

1. Understand the cell division, chromosome segregation and chromosome structure.
2. Understand the structure of nucleic acids, gene expression, mutation, selection and migration.
3. Understand the gene expression and gene regulation in Eukaryotes.
4. Explore the applications of gene mutation, repair and breeding methods in plants
5. Understand nuclear genome organization as well as genes and gene numbers.

Credit: 04 (L-3, T-1, P-0)

MM: 100

BOTANY 6

BEB 610: Plant Breeding and Tissue Culture

Course Code: BEB 610

Contact Hours: 60

Credit: 04 (L-3, T-1, P-0)

MM: 100

Course Objectives:

- Identify characteristics of self- and cross-pollinated plants
- Identify sources of genetic variation to conduct a breeding program
- Determine breeding methodology appropriate for plants with different mating systems
- Conduct basic statistical analyses related to plant breeding
- Analyze journal articles related to cultivar development
- Conduct and analyze a selection experiment
- Communicate background information and original ideas related to breeding a specific crop
- Know different techniques to improve the plant varieties using tissue culture techniques for commercial purposes.

UNIT I: General account: history of plant breeding, the disciplines to be known by a breeder – botany of the crop, cytogenetics (agronomy, physiology, pathology, entomology, biochemistry, bacteriology, statistics, plant biotechnology); objectives of plant breeding: high yield, improved quality, disease and pest resistance, early maturity, photosensitivity, varieties for new seasons, resistant varieties; activities in plant breeding: creation of new varieties, selection, evaluation, multiplication and distribution; centres of origin: different centres and their significance; germplasm conservation: *in situ* seed banks, plant banks, shoot tip banks, cell and organ banks, DNA banks, germplasm evaluation, cataloguing, multiplication and distribution

UNIT II: Plant introduction: history of plant introduction- primary and secondary, plant introduction agencies: procedure of plant introduction: quarantine, cataloguing, evaluation, multiplication, distribution, acclimatization, purpose of plant introduction, achievements, merits and demerits; methods of reproduction; incompatibility: different types – self incompatibility, homomorphic and heteromorphic incompatibility – gametophytic and sporophytic incompatibility, mechanism of self- incompatibility, pollen- stigma interaction, pollen tube -style interaction, pollen tube -ovary interaction –significance of self- incompatibility, methods to overcome self- incompatibility- bud pollination, surgical methods and off season pollination, high temperature, irradiation (iv) Sterility : male sterility – genetic male sterility - cytoplasmic male sterility – cytoplasmic genetic male sterility, application in crop improvement

Unit III: Selection: history of selection, pureline selection, mass selection, pedigree selection, bulk method of selection, merits and demerits, achievements of each type; backcross method of selection : Introduction, requirements, applications of back cross methods, genetic consequences of repeated back crossing, procedure of back cross method - transfer of a dominant gene, transfer of a recessive gene, number of plants necessary in backcross generation, selection of the characters being transferred, transfer of quantitative characters, modification of back cross method, production of F2 and F3, use of different recurrent parents, application of back cross method in cross pollinated crops, merits and demerits, achievements; hybridization: history , techniques and consequences, objectives, types of hybridization –interspecific, intergeneric, distant 26 hybridization, procedure of hybridization, choice of parents, evaluation of parents, emasculation – different methods, bagging, tagging, pollination , harvesting and storing of the F1 seeds and selfing, consequences of hybridization.

UNIT IV: Plant Tissue Culture: history of plant tissue culture research - basic principles of plant tissue callus culture, meristem culture, organ culture, Totipotency of cells, differentiation and dedifferentiation; methodology - sterilization (physical and chemical methods), culture media, Murashige and Skoog's (MS medium), phytohormones, medium for micro-propagation/clonal propagation of ornamental and horticulturally important plants; callus subculture maintenance, growth measurements, morphogenesis in callus culture –

Credit: 04 (L-3, T-1, P-0)

MM: 100

organogenesis, somatic embryogenesis; endosperm culture – Embryo culture -culture requirements – applications, embryo rescue technique; production of secondary metabolites; cryopreservation; Germ plasm conservation.

