Curriculum Framework

B.Sc.-B.Ed. Course (4-Year)

Academic Year 2022-23

INDIAN INSTITUTE OF TEACHER EDUCATION GUJARAT

IITE

॥ न हि ज्ञानेन सदृशं पवित्रमिह विद्यते ॥

Indian Institute of Teacher Education

(State Public University established by Govt. of Gujarat)

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B.Sc.-B.Ed. Course (4-Year)

in force from

Academic Year 2022-23

Semester - I To VIII

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Curriculum Framework B.Sc.-B.Ed Course (4-Year) 2022

Published by

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Registrar

Indian Institute of Teacher Education

Ramkrushna Paramhans Vidya Sankul, Near KH-5, Sector - 15, Gandhinagar - 382016

From the Desk of Vice-Chancellor....

Dear All,

Any curricula at any level should be based on what objectives or goals the educator or educational institution is trying to achieve in regard to students. A course of study for a class that teaches a student how to touch-type should be very different from one that teaches students to write a novel or a poem or even the results of a science experiment.

Therefore, a curriculum is of the utmost importance, as it mandates, among other things, how teachers and students will spend their time—in a lab? in clinical practice? in creating? in listening to lectures? It also clearly shows what a class, a department, a school, or an institution values, what these entities see as their mission, and what each expects its graduates to achieve. A curriculum should be the map to the essentials in any course of study, from the classroom level to the institutional level.

The success of any curriculum, then, should be judged on the basis of whether it achieves its objective. It's a test of how well an educational institution (or an individual teacher) defines and understands those objectives. It's a measure of how well an educational institution (or individual teacher) maps out a way for a student to find his or her way to success as defined by those objectives.

Curriculum consists of continuous chain of activities needed to translate educational goals into concrete activities, materials and observable change in behaviour. A lesson plan for example is a curriculum used by the teacher in the classroom. It answers the questions, "What do I want my students to know? How can I engage them in a series of activities that will maximize their chances of knowing? How can I measure what they have learned from the activities?"

Hence, for a society to achieve its educational goals, it needs a curriculum that is functional and relevant to its needs. Through the management of the curriculum, making use of the given resources in the best possible way. Developing policies to bring improvements in the whole system one can move towards a more promising future.

The curriculum sets the basis of any academic institution, without it, the institution would be a lost cause. As the syllabus would be commonly applied to the affiliated institutes across the state of Gujarat, we have concrete objectives of the system to apply. We have a defined set of aims and objectives for the syllabus that we have planned for our students. That's how we aim to move toward a better academic future for our nation.

It is a matter of great privilege and happiness writing to confirm the unveil of the latest curriculum of one and only university in the state of Gujarat dedicated to teacher education, Indian Institute of Teacher Education, Gandhinagar. We are glad to acknowledge that the latest curriculum has taken due care of the objectives and goals as set by NCFTE 2009 and guiding principles of NEP 2020. I also take the opportunity of appreciating the efforts put in by the teaching faculty of Centre of Education, IITE, Gandhinagar, Members of Board of Studies and Members of Acedemic Council for bringing a concrete neo-curriculum to the effect and application.

Date: 15th Sept., 2020

Gandhinagar

Dr. Harshad A. Patel

From the desk of Vice Chancellor ....

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B.Sc.-B.Ed. Course (4-Year)
in force from
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Semester - I To VIII

Curriculum Framework B.Sc.-B.Ed Course (4-Year)

Frame Work for B.Sc,. Subjects Principal, First Subsidiary and

	B.Sc.	Sem 1			Sem 2			Sem 3			Sem 4			Sem 5		
		Papers	Credit	Total Cr	Papers	Credit	Total Cr	Papers	Credit	Total Cr	Papers	Credit	Total Cr	Papers	Credit	Total Cr
Science (B.Sc.)	Principal	2	3	6	2	3	6	3	3	9	3	3	9	4	3	12
	First Sub	2	3	6	2	3	6	3	3	9	3	3	9			0
	Second Sub	2	3	6	2	3	6			0			0			0
	Total	6	9	18	6	9	18	6	6	18	6	6	18	4	3	12
		9	*16*	*25*	*9*	*16*	*25*	*9*	*13*	*25*	*9*	*13*	*25*	*8*	*17*	*26*

	B.Ed.	Sem 1			Sem 2			Sem 3			Sem 4			Sem 5		
		Papers	Credit	Total Cr	Papers	Credit	Total Cr	Papers	Credit	Total Cr	Papers	Credit	Total Cr	Papers	Credit	Total Cr
Area A: Foundations of Education	Learner Studies	1	3	3			0			0			0			0
				0	1	3	3			0			0			0
	Contemporary Studies			0			0			0			0			0
				0			0			0			0			0
	Educational Studies	1	3	3			0			0			0			0
				0	1	3	3			0			0			0
	Total Area A	2	6	6	2	6	6	0	0	0	0	0	0	0	0	0
Area B: Curriculum and Pedagogy	Curriculum Studies			0			0			0			0	1	3	3
				0			0			0			0			0
				0			0			0			0			0
				0			0	1	3	3			0			0
	Language Proficiency and Curriculum	1	1	1			0			0			0			0
				0	1	1	1			0			0			0
				0			0	1	1	1			0			0
				0			0			0	1	1	1			0
				0			0			0			0	1	3	3
	Pedagogical Studies			0			0	1	3	3			0			0
				0			0	1	3	3			0			0
				0			0			0	1	3	3			0
				0			0			0	1	3	3			0
				0			0			0			0			0
	Assessment & Evaluation Studies			0			0			0			0	1	3	3
	Enhancing Professional Capabilities (Tool Courses)			0			0			0			0			0
				0			0			0			0			0
				0			0			0			0			0
				0			0			0			0			0
	Total Area B	1	1	1	1	1	1	3	7	7	3	7	7	3	9	9
Area C: Sch. Internship	School Internship			0			0			0				1	5	5
				0			0			0			0			0
				0			0			0			0			0
				0			0			0			0			0
	Total Area C	0	0	0	0	0	0	0	0	0	0	0	0	1	5	5
	Overall B.Sc. B.Ed.	3	7	7	3	7	7	3	7	7	3	7	7	4	14	14

Second Subsidiary and B.Ed.

Subjects offered as Principal/ First Subsidiary/ Second Subsidiary	Sem 6			Sem 7			Sem 8			Total		
	Papers	Credit	Total Cr	Papers	Credit	Total Cr	Papers	Credit	Total Cr	Papers	Credit	Total Cr
Physics, Chemistry, Mathematics, Botany and Zoology	4	3	12	4	3	12	4	3	12	26	24	78
			0			0			0	10	12	30
			0			0			0	4	6	12
	4	3	12	4	3	12	4	3	12	40	42	120
	9	*17*	*26*	*8*	*15*	*24*	*8*	*15*	*24*	*69*	*122*	*200*
	Sem 6			Sem 7			Sem 8			Total		
Titles of Papers B.Ed.	Papers	Credit	Total Cr	Papers	Credit	Total Cr	Papers	Credit	Total Cr	Papers	Credit	Total Cr
Psychology of Learner			0			0			0	1	3	3
Learning & Teaching			0			0			0	1	3	3
Teacher & Learner in Society	1	3	3			0			0	1	3	3
Gender, School and Society			0			0	1	3	3	1	3	3
Perspectives in Education			0			0			0	1	3	3
Developing the Self			0			0			0	1	3	3
	1	3	3	0	0	0	1	3	3	6	18	18
Curriculum Development Principles			0			0			0	1	3	3
Knowledge and Curriculum	1	3	3			0			0	1	3	3
Inclusive Education			0	1	3	3			0	1	3	3
ICT in Curriculum						0			0	1	3	3
Gujarati Language			0			0			0	1	1	1
English Language			0			0			0	1	1	1
Hindi Language			0			0			0	1	1	1
Classical Sanskrit			0			0			0	1	1	1
Language across the curriculum			0			0			0	1	3	3
General Pedagogy for Maths and Science (O)			0			0			0	1	3	3
General Pedagogy for Lang., Soc. Sci. and Com.(O)			0			0			0	1	3	3
Pedagogy of Teaching Method 1			0			0			0	1	3	3
Pedagogy of Teaching Method 2			0			0			0	1	3	3
Advance Pedagogy	1	3	3			0			0	1	3	3
Assessment and Evaluation in Learning			0			0			0	1	3	3
Reflective Reading			0	1	1	1			0	1	1	1
Art in Education			0	1	1	1			0	1	1	1
Environment Edu/ Yoga in Edu/ Edu Management	1	1	1						0	1	1	1
Edu Statistics/Guidance & Counselling/Value Edu.			0			0	1	1	1	1	1	1
	3	7	7	3	5	5	1	1	1	18	38	38
Pre-practice Teaching (Micro-Simulation)			0			0			0	1	5	5
Practice Teaching (Stray Lessons)	1	4	4			0			0	1	4	4
Block Teaching			0				*1*	*4*	4	1	4	4
Internship & annual Lesson			0	1	7	7	1	4	4	2	11	11
	1	4	4	1	7	7	2	8	8	5	24	24
Overall B.Sc. B.Ed.	5	14	14	4	12	12	4	12	12	29	80	80