Suggested Readings:

1. Gardner EJ, Simmons MJ, Snustad DP (2008). Principles of Genetics. 8th Ed. Wiley-India.
2. Klug WS, Cummings MR, Spencer, C, Palladino, M (2011). Concepts of Genetics, 10th Ed., Benjamin Cummings
3. Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis. W. H. Freeman and Co., U.S.A. 10 edition.
4. Singh, B.D. (2005). Plant Breeding: Principles and Methods. Kalyani Publishers. 7th edition.
5. Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory and Practice. Amsterdam, Netherlands: Elsevier Science.
6. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications. Washington, U.S.: ASM Press.
7. Kochhar, S.L. (2011). Economic Botany in the Tropics, 4th edition, New Delhi, Delhi: MacMillan Publishers India Ltd.
8. Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory Practice. Elsevier Science Amsterdam. The Netherlands.

CO:By the end of this course, students will be able to:

- Understand the “Science of Heredity”.
- Realize the role of genes in evolution of species.
- To understand linkage, segregation and mutation of genes during evolution.
- Understand the science of plant breeding.
- To introduce the student with branch of plant breeding for the survival of human being from starvation.
- To study the techniques of production of new superior crop varieties.
- To study the evolution in living organisms

Practicals:

1. Hybridization techniques - Emasculation, Bagging (for demonstration only).
2. Induction of polyploidy conditions in plants (for demonstration only).
3. Practice of hybridization techniques in a self-pollinated and cross pollinated plants (any available plant).
4. A visit to agricultural research centre for observation and record of inter variety, inter specified integration plants.
5. Study of tissue culture methodologies.
6. Methods of plant propagation a) Budding b) Grafting c) Rooting d) Layering e) Cutting.

Course Outcomes

1. Understand the science of plant breeding.
2. To introduce the student with branch of plant breeding for the survival of human being from starvation.
3. To study the techniques of production of new superior crop varieties.
4. Understand the modern strategies applied in Genetics and Plant Breeding to sequence and analyze genomes
5. Get the detail knowledge about modern strategies applied in Plant Breeding for crop improvement i.e. Mass selection, Pureline Selection and Clonal selection.
6. Know about exploitation of Heterosis, hybrid and variety development and their release through artificial hybridization.

Chemistry Lab - VI

BEB651

Contact Hours: 30

**Credit: 01 (L 0, T
MM: 100**

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2)

Course Outline:

1. Viscosity-composition curve for a binary liquid mixture.
2. Surface tension-composition curve for a binary liquid mixture.
3. Determination of indicator constant - colorimetry.
4. Determination of pH of a given solution using glass electrode.
5. Beer's Law - Determination of concentration of solution by colorimetry.
6. Order of reaction of I₂ / Acetone / H⁺.
7. Equilibrium constant of methyl acetate hydrolysis reaction.
8. Dissociation constants of weak acid, base.
9. Conductometric titration: acid-base.
10. Potentiometric titration: acid-base.
11. Kinetics of catalytic decomposition of H₂O₂.
12. Kinetics of acid-catalysed hydrolysis of sugar (chemical method).

Zoology Lab-VI

Course Code: BEB653

Credit: 02 (L-0, T-0, P-4)

Contact Hours: 60

MM: 50

Course Outline:

Lab based on Zoology

- (a) Demonstration of counting of cells (blood and protozoan) by haemocytometer, haemoglobinometer.
- (b) Demonstration of pH meter, Colorimeter.
- (c) Experiments to be performed by candidates: Test for amylase.
- (d) d acetoOsmolarity of blood, Hemin crystals and test for sugar anne in urine.
- (e) Determination of haemoglobin % in blood sample (s).
- (f) Detection of amino acids in blood of an animal by paper chromatography.
- (g) Problems based on genetics- Pedigree analysis.
- (h) Preparation of buffers.
- (i) Blood group analysis.
- (j) Theoretical knowledge and demonstration of Blotting and Sequencing.

Botany Lab-VI

Course Code: BEB653

Credit: 02 (L-0, T-0, P-4)

Contact Hours: 60

MM: 50

Practicals:

1. Hybridization techniques - Emasculation, Bagging (for demonstration only).
2. Induction of polyploidy conditions in plants (for demonstration only).
3. Practice of hybridization techniques in a self-pollinated and cross pollinated plants (any available plant).
4. A visit to agricultural research centre for observation and record of inter variety, inter specified integration plants.
5. Study of tissue culture methodologies.
6. Methods of plant propagation a) Budding b) Grafting c) Rooting d) Layering e) Cutting.

Course Outcomes

1. Understand the science of plant breeding.
2. To introduce the student with branch of plant breeding for the survival of human being from starvation.
3. To study the techniques of production of new superior crop varieties.
4. Understand the modern strategies applied in Genetics and Plant Breeding to sequence and analyze genomes
5. Get the detail knowledge about modern strategies applied in Plant Breeding for crop improvement i.e. Mass selection, Pureline Selection and Clonal selection.
6. Know about exploitation of Heterosis, hybrid and variety development and their release through artificial hybridization.

Pedagogy of Physical Science: Part - II

BED603

Credit: 02 (L 2, T -0)

Contact Hours: 30

MM: 50

After going through the course the teacher trainee will be able:

- To determining planning and organizing aspect in teaching of Science
- To understand the role of lab and use of laboratory experiences for teaching-learning of Science □To facilitate development of scientific attitudes in learners. □To use effectively the different approaches in teaching of Science □To develop ability to use concepts for life skills.
- To understand the nature, importance and strategies of teaching physical science.

Unit I: Planning and Approaches in Teaching:

- Task analysis or pedagogical analysis, identification and organization of concepts for teaching-learning of Science.
- Instructional material required for teaching, identification and writing teaching objectives in behavioral terms, teaching operations, planning ICT applications in learning Science, organizing other activities for teaching-learning of Science.
- Formal Approaches: Observation, experimentation, demonstration, heuristic, project, lecture, laboratory, problem-solving, investigatory approach, concept mapping, programmed instruction, PLA technique, computer assisted instruction.
- Non-Formal approaches: Assignment, tutorials, independent self-study, seminar/conferences, workshop, Science clubs, Science exhibitions, Science fair, Science museum, herbarium, vivarium and scientific hobbies and its advantages.

Unit II: Lesson Planning:

- Meaning and need of lesson planning,
- Characteristics of good lesson plan, types of lesson plan, □Approaches in lesson planning; Herbart and RCEM.
- Design of lesson plan in the content area of Science, simulation teaching skills.
- Unit lesson Planning.

Unit III: Science laboratory and practical work:

- Objectives of laboratory, planning a science laboratory,
- organization of laboratory, types of science lab, rules for maintaining laboratory,
- requirements of apparatus and chemicals for development of science lab at secondary level.
- Laboratory manuals, practical work and record keeping in science lab.

Suggested Reading:

- Bennett, Jeffrey: on teaching Science (print/e-book) Big Kid Science Publication □Bloom, B.S.: Taxonomy of educational objectives, Mckay Co. New Delhi.
- Carin A and B R Sund: Teaching Science through Discovery, Charles E. Merrill Books Inc., Columbus Ohio.
- Chandra, T.: Principles of teaching, Anmol Publication, New Delhi
- Chauhan S.S.: Innovation in teaching, Vikas Publication, New Delhi
- Das, R.C.: Science teaching in schools, Steerling Publication, New Delhi