Curriculum Framework : Education

Sr. No.	Sem.	Paper Code	Title of the paper	Nature	Theory / Practical	Credit	Hours
1	1	191110	Psychology of Learner	C C	Theory	3	45
2	1	191310	Perspectives in Education	C C	Theory	3	45
3	1	192210	Gujarati Language	C C	Practical	1	30
4	2	191120	Learning and Teaching	C C	Theory	3	45
5	2	191320	Developing the Self	C C	Theory	3	45
6	2	192220	English Language	C C	Practical	1	30
7	3	192140	ICT in Curriculum	C C	Theory	3	45
8	3	192230	Hindi Language	C C	Practical	1	30
9	3	192311	General Pedagogy for Maths and Sciences (O)	C O	Theory	3	45
10	4	192240	Classical Sanskrit	C C	Practical	1	30
11	4	192331	Pedagogy of Mathematics	C O	Theory	3	45
12	4	192332	Pedagogy of Science	C O	Theory	3	45
13	5	192110	Curriculum Development Principles	C C	Theory	3	45
14	5	192250	Language across the Curriculum	C C	Theory	3	45
15	5	192510	Assessment and Evaluation in Learning	C C	Theory	3	45
16	5	193110	Pre-Practice Teaching	C C	Practical	5	150
17	6	191210	Teacher & Learner in Society	C C	Theory	3	45
18	6	192120	Knowledge and Curriculum	C C	Theory	3	45
19	6	192450	Advance Pedagogy	C C	Theory	3	45
20	6	192711	Environment Education (O1)	C O	Practical	1	30
21	6	192712	Yoga in Education (O1)	C O	Practical	1	30
22	6	192713	Educational Management (O1)	C O	Practical	1	30
23	6	193120	Practice Teaching	C C	Practical	4	120
24	7	192130	Inclusive Education	C C	Theory	3	45
25	7	192610	Reflective Reading	C C	Practical	1	30
26	7	192620	Art in Education	C C	Practical	1	30
27	7	193130	Internship	C C	Practical	7	210
28	8	191220	Gender, School and Society	C C	Theory	3	45
29	8	192821	Educational Statistics (O2)	C O	Practical	1	30
30	8	192822	Guidance and Counselling (O2)	C O	Practical	1	30
31	8	192823	Value Education (O2)	C O	Practical	1	30
32	8	193140	Block Teaching & Internship	C O	Practical	8	240

Curriculum Framework : Mathematics

Sr. No.	Sem.	Paper Code	Title of the paper	Nature	Theory / Practical	Credit	Hours
1	1	111010	Calculus-I	CC	Theory	3	45
2	1	111020	Practical: Calculus-I	CC	Practical	3	90
3	2	111030	Linear Algebra	CC	Theory	3	45
4	2	111040	Practical: Linear Algebra	CC	Practical	3	90
5	3	111050	Calculus-II	CC	Theory	3	45
6	3	111060	Co-ordinate Geometry	CC	Theory	3	45
7	3	111070	Practical: Calculus-II & Co-ordinate Geometry	CC	Practical	3	90
8	4	111080	Differential Equations	CC	Theory	3	45
9	4	111090	Numerical Analysis	CC	Theory	3	45
10	4	111100	Practical: Differential Equations & Numerical Analysis	CC	Practical	3	90
11	5	111110	Mathematical Analysis-I	CC	Theory	3	45
12	5	111120	Abstract Algebra-I	CC	Theory	3	45
13	5	111130	Practical: Mathematical Analysis-I & Abstract Algebra-I	CC	Practical	3	90
14	5	111141	Probability and Statistics	CO	Theory	3	45
15	5	111142	Graph Theory	CO	Theory	3	45
16	6	111150	Complex Analysis-I	CC	Theory	3	45
17	6	111160	Metric Space	CC	Theory	3	45
18	6	111170	Practical: Complex Analysis-I & Metric Space	CC	Practical	3	90
19	6	111181	Elementary Number Theory	CO	Theory	3	45
20	6	111182	Combinatorics and Fuzzy Set	CO	Theory	3	45
21	7	111190	Mathematical Analysis-II	CC	Theory	3	45
22	7	111200	Abstract Algebra-II	CC	Theory	3	45
23	7	111210	Practical: Mathematical Analysis-II & Abstract Algebra-II	CC	Practical	3	90
24	7	111221	Mathematical Modeling	CO	Theory	3	45
25	7	111222	Transform Theory	CO	Theory	3	45
26	8	111230	Complex Analysis-II	CC	Theory	3	45
27	8	111240	Theory of Equations	CC	Theory	3	45
28	8	111250	Practical: Complex Analysis-II & Theory of Equations	CC	Practical	3	90
29	8	111261	Linear Programming	CO	Theory	3	45
30	8	111262	Dynamics and Statics	CO	Theory	3	45

Curriculum Framework : Physics

Sr. No.	Sem	Paper Code	Title of the Paper/Course	Nature	Type	Credit	Hour
1	1	123010	Mechanics and Semiconductor Physics	CC	Theory	3	45
2	1	123020	Physics Practical I	CC	Practical	3	90
3	2	123030	Optics and Wave Theory	CC	Theory	3	45
4	2	123040	Physics Practical II	CC	Practical	3	90
5	3	123050	Electricity, Magnetism and Electromagnetic Theory	CC	Theory	3	45
6	3	123060	Nuclear Physics	CC	Theory	3	45
7	3	123070	Physics Practical III	CC	Practical	3	90
8	4	123080	Elements of Modern Physics	CC	Theory	3	45
9	4	123090	Electronics	CC	Theory	3	45
10	4	123100	Physics Practical IV	CC	Practical	3	90
11	5	123110	Solid State Physics	CC	Theory	3	45
12	5	123120	Thermodynamics and Statistical Physics	CC	Theory	3	45
13	5	123130	Physics Practical V	CC	Practical	3	90
14	5	123141	Atmospheric and Space Science	CO	Theory	3	45
15	5	123142	Elements of Experimental Physics	CO	Theory	3	45
16	6	123150	Classical Mechanics and Relativity	CC	Theory	3	45
17	6	123160	Electrodynamics and Plasma Physics	CC	Theory	3	45
18	6	123170	Physics Practical VI	CC	Practical	3	90
19	6	123181	Introduction to Nanoscience and Applications	CO	Theory	3	45
20	6	123182	Instrumentation and Sensors	CO	Theory	3	45
21	7	123190	Mathematical Physics	CC	Theory	3	45
22	7	123200	Solid State and Digital Electronics	CC	Theory	3	45
23	7	123210	Physics Practical VII	CC	Practical	3	90
24	7	123221	Applied Crystallography and Bio Physics	CO	Theory	3	45
25	7	123222	Astronomy and Astrophysics	CO	Theory	3	45
26	8	123230	Quantum Mechanics	CC	Theory	3	45
27	8	123240	Atomic and Molecular Spectroscopy	CC	Theory	3	45
28	8	123250	Physics Practical VIII	CC	Practical	3	90
29	8	123261	Numerical Techniques	CO	Theory	3	45
30	8	123262	Nonconventional Energy Resources	CO	Theory	3	45

Curriculum Framework : Chemistry

Sr. No.	Sem	Paper Code	Title of the Paper/Course	Nature	Type	Credit	Hour
1	1	122010	Basic Organic Chemistry	CC	Theory	3	45
2	1	122020	Chemistry Practical-1	CC	Practical	3	90
3	2	122030	Chemical Bonding	CC	Theory	3	45
4	2	122040	Chemistry Practical-2	CC	Practical	3	90
5	3	122050	Physical Chemistry-I	CC	Theory	3	45
6	3	122060	Chemistry of Hydrocarbons	CC	Theory	3	45
7	3	122070	Chemistry Practical-3	CC	Practical	3	90
8	4	122080	Organic Chemistry-I	CC	Theory	3	45
9	4	122090	Inorganic Chemistry-I	CC	Theory	3	45
10	4	122100	Chemistry Practical-4	CC	Practical	3	90
11	5	122110	Organic Chemistry-II	CC	Theory	3	45
12	5	122120	Physical chemistry-II	CC	Theory	3	45
13	5	122130	Chemistry Practical-5	CC	Practical	3	90
14	5	122141	Polymer Chemistry	CO	Theory	3	45
15	5	122142	Inorganic Chemistry-II	CO	Theory	3	45
16	6	122150	Organic Chemistry-III	CC	Theory	3	45
17	6	122160	Thermodynamics	CC	Theory	3	45
18	6	122170	Chemistry Practical-6	CC	Practical	3	90
19	6	122181	Environmental Chemistry	CO	Theory	3	45
20	6	122182	Advanced Inorganic Chemistry-I	CO	Theory	3	45
21	7	122190	Heterocyclic and Organometallic Chemistry	CC	Theory	3	45
22	7	122200	Chromatography	CC	Theory	3	45
23	7	122210	Chemistry Practical-7	CC	Practical	3	90
24	7	122221	Industrial Chemistry-I	CO	Theory	3	45
25	7	122222	Advanced Inorganic Chemistry-II	CO	Theory	3	45
26	8	122230	Spectroscopy	CC	Theory	3	45
27	8	122240	Green Chemistry	CC	Theory	3	45
28	8	122250	Chemistry Practical-8	CC	Practical	3	90
29	8	122261	Industrial Chemistry-II	CO	Theory	3	45
30	8	122262	Advanced Physical Chemistry	CO	Theory	3	45

Curriculum Framework : Botany

Sr. No.	Sem	Paper Code	Title of the Paper/Course	Nature	Type	Credit	Hour
1	1	121010	Cryptogamic Botany I	CC	Theory	3	45
2	1	121020	Practical in Plant Science I	CC	Practical	3	90
3	2	121030	Cryptogamic Botany II	CC	Theory	3	45
4	2	121040	Practicals in Plant Science II	CC	Practical	3	90
5	3	121050	Gymnosperm and Paleobotany	CC	Theory	3	45
6	3	121060	Plant Taxonomy	CC	Theory	3	45
7	3	121070	Practicals in Plant Science III	CC	Practical	3	90
8	4	121080	Plant Embryology	CC	Theory	3	45
9	4	121090	Plant Anatomy	CC	Theory	3	45
10	4	121100	Practicals in Plant Science IV	CC	Practical	3	90
11	5	121110	Fundamentals of Microbiology	CC	Theory	3	45
12	5	121120	Cell Biology	CC	Theory	3	45
13	5	121130	Practicals in Plant Science V	CC	Practical	3	90
14	5	121141	Biostatistics &Bioinformatics	CO	Theory	3	45
15	5	121142	Biodiversity	CO	Theory	3	45
16	6	121150	Biochemistry and Enzymology	CC	Theory	3	45
17	6	121160	Plant Physiology & Metabolism	CC	Theory	3	45
18	6	121170	Practicals in Plant Science VI	CC	Practical	3	90
19	6	121181	Plant Pathology	CO	Theory	3	45
20	6	121182	Economic Botany	CO	Theory	3	45
21	7	121190	Genetics and Evolution	CC	Theory	3	45
22	7	121200	Plant Ecology	CC	Theory	3	45
23	7	121210	Practicals in Plant Science VII	CC	Practical	3	90
24	7	121221	Horticulture	CO	Theory	3	45
25	7	121222	Environmental Biology	CO	Theory	3	45
26	8	121230	Molecular Biology	CC	Theory	3	45
27	8	121240	Plant Tissue Culture	CC	Theory	3	45
28	8	121250	Practicals in Plant Science VIII	CC	Practical	3	90
29	8	121261	Ethnobotany and Herbalism	CO	Theory	3	45
30	8	121262	Plant Breeding	CO	Theory	3	45

Curriculum Framework : Zoology

Sr. No.	Sem	Paper Code	Title of the Paper/Course	Nature	Type	Credit	Hour
1	1	124010	Invertebrate Zoology	CC	Theory	3	45
2	1	124020	Practicals in Zoology -1	CC	Practical	3	90
3	2	124030	Cell and Molecular Biology	CC	Theory	3	45
4	2	124040	Practicals in Zoology -2	CC	Practical	3	90
5	3	124050	Principles of Evolution & Genetics	CC	Theory	3	45
6	3	124060	Vertebrate Zoology	CC	Theory	3	45
7	3	124070	Practicals in Zoology -3	CC	Practical	3	90
8	4	124080	Fundamentals of Microbiology	CC	Theory	3	45
9	4	124090	Immunology & Haematology	CC	Theory	3	45
10	4	124100	Practicals in Zoology -4	CC	Practical	3	90
11	5	124110	Animal Anatomy	CC	Theory	3	45
12	5	124120	Applied Zoology	CC	Theory	3	45
13	5	124130	Practicals in Zoology -5	CC	Practical	3	90
14	5	124141	Biostatistics and Bioinformatics	CO	Theory	3	45
15	5	124142	Animal Diversity in India	CO	Theory	3	45
16	6	124150	Reproductive and Developmental Biology	CC	Theory	3	45
17	6	124160	Basics of Biochemistry	CC	Theory	3	45
18	6	124170	Practicals in Zoology -6	CC	Practical	3	90
19	6	124181	Endocrinology	CO	Theory	3	45
20	6	124182	Mammalian Physiology	CO	Theory	3	45
21	7	124190	Animal Husbandary	CC	Theory	3	45
22	7	124200	Wildlife and Conservation Biology	CC	Theory	3	45
23	7	124210	Practicals in Zoology -7	CC	Practical	3	90
24	7	124221	Ecology and Environmental Science	CO	Theory	3	45
25	7	124222	Fisheries and Marine biology	CO	Theory	3	45
26	8	124230	Animal Biotechnology	CC	Theory	3	45
27	8	124240	Animal Behaviour	CC	Theory	3	45
28	8	124250	Practicals in Zoology -8	CC	Practical	3	90
29	8	124261	Embryology	CO	Theory	3	45
30	8	124262	Analytical Techniques	CO	Theory	3	45

Curriculum Framework for **B.Sc.-B.Ed. Course (4-Year)** in force from Academic Year 2022-23

Semester - I

Any three subjects of Science (Mathematics, Physics, Chemistry, Botany and Zoology) will have to be opted by the student.

Semester - I								
			Total Papers	Hours	Credit	Internal	External	Total
Education	Education	Theory/ Practical	2+1	120	7	75	175	250
B.Sc (Science)	Principal	Theory/ Practical	1+1	90+45	6	60	140	200
	First Subsidiary	Theory/ Practical	1+1	90+45	6	60	140	200
	Second Subsidiary	Theory/ Practical	1+1	90+45	6	60	140	200
		Total	**9**	**525**	**25**	**255**	**595**	**850**

Sr. No.	**Subject**	**Title of the paper**	**T/P**	**Hours**	**Credit**	**Internal**	**External**	**Total**
1	Education	Psychology of Learner	Theory	45	3	30	70	100
2	Education	Perspectives in Education	Theory	45	3	30	70	100
3	Education	Gujarati Language	Practical	30	1	15	35	50
4	Mathematics	Calculus-I	Theory	45	3	30	70	100
5	Mathematics	Practical: Calculus-I	Practical	90	3	30	70	100
6	Physics	Mechanics and Semiconductor Physics	Theory	45	3	30	70	100
7	Physics	Physics Practical I	Practical	90	3	30	70	100
8	Chemistry	Basic Organic Chemistry	Theory	45	3	30	70	100
9	Chemistry	Chemistry Practical-1	Practical	90	3	30	70	100
10	Botany	Cryptogamic Botany 1	Theory	45	3	30	70	100
11	Botany	Practical in Plant Science I	Practical	90	3	30	70	100
12	Zoology	Invertebrate Zoology	Theory	45	3	30	70	100
13	Zoology	Practicals in Zoology -1	Practical	90	3	30	70	100

Any three subjects of Science (Mathematics, Physics, Chemistry, Botany and Zoology) will have to be opted by the student.

EDUCATION

Sem

I

LS 1: Psychology of Learner

Compulsory

Marks : 70 + 30

Objectives

To enable the prospective teachers

- To develop insight about Educational Psychology and the stages of human growth and development
- To understand different theories of Development and its implication in real classroom scenario
- To understand and imply theories of Intelligence, Personality and Creativity
- To understand Mental Health and Adjustment

Unit 1: Educational Psychology & Growth and Development

1.1 Psychology: Concept; Educational Psychology: Concept, Scope and Significance

1.2 Growth, Development & Maturity: Concept, Principles and Factors affecting Growth and Development

1.3 Stages of Human Development: Characteristics and Educational Implications

1.4 Adolescence: Concept, Characteristics, Challenges and Educational Implications

Unit 2: Developmental Theories: Concept, Stages and Characteristics

2.1 Piaget's Cognitive Development Theory

2.2 Vygotsky's Theory of Cognitive Development

2.3 Kohlberg's Moral Development Theory

2.4 Erickson's Theory of Psycho-Socio Development

Unit 3: Intelligence, Personality and Creativity

3.1 Individual Difference: Concept, areas of Individual Differences, Educational Implications

3.2 Intelligence: Concept and theories (Two factor theory, Guilford's SOI) Measurement of Intelligence and its Educational implications

3.3 Personality: Concept, Factors, Types of Personality (Introvert, Extrovert).

3.4 Creativity: The Concept, difference between Creativity and Intelligence, Techniques of fostering creativity

Unit 4: Mental Health and Adjustment

4.1 Mental Health: Concept, Factors affecting Mental Health, Concept of Mental Hygiene

4.2 Adjustment: Concept, Characteristics and Maladjustment

4.3 Defence Mechanisms: Types and Implications

4.4. Group Dynamics: Concept & Implications, Sociometry.

Sem I

ES 1: Perspectives in Education

Compulsory

Marks : 70 + 30

Objectives

To enable the prospective teachers

- To understand the Education as a System in India and Education envisioned by Indian Thinkers
- To understand the importance of Development of Education System
- To understand the policies implemented in Post-independance Era
- To appreciate the futuristic National Polices being introduced

Unit 1: Education

1.1 Concept of Philosophy and Education; Significance of Education
1.2 Types of Education: Formal, Informal, Non-formal
1.3 Education perceived by Gandhiji, Vivekanand, Rabindranath Tagore, Maharshi Aurbindo
1.4 Ancient Educational Institutions: Takshashila, Nalanda and Valabhi

Unit 2: Education in India

2.1 Education in Ancient India: Vedic System of Education
2.2 Efforts of Strengthening Education System through Math, Mandir, Pathshala and Madressa
2.3 Reformation through Education in Indian Societies: Raja Rammonan Ray, Dayanand Sarswati, Thiruvalluvar, Sant Gyaneshwar
2.4 Wardha Scheme of Basic Education (Nai Talim)

Unit 3: Education in Post Independent India

3.1 Radhakrishna Commission, Secondary Education Commission
3.2 Kothari Commission
3.3 National Policy on Education 1986, Programme of Action 1992
3.4 RTE Act 2009

Unit 4: National Education Policy 2020

4.1 Restructuring School Education: 5 + 3 + 3 + 4 and Early Childhood Care and Education
4.2 School Curriculum and Pedagogy
4.3 Teacher
4.4 Promotion of Indian Languages, Art and Culture; Online and Digital Education

Sem I

LPC 1: Gujarati Language

Compulsory

Marks : 35 + 15

હેતુઓ

- પ્રશિક્ષણાર્થીઓનો વિવિધ પ્રવૃત્તિઓ દ્વારા ગુજરાતી ભાષામાં શ્રવણ, લેખન, કથન અને વાંચન કૌશલ્યનો વિકાસ થાય.
- પ્રશિક્ષણાર્થીઓ અર્થગ્રહણ સાથે ધ્યાનપૂર્વક સાંભળતા શીખે.
- પ્રશિક્ષણાર્થીઓ પોતાના વિચારો શુદ્ધભાષામાં વિનય અને વિવેકપૂર્વક અભિવ્યક્ત કરતાં શીખે.
- પ્રશિક્ષણાર્થીઓ ધ્યાનપૂર્વક, સ્પષ્ટ, શુદ્ધ અને યોગ્ય ગતિથી અર્થઘટન સાથે વાંચતા શીખે.
- પ્રશિક્ષણાર્થીઓ પોતાના વિચારો ક્ષોભ, શરમ, સંકોચ વિના અને યોગ્ય પ્રવાહી શૈલીમાં અભિવ્યક્ત કરતાં શીખે.