- Judith Bennett: Teaching and Learning Science: A guide to recent research and its applications, Continuum, London.
- Kulshrestha, S.P.: Teaching of Physical Science, R.Lal Book Depot, Meerut
- Nathan S Washton: Teaching Science Creatively, Saunders Company, London.
- Norman Herr: The source book for teaching Science (e-book/print) Wiley Publication
- Novak D J and D Bob Gowin: Learning how to learn, Press Syndicate of the University of Cambridge, Ohio.
- Pandey, Shashi Kiran: Science teaching, Vani Prakashan, New Delhi
- Pathak, R.P.: Teaching skills, Pearson Publication, New Delhi
- Ralph Martin, Colleen Sexton, Kay Wagner, Jack Gerlovich: Science for All Children: Methods for Constructing Understanding, Allyn and Bacon, London.
- Rawat, D.C.: Teaching of Science, Vinod Pustak, Agra
- Robin Millar: Doing Science: Images of Science in Science Education, The Falmer Press, London.
- School Science Review, The Association for School Education, College Lane, Hatfield, Hertfordshire, AL 109 AA, UK.
- Siddiqui, N.N. & Siddiqui, M.N.: Teaching of Science, Doaba House, New Delhi □Singh, R.: Teaching methods in schools, Commonwealth Publication, Delhi.
- Sood, J.K.: Teaching of Physical Science, Agarwal Publication, Agra
- Steve Alsop, Keith Hicks: Teaching Science: A Handbook for Primary and Secondary School Teachers, Kogan Page, New Delhi.
- Yadav, M.S.: Objective Science, Anmol Publication, New Delhi

Pedagogy of Biological Science: Part - II

Course Code: BED605

Credit: 02 (L 2, T -0)

Contact Hours: 30

MM: 50

After going through the course the teacher trainee will be able to:

- Explore different ways of creating learning situations for different concepts of biological science;
- Formulate meaningful inquiry episodes, problem-solving situations, investigatory and discovery learning projects based on upper primary, secondary and higher secondary stages
- Develop ability to use biological science concepts for life skills
- Estimate the facilities required for the organization and maintenance of Science laboratory □Organize Biology related activities through eco or science club during school attachment.
- study the science laboratories in schools – lay out, facilities, equipments, and materials, specimens, models, and other learning aids available that facilitate learning of Biology. **Course Outline:**

Unit I: Planning for Teaching-Learning Biological Science:

- Task analysis or pedagogical analysis, identification and organization of concepts for teaching-learning of Science.
- Instructional material required for teaching, identification and writing teaching objectives in behavioral terms, teaching operations,
- Organizing laboratory experiences and other activities for teaching-learning of Biological Science,
- Planning ICT applications in learning Science

Unit II: Lesson Planning and Approaches in Teaching:

- Meaning and need of lesson planning, characteristics of good lesson plan, types of lesson plan,
- Approaches in lesson planning. Design of lesson plan in the content area of biological Science, simulation teaching.
- Formal Approaches: Observation, experimentation, demonstration, heuristic, project, lecture, laboratory, problem-solving, investigatory approach, concept mapping, programmed instruction, PLA technique, computer assisted instruction.
- Non-Formal Approaches: Assignment, tutorials, independent self-study, seminar/conferences, workshop, Eco-clubs, exhibitions, fair, museum, herbarium, vivarium etc.

Unit III: Learning Resources in Biological Science:

- Identification and use of learning resources in biological science from immediate environment, exploring alternative sources; Developing Science Kit;
- Designing Science laboratory- Use of science labs – facilities, equipments, materials and manuals, science records; Planning and organizing field observations (visit to botanical garden, science park, science centre, zoo, national laboratories etc);
- Using community resources for biology learning; Pooling of learning resources in school complex/block/ district level; Handling hurdles in utilization of resources.
- Facilitating learning progress of learners with various needs in biology; Ensuring equal partnership of learners with special needs; Stimulating creativity and inventiveness in biology;
- Organizing various curricular activities, such as debate, discussion, drama, poster making on issues related to science/biology; Organizing events on specific day, such as Earth Day, Environment Day, etc.;

Suggested Reading:

- Carin. A & B.R. Sund (1964): Teaching Science through Discovery, Charles E. Merrill Books, Inc., Columbus, Ohio.