યુનિટ : ૧ શ્રવણ અને લેખન કૌશલ્ય આધારિત પ્રવૃત્તિઓ.

1.1 https://www.youtube.com/watch?v=h9OM--rX0Jc - youtube પરથી મનુભાઈ પંચોળી 'દર્શક' લિખિત દીપનિર્વાણ પુસ્તકનો આસ્વાદ સાંભળો અને ચિંતન કરો.

1.2 https://www.youtube.com/watch?v=iKaIzzuDp0o - youtube પરથી અશોક વ્યાસની મુલાકાત સાંભળો અને ચિંતન કરો.

1.3 ગુજરાતી ભાષાના કોઈ એક નામાંકિત વક્તાના વક્તવ્યની વિડીયો/ઓડિયો ક્લિપ સાંભળો.

1.4 ગુજરાતી ભાષાની કોઈ એક કાવ્ય રચના અને તેના આસ્વાદની વિડીયો/ઓડિયો ક્લિપ સાંભળો.

1.5 https://www.youtube.com/watch?v=7H58DXWLe8E - આ youtube પરથી હાસ્ય લેખક "રતિલાલ બોરીસાગર"ની મુલાકાત સાંભળો અને ચિંતન કરો.

(પ્રશિક્ષણાર્થીઓએ ક્રમ 1 થી 5 ની પ્રવૃત્તિ જાતે પસંદ કરવાની અને પ્રવૃત્તિનો અહેવાલ પાવર પોઇન્ટ પ્રેઝેંટેશન, બ્લોગ જેવા સ્વરૂપે લેખિતમાં રજૂ કરવો. જેમા શ્રવણ કૌશલ્યની પ્રવૃતિની લિંકની નોંધ કરવાની રહેશે.)

યુનિટ : ૨ વાચન અને કથન કૌશલ્ય આધારિત પ્રવૃત્તિઓ.

2.1 કોઈપણ બે કાવ્યોનું આદર્શ કાવ્ય પઠન કરવું.

2.2 ગુજરાતી સમાચાર પત્ર અથવા સામયિકમાંથી કોઈપણ બે લેખકોના કોલમનું વાંચન કરવું.

2.3 ગુજરાતી ભાષા સાહિત્યના કોઈ એક સાહિત્ય સ્વરૂપની વિશેષતા વાંચો.

2.4 કોઈ પણ એક મહાપુરુષના જીવન-ચિત્રનું આદર્શ વાંચન કરવું.

2.5 તોતોચાન અથવા દિવાસ્પનનું વાંચન કરવું.

નોંધ : વિભાગ અ અને વિભાગ બ આધારે કાર્યશાળા કે પ્રવૃત્તિનું આયોજન કરવું.

- સુપરત કાર્ય માટે પ્રશિક્ષણનાર્થીઓ અ વિભાગમાંથી કોઈ એક પ્રવૃત્તિ પસંદ કરીને તેનું ઓછામાં ઓછા 250 શબ્દોમાં લેખનકાર્ય જમા કરાવશે.
- બ વિભાગમાંથી કોઈ એક પ્રવૃત્તિ પસંદ કરીને વર્ગમાં ઓછામાં ઓછી ૫ થી ૧૦ મિનિટ મૌખિક અભિવ્યક્તિ કરવાની રહેશે.
- વૈવિધ્યતા જળવાઈ રહે તે માટે આ બન્ને વિભાગમાંથી ઓછામાં ઓછી ત્રણ પ્રવૃત્તિ દરેક સંસ્થાએ કરવી જરૂરી છે.
- પ્રશિક્ષણાર્થીએ આપેલ અહેવાલના આધારિત તેનું પ્રાયોગિક કાર્ય પૂર્ણ ગણવામાં આવશે.

MATHEMATICS

Sem

I

Calculus-I

Compulsory

Marks : 70 + 30

Objectives

- To Understand geometrical approach of limit, continuity, differentiability of a real function.
- To Understand convergence criteria of sequence and series.
- To acquire the Knowledge of convergence of sequence and series.
- To Apply the knowledge of Partial derivative to a real phenomenon.

Learning Outcomes

This course will enable students to

- Find limit, continuity and derivative of the function
- Apply reduction formula to find integrals
- Check the convergence of sequence and series.
- Apply Euler's theorem to homogeneous function

Unit 1 Limit and Continuity of a function

1.1 Limits, Continuity and Derivative

1.2 Successive Differentiation

1.3 Mean Value theorems: Rolle's mean value theorem, Lagrange's mean value theorem, Different forms of LMVT, Cauchy's mean value theorem

1.4 Applications of MVTs

Unit 2 Improper Integral

2.1 Definite Integral

2.2 Fundamental theorem of calculus

2.3 Reduction Formula

2.4 Improper Integral: Improper integrals of the first and second kind

Unit 3 Sequence and Series

3.1 Infinite Sequences and Series: Definition of Sequence and Series

3.2 Convergent and divergent series of real numbers, sum of series

3.3 Different test of convergence of infinite series-convergence of geometric series, comparison test, practical comparison test, D'Alembert ratio test, Cauchy's root test, alternating series, power series

3.4 Taylor's and Maclaurin's Theorems (without proof), Expansions of some standard functions as infinite power series without validity of the expansions

Unit 4 Partial Derivatives

4.1 Differential of function of two variables, Chain rules for differentiability, derivatives of implicit functions

4.2 Homogeneous functions, Euler's theorem for homogeneous functions of n-variables, Directional Derivatives, Gradient Vectors

4.3 Extreme values of functions of two variables and its converse

4.4 Lagrange's method of undetermined multipliers (only problems to be asked)

Sem
I

Practical: Calculus-I

Compulsory

Marks : 70 + 30

Objectives

- To Understand geometrical approach of limit, continuity, differentiability of a real function.
- To Understand convergence criteria of sequence and series.
- To acquire the Knowledge of convergence of sequence and series.
- To Apply the knowledge of Partial derivative to a real phenomenon.

Learning Outcomes

- Find limit, continuity and derivative of the real function
- Evaluate the improper integral
- Check the convergence of infine series.
- Verify Euler's theorem to homogeneous function

List of Practicals (Problems)

1. Geometrical interpretation of M.V.T. Problems on M.V.T.
2. Examples of finding limits using definition of limits
3. Reduction formula for integration of sin^n x,cos^n x,sin^p xcos^q x,tan^n x, cot^n x,cosec^n x,sec^n x
4. Discuss convergence of the infinite series (Comparison test, Practical comparison test, Ratio test, root test)
5. Practical based on Power series.
6. Examples using Leibnitz's test
7. Series expansion of some basic functions using Taylor theorem.
8. Series expansion of some basic functions using Maclaurin's theorem.
9. Examples on limit, continuity and differentiation of function of several variables using definition
10. Examples Euler's theorem and examples on extreme values
11. Examples based on gradient vectors.

PHYSICS

Sem I

Mechanics and Semicondutor Physics

Core Compulsory

Marks : 70 + 30

Objectives

- This paper reviews the concepts of mechanics learnt at school from a more advanced perspective and goes on to build new concepts.
- It begins with Vector analysis; Newton's Laws of Motion and ends with the Elasticity.
- The students will be able to apply the concepts learnt to several real world problems.

Learning Outcomes

- Upon completion of this course, students are expected to understand the following concepts:
- Understand the role of laws of motion and their application to various dynamical situations.
- Understand the phenomena of Newton`s law, phenomenon of rotational dynamics, understand angular momentum of a system of particle, understand concept of Geosynchronous orbits.
- Understand the concept of Elasticity along with different method.

UNIT 1

1.1 Laws of Motion: Newton's Laws of motion, Concept of Centre of Mass, Center of Mass of Two Particles and Several group of Particles, Linear of Momentum and its Conservation Principle, Collisions, Inelastic Collisions, Elastic Collisions (one dimension and two dimension explanation), Numerical Examples.

1.2 Rotational Dynamics: Angular Velocity, Angular Acceleration, Torque of a Force about the Axis of Rotation, Moment of Inertia (M.I) and $\tau = I\alpha$, Moment of Inertia of rectangular Bar, Moment of Inertia of Solid Cylinder, Angular Momentum, Conservation of angular momentum, Kinetic Energy of a Rigid body, Two Theorems on Moment of Inertia. Numerical Examples.

UNIT 2

2.1 Gravitation: Newton's Law of Gravitation, Gravitation Potential Energy, Gravitation potential, Gravitational field, Calculation of Gravitational Potential and Field due to a Point Mass

2.2 Kepler's laws: Statement of the three Kepler's Laws, Satellite in circular orbit and applications, Geosynchronous orbits.

UNIT 3

3.1 Elasticity:Elasticity,Stress and Strain, Hooke's law. Relation between Longitudinal Stress and Strain (stress-strain diagram), Modulus of Elasticity, Poisson's Ratio, Modulus of rigidity, Young modulus, Determination of Young modulus by Searle's method.

3.2 Pendulums:Bar pendulum, Torsional pendulum, Statistical method (Horizontal twisting apparatus for a rod). Maxwell's vibrating needle method. Determination of M.I with the help of torsional pendulum, bending of beam, bending moment.

Unit 4

4.1 Semiconductor physics: Introduction, Semiconductor materials, Energy levels, Extrinsic semiconductors: N-type & P-type Semiconductor,

4.2 Semiconductor Diode: The ideal diode, Static and Dynamics Resistance of a diode. Zener Diode, Zener Breakdown, V-I Characteristic of a Zener diode

Sem

I

Physics Practical I

Core Compulsory

Marks : 70 + 30

Objectives

To learn about different experiments in mechanics and Electronics

Learning Outcomes

After learning the course, students will be able to learn practically different concepts of mechanics.

List Of Experiments

1. Find out the acceleration due to gravity by simple pendulum
2. To determine the surface tension of the given liquid
3. To determine the modulus of rigidity of material of given wire by Maxwell needle
4. Young's modulus by Searle's method
5. Young's modulus by cantilever method
6. Young's modulus by bending method
7. To determine moment of Inertia and modulus of rigidity using Torsional pendulum
8. To determine the Poisson's ratio of rubber tube.
9. To determine 'g' and radius of gyration using Bar Pendulum
10. Characteristics of pn junction diode
11. Characteristics of Zener diode as a voltage regulator

CHEMISTRY

Sem
I

Basic Organic Chemistry

Compulsory

Marks : 70 + 30

Objectives

- To understand the basic terms such as Hybridization, bond length, bond energy, bond angle, localized and delocalized chemical bond, resonance, conditions of resonance
- To get idea about Nature of fission of covalent bond, type of reagents: nucleophiles, electrophiles, and reaction intermediates
- To conceptualize elements of symmetry, molecular chirality, enantiomers, stereogenic centre, optical activity, properties of enantiomers, chiral and achiral molecules
- To understand the basic concepts of nomenclature for organic molecules

Learning Outcomes

- Students can understand the atomic and molecular basis of organic chemistry
- They can know t h e impact of organic chemistry on the fields of medicine, pharmacy and its impact on the global economy
- They can understand the fundamental principles of molecular structure and shape as they relate to organic molecules and their properties
- Students can learn the basics of stereochemistry
- They can identify organic molecules by functional group: alkane, alkene, alkyne, haloalkane, alcohol, thiol, ether, sulfide, amine, aldehyde, ketone, carboxylic acid and carboxylic acid derivatives
- How to do organic nomenclature and its symbolism and can learn also the fundamental principles of functional group convers ion and organic synthesis

UNIT 1: Structure of Organic Molecules

1.1 Classical concepts of binding
1.2 Valence of Carbon
1.3 Bond length and Bond Energy
1.4 Modern concept of bonding
1.5 Hybridization of Carbon (sp, sp2, sp3)
1.6 Hybridization of Nitrogen
1.7 Hybridization of Oxygen
1.8 Resonance concept
1.9 Hydrogen Bonding in organic molecules

UNIT 2: Organic reactions and their Mechanism

2.1 Inductive Effect
2.2 Mesomeric Effect
2.3 Electrometric Effect
2.4 Homolytic and Heterolytic Fission
2.5 Carbocations and Carbanions
2.6 Free radicals and Carbenes
2.7 Hyper conjugation
2.8 Electrophiles and Nucleophiles
2.9 Types of Organic Reactions
2.10 Types of Reaction Mechanism
2.11 Exothermic and Endothermic reactions

UNIT 3: Stereochemistry of Organic compounds

3.1 Constitutional (Structural) Isomerism
3.2 Geometrical Isomerism
3.3 Optical Isomerism and Optical Activity
3.4 Enantiomers and Diastereomers
3.5 Meso Compounds and Chirality
3.6 Resolution of Racemic Mixtures
3.7 D & L and R & S system of nomenclature
3.8 Absolute Configuration
3.9 E & Z Systems of Configuration
4.0 Introduction to Newman projections and sawhorse formulae
4.1 Fischer and flying wedge formulae

UNIT 4: Nomenc¬lature of Organic Compounds

4.1 Types of Organic Compounds
4.2 Functional Groups
4.3 Homologous Series
4.4 IUPAC System of Nomenclature
4.5 Rules of IUPAC Nomenclature
4.6 Nomenclature of mono, bi, tri and Polyfunctional compounds

Sem I

Chemistry Practical-1

Compulsory

Marks : 70 + 30

Objectives

- To get knowledge of safety norms for laboratory
- To get training of handling of various glass wares
- To get training of handling of Chemicals
- To sharpen observation power
- To develop a skill of multitasking i.e. To carry out chemical tests, observe the changes, analyze the changes and writing the same simultaneously
- To perform experiment of titration
- To gain experience titrating carefully to a visible endpoint
- To determine the concentration of unknown solution from the result of a titration

Learning Outcomes

- Learners will be able to:
- Apply theoretical aspects into practicals
- Know safety norms and Hazards
- Develop analytical skills
- Develop skill of handling of various glass wares
- Develop skill of handling of Chemicals and other utilities
- Perform Qualitative analysis of organic substances
- Develop accuracy and skill of experiment of titration
- Detect equivalence point by titrating experiment carefully
- Calculate the concentration of unknown solution from the result of a titration

(A) Organic qualitative analysis of solid substances: (Minimum 10)

Identification of Unknown organic solid substance is carried out through systematic process having different stages and determination of melting point of solid substances of following type:

1. Oxalic acid
2. Benzoic acid
3. Succinic acid
4. Cinnamic Acid
5. α-Naphthol
6. β-Naphthol
7. catechol
8. Resorcinol
9. o-Nitro aniline
10. m-Nitro aniline
11. p-Nitro aniline
12. Naphthalene
13. Urea
14. Thiourea
15. m-dinitrobenzene etc.

(B) Volumetric Analysis (Acid and Base)

1. Preparation and Standardization of NaOH and HCl
2. Succinic Acid against NaOH
3. Oxalic Acid against NaOH (Hydrated & Anhydrous)
4. Na_2CO_3 against HCl

BOTANY

Sem
I

Cryptogamic Botany 1

Compulsory-
Marks : 70 + 30

Objective:

- To enable students to understand the lower plants and microorganisms and organizational hierarchies and complexity, the evolutionary trends in external morphology and internal structures, identification and classification.

Learning Outcomes

On completion of this paper, students will be able to

- Understand world of microorganisms and bacteria in particular
- Explain the properties of prokaryotes
- Discuss the importance of prokaryotes in nature
- Comprehend general properties and area of usages of algae and fungi
- Know morphological features of Algae and Fungi
- Classify algae and fungi according to their morphological structure.
- Discuss about importance of morphological structure in classification of Algae and Fungi
- Name reproduction types in Algae.
- Explain economic importance of Algae and Fungi with samples.

UNIT 1 PROKARYOTES

1.1 Shape, Size and Arrangement of Bacteria
1.2 Structure of a Typical Prokaryotic Cell
1.3 Nutritional Types of Bacteria
1.4 Distribution and Occurrence of Bacteria
1.5 Eight Kingdom and Three Domain Classification systems

UNIT 2 PHYCOLOGY AND MYCOLOGY

2.1 General characters of Algae
2.2 Classification of Algae by Smith
2.3 General Characteristics of Fungi
2.4 Classification of Fungi by Ainsworth

UNIT 3 ALGAE

3.1 Life cycle, Distribution, Occurrence, Morphology and Reproduction of
3.1.1 *Nostoc*
3.1.2 *Spirogyra*
3.2 Economic importance of Algae

UNIT 4 FUNGI

4.1 Life cycle, Distribution, Occurrence, Morphology and Reproduction of
4.1.1 *Mucor*
4.1.2 *Saccharomyces*
4.2 Economic importance of Fungi

Sem

I

Practicals in Plant Science 1

Compulsory-

Marks : 70+ 30

Objectives

- Get knowledge of safety norms for laboratory.
- To get training of handling of biological specimens
- To get training of handling and use of microscope.
- To get training of handling of various glass wares.
- To get training of identification of algae and fungi.

Learning Outcomes

Learners will be able to:

- Apply theoretical aspects into practical.
- Know safety norms and Hazards
- Develop skill of handling microscope.
- Develop skill of handling of various glass wares
- Develop skill of handling of Chemicals and other utilities.
- Develop a skill of identifying Algae and fungi.

List Of Experiments

Practical 1: Introduction to the microscope and its mechanical operation.

Practical 2: To perform Monochrome staining from given bacterial culture.

Practical 3: To perform Negative staining from tooth tartre.

Practical 4 : To observe bacterial motility by hanging drop method.

Practical 5: To Study Scalariform conjugation in spirogyra and lateral conjugation in *Spirogyra*.

Practical 6: To study external features of thallus in *Nostoc*.

Practical 7: To study outline classification of Fungi.

Practical 8: To study vegetative structure of *Mucor*.

Practical 9: To study asexual reproduction.

Practical 10: To study sexual reproduction.

Practical 11: To study structure of cell in *Saccharomyces*.

Practical 12: To study asexual reproduction in *Saccharomyces*.

Practical 13: Study of chart showing life cycle of *Sacchromyces.*

Practical 14: Study of chart showing life cycle of *Mucor*.

Practical 15: To study permanent slides of *Spirogyra*.

Practical 16: To study permanent slides of *Nostoc.*

Practical 17: To study permanent slides of *Mucor*.

Practical 18: To study permanent slides of *Sacchromyces*.

ZOOLOGY

Sem I | **Invertebrate Zoology** | Optional Marks : 70+ 30

Invertebrate Zoology

OBJECTIVE:

This paper introduces student to the subject. It opens up a new world of classification of organisms under various categories. It gives knowledge about the classification of invertebrates and lower non-chordates.

Learning Outcomes

On completion of this paper, students will be able to

- Understand about the classification of invertebrate phyla
- Describe the general characteristics of various phyla.
- Describe the general features of various class of invertebrate phyla.
- Explain various internal characteristics and systems of various phyla
- Learning important differentiating features of various phyla/class
- Learn in detail various systems of representative animals of various phyla

UNIT 1 INTRODUCTION TO PROTISTA, PARAZOA AND METAZOA

1.1 Branches of Biology and areas of Zoological Studies
1.2 General characteristics and classification up to classes
1.3 Study of Euglena, Amoeba and Paramecium
1.4 Life cycle and pathogenicity of Plasmodium vivax and *Entamoeba histolytica*
1.5 Locomotion an Reproduction in Protista

UNIT 2 PORIFERA, CNIDERIA AND CTENOPHORA

2.1 Porifera- General characteristics and classification up to classes
2.1 Cnidaria- General Characteristic and classification up to classes
2.1 Metagenesis in *Obelia*, Polymorphism in Cnidaria, Corals and coral reefs
2.1 Ctenophora- genral characteristics and evolutionary significance.