- Esler, K. William & Mark. K. Esler (2001): *Teaching Elementary Science* (8th edition) Wadsworth group, Thomas learning, Printed in the USA.
- Gupta S.K. (1983): *Technology of Science Education*, Vikas Publishing House Pvt Ltd, Delhi
- Hein, E. George & S. Price (1994): *Active assessment for Active science- a guide for Elementary school teachers*, Published by Heinemann, Printed in the USA.
- Heiss, E. D. Obourn E.S and Hoffmann C W (1961): *Modern Science teaching* by Macmillan publication, New York.
- Jakab, Cheryl (1990): *Exploring together (Revised Edition) – A science course for Primary schools*, Phoenix Education Private Limited.
- Jennings T (1986): *the young scientist investigates- Teacher’s Book of Practical work*, Oxford University Press, Oxford.
- Keith Skamp (ed) (2004): *Teaching primary science constructively -2nd edition*, Thomson, by Nelson Australia Private Ltd.
- Maheshwari, V. K. and Maheshwari, Sudha (2010): *Teaching of Science*, R. Lall Book depot, Meerut.
- Mason M & Ruth T. Peters: *Teacher guide for Life sciences*, Published by D. Van Nostrand Company, Inc, New york.
- NCERT (1982): *Teaching of Science in Secondary Schools*. New Delhi: NCERT,
- Novak. D.J & D. Bob Gowin (1984): *Learning how to Learn*, published by the press syndicate of the University of Cambridge, Printed in the USA.
- Rawat D. S. (1996): *Biology Teaching*, Agra: Sahitya Prakashan,
- Saunders, N.H. (1962) *The teaching of General science in Tropical secondary schools*; London; Oxford University press.
- Sundarajan, S. (1995): *Teaching Science in Middle School: A Resource Book*. Orient Longman: Hyderabad
- Turner, T & W. Dimarco (1988); *learning to teach science in the secondary school – a companion to school experience*, Published by Routledge, USA.

Open Educational Resources

Course Code: BED603

Credit: 02 (L-2, T-0, P-0)

Course Outline:

Unit I: Introduction of OER

- Introduction: Objectives of Open Educational Resources
- Meaning and definition of OER
- Benefits, History and Development
- Challenges, Uses and Identification of OER
- Institutions Promoting OER: The William and Flora Hewlett Foundation, UNESCO, Commonwealth of Learning

Unit II: Copyright and Open Licensing

- Learning Outcomes
- Understanding Copyright
- Open Licensing
- The Creative Commons Licensing System
- Promoting Open Licensing: Policy, Advocacy and Capacity Building
- Policy
- Advocacy
- Capacity Building

Unit III: Finding and Evaluating of OER

- Types of OER
- Directories, Platforms and Repositories
- Creative Commons License
- Wikipedia
- MERLOT
- YouTube
- Teacher Tube
- Slide share
- Sakshat
- E-Gyankosh
- NROER

Practicum - V
(Workshop On Preparation for Teaching, Simulation and Practice Teaching)

Course Code: BED651
P-4)

Credit: 02 (L-0, T-0,

Contact Hours: 60

MM: 100

Course Outline:

1. Participation in workshop on preparation for teaching.
2. Report writing.
3. Preparation and presentation of 10 Simulation teaching lesson plans (minimum 5 for each teaching subject).
4. Viva – voce.

Note: For successful completion of the course participation in all activities of practicum is compulsory.

**School Internship – II
(For Practice Teaching)**

Course Code: BED671

Duration: 02 Week

After going through the course the teacher trainee will be able: **Course Outline:**

Credit:

MM: 50

1. Participation in Internship for Practice Teaching.
2. Preparation and presentation of minimum 20 practice teaching lesson plans (minimum 10 for each teaching subject).
3. Record Maintenance.
4. Viva – voce. (External)

Note: For successful completion of the course, Participation in all activities of School Internship is compulsory.