UNIT 3 PLATYHELMINTHES AND NEMATHELMINTHES

3.1 Platyhelminthes- General characteristics and classification up to classes
3.2 Life cycle and Pathogenicity of Fasciola hepatica and Taenia solium
3.3 Nemathelminthes- Genral Characterisitics and classification up to classes
3.4 Life cycle and pathogenecity of *Ascaris lumbricoides* and *Wuchereria bancrofti*

UNIT 4 INTRODUCTION TO COELOMATES

4.1 Annelida- General characterisitics and classification up to classes, Excretion in Annelida
4.2 Arthropoda- General Characteristics and Classification up to classes, Vision and Respiration in Arthropoda
4.3 Mollusca- General Characteristics and classification up to classes,
4.4 Respiration in Mollusca, Torsion and Detorsion in Gastropoda, Pearl formation in bivalves and evolutionary significance of trocophore larva

Sem
I

Practicals In Zoology 1

Compulsory

Marks : 70 + 30

Objectives

To equip the students with in depth knowledge of classification of invertebrate phyla and lower non-chordates along with providing detailed understating of characteristic features of each phylum.

Learning Outcomes

On completion of the paper, students will be able to:

- Identify and classify organisms of invertebrate phyla based on their general characteristic features
- Describe internal characteristics and physiological systems of different invertebrate phyla
- Learn various systems of representative animals of various invertebrate phyla
- Identify and describe various body parts of Earthworm, Pila, Honey Bee and Cockroach
- Differentiate salient features of various invertebrate phyla/class

List Of Experiments

1. Study of classification and general characters of different phyla with their representative examples (as per prescribed theory syllabus).
    - Protozoa
    - Porifera
    - Coelenterata
    - Platyhelminthes
    - Aschelminthes
2. Study of specified type/species (Obelia Colony) using whole mount technique.
3. Study of salient characteristics of species with reference to their distinguished features (Gemmules, Spicules of Sponges, Fasciola hepatica).
4. Preparation of Glycerin Mount (stained or unstained as specified) of some suitable materials (septal nepheridia, setae and ovary of earthworm, Parapodia of Neries) for observation of their internal structures.
5. Study of Protozoans in pond water sample.
6. Identification and description of various Parts of Earthworm.
7. Identification and description of Mouth Parts of Cockroach.
8. Study of Ctenidium and Osphradium of Pila.
9. Study of Salivary Gland of Cockroach.
10. Study of Sting Apparatus of Honey Bees.
11. Experimental analysis of Radula of Pila.

Semester II

Semester II

Semester - II								
			Total Papers	Hours	Credit	Internal	External	Total
Education	Education	Theory	3	120	7	75	175	250
B.Sc (Science)	Principal	Theory/ Practical	2 (1+1)	90+45	6	60	140	200
	First Subsidiary	Theory	2 (1+1)	90+45	6	60	140	200
	Second Subsidiary	Theory	2 (1+1)	90+45	6	60	140	200
		Total	**9**	**525**	**25**	**255**	**595**	**850**

Sr. No.	Subject	Title of the paper	T/P	Hours	Credit	Internal	External	Total
1	Education	Learning and Teaching	Theory	45	3	30	70	100
2	Education	Developing the Self	Theory	45	3	30	70	100
3	Education	English Language	Practical	45	1	15	35	50
4	Mathematics	Linear Algebra	Theory	45	3	30	70	100
5	Mathematics	Practical: Linear Algebra	Practical	90	3	30	70	100
6	Physics	Optics and Wave Theory	Theory	45	3	30	70	100
7	Physics	Physics Practical II	Practical	90	3	30	70	100
8	Chemistry	Chemical Bonding	Theory	45	3	30	70	100
9	Chemistry	Chemistry Practical-2	Practical	90	3	30	70	100
10	Botany	Cryptogamic Botany II	Theory	45	3	30	70	100
11	Botany	Practicals in Plant Science II	Practical	90	3	30	70	100
12	Zoology	Cell and Molecular Biology	Theory	45	3	30	70	100
13	Zoology	Practicals in Zoology -2	Practical	90	3	30	70	100

Any three subjects of Science (Mathematics, Physics, Chemistry, Botany and Zoology) will have to be opted by the student.

EDUCATION

Sem II

LS 2 : Learning and Teaching

Compulsory

Marks : 70 + 30

Objectives

To enable the prospective teachers

- To understand the concept and nature of learning
- To comprehend the theories of learning with reference to concepts and implications
- To understand concept of teaching and use of various teaching method
- To understand models of teaching and programmed learning

Unit 1 Learning: Concept and Nature

1.1 Concept and Nature of Learning, Factors affecting learning
1.2 Motivation: Concept, Need, Theory (Abraham Maslow and McClelland)
1.3 Transfer of learning: Concept, types, factors affecting transfer of learning
1.4 Learning style: Concept and Classification by Kolb's, Edger Dale's Cone of Experience

Unit 2 Theories of Learning (Concepts and Implications)

2.1 Classical Conditioning theory
2.2 Operant Conditioning theory
2.3 Learning by trial and error
2.4 Gestalt theory (Insight learning)

Unit 3 Teaching and Role of Teacher

3.1 Concept and Nature of Teaching, Teaching as a Profession
3.2 Phases of Teaching: Planning, Execution and Reflection
3.3 Levels of Teaching: Memory Level(Herbartian), Understanding Level(Morrison), Reflective Level(Hunt)
3.4 Role of a Teacher: As a Model, Facilitator, Nagotiator, Co-Learner, Reflective Practioner and Classroom Researcher

Unit 4 Models of Teaching and Programmed Learning

4.1 Models of Teaching: Concept, Characteristics, Elements
4.2 Concept attainment Model
4.3 Advance Organizer Model
4.4 Programmed Learning: Concept, Principles, Types, Steps of Development

Sem
II

ES 2 : Developing the Self

Compulsory

Marks : 70 + 30

Objectives

To enable the prospective teachers

- To develop critical understanding of concept of self and self-identity
- To analyze the role of socialization in development of self
- To analyze the role of spiritualism in development of self
- To discuss critically and analyses the role of teacher, books, films and case studies on development of self

Unit 1 Self and Self Identity

1.1 Concept of Self and Self-identity
1.2 Indian Concept of Self with reference to Satva, Rajas and Tamas Guna
1.3 Constituent of Panch Kosh
1.4 Components of Self – Attitude, Beliefs, Values

Unit 2 Development of Social Self

2.1 Concept of Social Self & Cultural Self
2.2 Agencies that shape the Self: Family, School and Community
2.3 Stereotypes and Prejudices: Concept and role of Gender, Caste, Language and Religion in Developing Self
2.4 Crisis of Self-identity in the era of Internet and Skills of enhancing self

Unit 3 Development of Spiritual Self

3.1 Concept of Spiritual Self, Spiritualism and Integral Humanity
3.2 Process of Self-awareness, Self-observation, Introspection and Austerity
3.3 Concept of Sthitpragya (Bhagwad Geeta Ch-2)
3.4 Yoga as a tool for Integration of Individual and Universal Self (Ashtang Yog)

Unit 4 Developing Self through Books, Case Studies, Films

4.1 Books: Kon (Labhshankar Thakar), Gora (Ravindranath Tagore), Potani Olakh (Bababhai Patel)
4.2 Case Study: J. Krishnamurthy, Ramkrishna Paramhans
4.3 Films: Adi Shankracharya, Reva, Mystic India
4.4 Role of a Teacher(Guru) in Developing the Self

Sem
II

LPC 2 : English Language

Compulsory

Marks : 35 + 15

Objectives : To enable the propective teachers

- To develop Listening, Speaking, Reading and Writing skills in language
- To use language in daily life/communication.
- To get proficiency over the language.
- To develop their own tools/contents and strategies to apply language effectively

Unit : 1 Activities related to Listening & Writing skills

1.1 https://www.youtube.com/watch?v=M8JdkfZdhe8 Listen this video and reflect upon it.
1.2 https://youtu.be/NLyGQeqrKOM Listen this video and reflect upon it.
1.3 https://youtu.be/hN7j7Ey-cM0 Listen this video and reflect upon it.
1.4 https://youtu.be/SDNK8lT0lxs Listen this video and reflect upon it.
On the basis of the above activities carried out in the sr. no.1 to 4, prepare a report in written form (may be in form of ppt, blog post, etc.)
1.5 Email writing/Letter writing/Report writing/Prepare your resume with application for the post of a teacher.

Unit 2 : Activities related to Reading and Speaking skills

2.1 Poem recitation of any two poems.
2.2 Read the editorial/speaking from Newspaper.
2.3 Ideal Reading of any one short stories.
2.4 Read any one book you like such as “Wings of Fire”
2.5 Read any one research article from the magazine.
On the basis of the above activities carried out in the sr. no.1 to 5, prepare report (may be in form of podcast, YouTube video, blog post, etc.)

Mode of Transaction: Workshop to describe the idea and the activity. Activities to be conducted (Any one from section A and B respectively)

Note:

1. Trainees will select one activity from each section for submission BUT for the better exposure minimum three activities from each section must be carried out at institutional level)
2. The practicum will be considered as completed on the basis of the submission.

MATHEMATICS

Sem

II

Linear Algebra

Compulsory

Marks : 70 + 30

Objectives

- To Develop the skills of obtaining basis and dimension of vector space
- To acquire knowledge of linear transformation
- To find the solution of system of linear equations
- To determine eigenvalues and eigenvectors

Learning Outcomes

This course will enable students to:

- Understand different types of matrices
- Find eigen value and eigen vector of the matrices
- Check vector space and subspace of a set.
- Find quadratic forms

Unit 1 Vector Space

1.1 Vector spaces, subspaces
1.2 Span of a set
1.3 More about subspaces, Linear dependence. Independance
1.4 Dimension and Basis

Unit 2 Linear Transformation

2.1 Definition and examples, Range and Kernel of a linear map
2.2 Rank and Nullity, Inverse of a linear transformation
2.3 Consequences of rank-nullity theorem
2.4 The space L(U, V), composition of linear maps, operator equation

Unit 3 Matrices

3.1 Matrix associated with a linear map, linear map associated with a matrix
3.2 Linear operator in $M_{m,n}$, Matrix multiplication
3.3 Rank & Nullity of a matrix, Transpose of a matrix and special types of matrices
3.4 Elementary row operations, system of linear equations, Matrix Inversion.

Unit 4 Determinants & more matrix theory

4.1 Definition, Fundamental properties of determinants, Proofs of theorem, Cofactors
4.2 Determinants, Minor & rank of a matrix, Product of determinants
4.3 Eigenvalues, Eigenvectors, Wronskian
4.4 Similarity of matrices, Inner product space, Orthogonal and unitary matrices, Application of reduction of quadrices

Sem

II

Practical: Linear Algebra

Compulsory

Marks : 70 + 30

Objectives

- To Develop the skills of obtaining basis and dimension of vector space
- To introduce the basic tools of theory of matrices and relate it with the real-world problems.
- To Understand the concept of Cayley Hamilton theorem
- To acquire knowledge of linear transformation.

Learning Outcomes

- Find basis and dimension of vector space
- Verify rank nullity theorem
- Find the solution of system of linear equations
- Evaluate the eigen value and eigen vector of the matrix

List of Problems:

1. Examples on vector space
2. Examples on vector subspace and basis
3. Examples based on linearly dependent and independent sets
4. Dimension theorem and problem based on its verification
5. Examples of Linear transformation
6. Rank nullity theorem and its example
7. Find RRE form and rank of the matrix
8. Find inverse using Gauss Jordan Method (Using row operations)
9. Verify the Cayley-Hamilton theorem-inverse of matrix using it-Problems on Cayley-Hamilton theorem
10. Solution of a system of linear equations using row operations and Cramer's rule.
11. Find eigenvalues and eigenvectors of square matrices of order 2 and 3.
12. Example based on Gram-Schmidt process to orthonormalise linearly independent sets of vectors
13. Reduction of conics to their principal axes

PHYSICS

Sem

II

Optics and Wave Theory

Core Compulsory

Marks : 70 + 30

Objectives

- This core course in Physics curriculum begins with explaining ideas of superposition of harmonic oscillations leading to physics of travelling and standing waves.
- This course aims to provide a clear understanding of sound waves and ultrasonic.
- This course also deals with defects of vision and Fermat's principle.
- The course also provides an in depth understanding of wave phenomena of light, namely, interference, diffraction and polarization with emphasis on practical applications of the same.

Learning Outcomes

- After learning this course, students are expected to
- Hold a firm understanding of basics of wave theory, sound waves and ultrasonic.
- Grasp the concepts in ray optics and wave optics namely Fermat's principle, defects of vision, interference, diffraction and polarization.

UNIT 1

1.1 Harmonic Motion: Simple Harmonic motion, Composition of two simple harmonic oscillations at right angles, Lissajous figures. Free, damped and forced oscillations, resonance, and sharpness of resonance.

1.2 Wave Motion: Wave motion in an elastic medium, characteristic of progressive waves,mathematical representation of a progressive wave. Differential wave equation in one dimension, solution of wave equation (method of separation of variables). Energy density of plane progressive waves, Superposition of waves. Stationary waves, characteristics of stationary waves.

UNIT 2

2.1 Sound Waves: Velocity of longitudinal waves in a solid bar. Intensity of sound wave.Units of intensity. Acoustics of auditorium, reverberation, Sabine's law.

2.2 Ultrasonic:Introduction, Generation of ultrasonic, Piezoelectric effect, Piezoelectric generator, advantages of Piezoelectric generator, Magnetostriction effect, Magnetostriction oscillator, advantages and disadvantages of Megnetostriction oscillator, Detection of ultrasonic, Properties of ultrasonic, Applications of ultrasonic.

UNIT 3

3.1 Fermat's principle:Fermat's principle and its application in establishing laws of reflection and refraction at spherical and plane boundaries.

3.2 Defects of image:Spherical aberration, Qualitative idea about coma, astigmatism and distortion, Chromatic aberration, circle of least confusion, achromatism of two thin lenses separated by a distance.

UNIT 4

4.1 Interference: Definition and properties of wave front. Huygens Principle, meaning of coherence, Temporal and Spatial Coherence, Complex representation of superposition of waves, , interference due to Fresnel's biprism, interference by a plane parallel film, wedge shaped film, colour of thin film, Newton's rings, Michelson interferometer and its application for finding difference in wavelengths.

4.2 Diffraction: Difference between Fresnel and Fraunhofer classes, half-period zones and strips, Zone plate and its lensing property, diffraction at a straight edge and at a circular aperture, Fraunhofer diffraction due to a single slit, double slit and transmission grating, wavelength measurement by the plane transmission grating, resolving power of a grating, theory of concave grating.

4.3 Polarisation: Double refraction, optic axis and $CaCO_3$ crystal, plane, circular and elliptically polarised light, Retarding plates and their uses for producing and analysing different polarised light, specific rotation of plane of polarisation and half-shade polarimeter.

Sem
II

Physics Practical Ii

Core Compulsory
Marks : 70 + 30

Objectives
To study different experiments in optics and lasers.
Learning Outcomes
- After learning the paper, students will be able to clear their concepts in optics and laser physics by performing different experiments.

LIST OF EXPERIMENTS
1. Diagonalization of given matrix (2x2). Evaluate trace of a matrix.
2. To determine the wavelength of sodium light using Newton's ring.
3. To find out the prism angle and dispersive power by spectrometer
4. To find out the wavelength of sodium light using diffraction grating
5. To prove inverse square law in optics
6. To determine the refractive index of an unknown liquid using liquid lens.
7. To find out the resolving power of telescope
8. To determine the flatness and refractive index of glass plate and radius of curvature of lenses by optical lever.
9. To determine the wavelength of a laser beam
10. To determine the wavelength of monochromatic source using Lloyd's mirror

CHEMISTRY

Sem
II

Chemical Bonding

Compulsory
Marks : 70 + 30

Objectives

- To study the theory of various types of hybridization and shapes of simple molecules and ions
- To compare VB and Molecular Orbital (MO) for these molecules
- To learn chemistry of boron and its compounds
- To define and explain about ionic bond, unit cell and space lattice and Laws of crystallography.

Learning Outcomes

The students will be able to understand the hybridization and shape of inorganic molecules.
The students will be able to explain VB theory and MO theory efficiently
The students will be able to understand boron and its compounds
The students will be able to get idea about ionic bond, unit cell and apace lattice and laws of crystallography

UNIT 1: Chemical Bonding-I

1.1 Covalent bond
1.2 Valence bond theory and its limitations
1.3 Various types of hybridization and shapes of simple molecules and ions (BeF_2, BF_3, CH_4, PF_5, SF_6, IF_7, $SnCl_2$, XeF_4, BF_4^- PF_6^-, $SnCl_6^{2-}$
1.4 Molecular orbital approach of bonding (LCAO method) symmetry and overlap symmetry of molecular orbital
1.5 bonding in homonuclear molecules for e.g. H_2, Be_2, N_2, N_2^+, O_2, O_2^-, $O_2^+$and Ne_2

UNIT 2 : Chemical Bonding- II

2.1 Comparison of VB and Molecular Orbital (MO) for these molecules
2.2 Molecular Orbital (MO) treatment for $[IrF_6]^{4-}$, $[FeF_6]^{3-}$ and $[V(CN)_6]^{3-}$
2.3 Simple Huckel theory –
2.4 Variation principle
2.5 Huckel Molecular Orbital (HMO) treatment to allylic System (allylic cation, allylic free radical and allylic anion)
2.6 Hybridization: Derivation of wave functions of sp, sp^2 and sp^3 (including their Bond angles)

UNIT 3: Boron Chemistry

3.1 Structure, bonding, preparation, properties and uses of boron compounds
3.2 Boric acid and borates
3.3 Boron nitrides
3.4 Borohydrides (diborane) carboranes
3.5 Three centered bond in B_2H_6
3.6 Structures of Boranes: Classification, wade rule styx code, fram electrons, structures (minimum six)
3.7 Three centered bond in B_2H_6 and structures of Boranes

UNIT 4 : Ionic and solid compounds

4.1 Definition of unit cell and space lattice

4.2 Laws of crystallography: (i) Law of constancy of Interfacial angles. (ii) Law of rationality of indices

4.3 Kinds of symmetry elements and symmetry operations. X-ray diffraction by crystals

4.4 Bragg's equation (only qualitative analysis). Determination of crystal structures of NaCl, CsCl and CaF_2

Sem

II

Chemistry Practical-2

Compulsory

Marks : 70 + 30

Objectives

- Get idea about inorganic qualitative analysis
- To get knowledge of handling of various glass wares and chemicals
- To sharpen observation power
- To get familiarize with safety norms in laboratory
- To develop a skill of multitasking i.e. To carry out chemical tests, observe the changes, analyses the changes and writing the same simultaneously
- To perform experiment of titration and understand about oxidizing agent, reducing agent and formation of complex.
- To gain experience titrating carefully to a visible endpoint.
- To determine the concentration of unknown solution from the result of a titration

Learning Outcomes

Learners will be able to:

- Know safety norms and Hazards
- Develop analytical skills
- Develop skill of handling of various glass wares and chemicals
- Perform Qualitative analysis of inorganic substances
- Apply theoretical aspects into practicals
- Develop accuracy and skill of experiment of titration understand about oxidizing agent, reducing agent and formation of complex.
- Detect equivalence point by titrating experiment carefully.
- Calculate the concentration of unknown solution from the result of a titration

(A) Inorganic qualitative analysis: (Minimum 10)

- To carry out Qualitative analysis of unknown Inorganic compound and determination of cation and anion by systematic process of following types:

  $CuSO_4$, $MgCl_2$, $FeCl_3$, KCl, $K_2Cr_2O_7$, $NiSO_4$, $KMnO_4$, $NaNO_3$, $BaCl_2$, $Sr(NO_3)_2$, $ZnCO_3$, $Al_2(PO_4)_3$, $Pb(NO_3)_2$, $NaNO_2$, $MnSO_4$, $NaHSO_3$, K_2CrO_4, $FeSO_4$, $(NH_4)_2SO_4$, $CaSO_4$, $MgSO_4$, KBr, etc.

(B) Volumetric Analysis:

(I) Redox Titrations:

(1) $FeSO_4.7H_2O$ against $KMnO_4$

(2) $FeSO_4(NH_4)_2SO_4.6H_2O$ against $K_2Cr_2O_7$

(II) Complexometric Titrations:

(1) Estimation of Ca^{+2} against EDTA

(2) Estimation of Mg^{+2} against EDTA

BOTANY

Sem
II

Cryptogamic Botany 2

Compulsory-

Marks : 70+ 30

OBJECTIVE

To enable students to understand the higher cryptogams, the evolutionary trends in external morphology and life cycle, identification and classification.

LEARNING OUTCOMES

After successfully completing this paper, students will be able to:

- Define Higher and Lower cryptogams.
- Identify the vegetative and reproductive structures in Bryophytes and Pteridophytes.
- Describe thallus organization of cryptogams.
- Diagram life cycle of various Bryophyte and Pteridophytic forms.
- Classify the higher cryptogams Bryophyte and Pteridophytes.
- Describe uses and economic importance and role of higher Cryptogams for human welfare

UNIT 1 INTRODUCTION TO BRYOPHYTE AND PTERIDOPHYTE

1.1 Classification of Bryophyte
1.2 General characteristics of Bryophyte
1.3 Economic importance of Bryophyte

UNIT 2 INTRODUCTION TO PTERIDOPHYTE

2.1 Classification of Pteridophyte
2.2 General characteristics of Pteridophyte
2.3 Economic importance of Pteridophyte

UNIT 3 BRYOPHYTE

3.1 Type studies: Occurrence, Distribution, Morphology and Reproduction of
3.1.1 *Marchantia*
3.1.2 *Anthoceros*

UNIT 4 PTERIDOPHYTE

4.1 Type studies: Distribution , life cycle and systematic position of
4.1.1 *Sellaginela*
4.1.2 *Nephrolepis*

Sem
II

Practicals In Plant Science 2

Compulsory
Marks : 70 + 30

Objectives

- To get training of identification of higher cryptogams.
- To get training of identification of Bryophytes.
- To get training of identification of Fungi.

Learning Outcome

Learners will be able to:

- To develop a skill of multitasking i.e. To carry out keen analysis of characters, observe the changes, analyze the changes and writing the same simultaneously.
- To perform experiment of higher cryptogams.
- To identify the bryophytes from morphological characteristics.
- To identify the pteridophytes from morphological characteristics.

List of Experiments

Practical 1: To study outline classification of Bryophytes.
Practical 2: To study morphology of *Marchantia* thallus.
Practical 3: To study anatomy of *Marchantia* thallus.
Practical 4: To study vegetative reproductive structure, 'The gemma cup'.
Practical 5: To study male sex organ (Antheridium) in *Marchantia*
Practical 6: To study female sex organ (Archegonium) in *Marchantia.*
Practical 7: The study of Sporophyte in *Marchantia.*
Practical 8: The study of Life cycle of *Marchantia* through chart.
Practical 9: The study of permanent slides of *Marchantia.*
Practical 10: To study morphology of *Anthoceros* thallus.
Practical 11: To study anatomy of *Anthoceros* thallus.
Practical 12: To study male sex organ (Antheridium) in *Anthoceros.*
Practical 13: To study female sex organ (Archegonium) in *Anthoceros.*
Practical 14: The study of Sporophyte in *Anthoceros.*
Practical 15: The study of Life cycle of *Anthoceros* through chart.
Practical 16: The study of permanent slides of *Anthoceros*.
Practical 17: To study external features of the *Selaginella.*
Practical 18: The study of spore producing organ in *Selaginella.*
Practical 19: The study of chart showing Life cycle of *Selaginella.*
Practical 20: The study of permanent slides of *Selaginella.*
Practical 21: To study morphological characteristic of *Nephrolepis.*
Practical 22: To study structure of sporophyll in *Nephrolepis.*
Practical 23: The study of chart showing Life cycle of *Nephrolepis.*
Practical 24: The study of permanent slides of *Nephrolepis.*

ZOOLOGY

Sem
II

Cell and Molecular Biology

Compulsory

Marks : 70 + 30

OBJECTIVE

To enable students with the applied aspects of cell biology and microscopy. Experiments with the utilization of microscope will make students technically sound in the field of cell biology. To demonstrate significant cell biological principles, quantitative and analytical approaches that enable the students to translate the theoretical foundation in cell biology to be translated into practical understanding.

LEARNING OUTCOMES

On completion of the paper, students are able to understand

- Define terminologies related to cell biology.
- Students will understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles
- Identify localization and describe all cell organelles.
- Discuss the dynamics of plant cell structure and function.
- The eukaryotic cell cycle and mitotic and meiotic cell division
- Structure and organization of cell membrane
- Process of membrane transport and membrane models
- Structure and function of various cell organelles
- Cell division process
- Integrate classical research findings to current hands-on experiences with the latest biotechnology and information technology.
- Students will understand how these cellular components are used to generate and utilize energy in cells
- Students will understand the cellular components underlying mitotic cell division.

UNIT 1 CYTOLOGY AND CELL CONCEPT

1.1 Cell concept, principal levels of cellular organization
1.2 Historical aspects of Cytology
1.3 Basic differences in structural organization in Prokaryotes and Eukaryotes
1.4 Structure of Animal and Plant cell
1.5 Endosymbiosis Theory

UNIT 2 CELL CYCLE AND CELL BOUNDARY

2.1 Cell Cycle and Cell Division – Mitosis and Meiosis
2.2 Models of cell membrane
2.3 Structural organization of plasma membrane – Fluid Mosaic Model
2.4 Cell wall: its ultra structure and function
2.5 Nucleus and Chromosomes

UNIT 3 : CELL ORGANELLES

3.1 Endoplasmic reticulum: structure, chemical nature and function
3.2 Golgi apparatus: structure, chemical nature and function
3.3 Chloroplast: ultrastructure and function
3.4 Mitochondria: structure, morphogenesis, chemical nature and functions
3.5 Lysosomes: structure, chemical nature, concept of suicide bag
3.6 Peroxisomes and Glyoxisomes - structure, chemical nature & functions

UNIT 4 : MOLECULAR BIOLOGY

4.1 Structure of Nucleic acids
4.2 DNA Replication
4.3 Types of RNA and Genetic Code
4.4 Transcription and Translation
4.5 Regulation of Gene Expression

Sem II

Practicals in Zoology 2

Compulsory

Marks : 70+ 30

Objectives

- To demonstrate significant cell biological principles, quantitative and analytical approaches that enable the students to translate the theoretical foundation in cell biology to be translated into practical understanding. Build on the fundamental concepts of cell structure and function from previous study to include:
- A. the relationship between molecular structure and function.
- B. the dynamic character of cellular organelles.
- C. unity and diversity at the macromolecular and cellular levels and the relationship to adaptation through time.

Learning Outcomes

- After the practical course, students will be able to differentiate the cells of various living organisms and get awareness of physiological processes of cell e.g. cell divisions.
- Demonstrate the knowledge of common and advanced laboratory practices in cell and molecular biology
- Students will be able to observe and correctly identify different cell types, cellular structures using different microscopic techniques.
- Relate experimental processes and evidence to the knowledge of cell structure and function that is being learned.
- Relate the molecular and sub-cellular components of a cell to a framework of heredity and evolution.
- Students will understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles
- Integrate classical research findings to current hands-on experiences with the latest biotechnology and information technology.
- Students will understand how these cellular components are used to generate and utilize energy in cells
- Students will understand the cellular components underlying mitotic cell division.

List of Experiments

1. Introduction to the principle components of Light Microscope.
2. Study of different Stains used in Cell Biology.
3. Observation of distinguishing features of prokaryotic and eukaryotic cells.
4. Study of permanent cytological slides in Cell Biology.
5. Study of Nucleic Acids using permanent cytological staining technique.
6. Study of different Stages of Mitosis in Onion Root Tip Cells.
7. Cytogenetics analysis of various Stages of Meiosis.
8. Identification of various types of Leucocytes through Differential Count Technique.
9. Measurement of Cell Size and study of Subcellular Components using Light Microscopy.
10. Demonstration of molecular organization of Chloroplast through charts.
11. Demonstration of molecular organization of Mitochondria through charts.

Semester III

Semester – III

			Total Papers	Credit	Hours	Internal	External	Total
Education	Education	Theory/ Practical	3 (2+1)	7	120	75	175	250
B.Sc (Science)	Principal	Theory/ Practical	3 (2+1)	9	180	90	210	300
	First Subsidiary	Theory/ Practical	3 (2+1)	9	180	90	210	300
		Total	**9**	**25**	**480**	**255**	**595**	**850**

Sr. No.	Subject	Title of the paper	T/P	Credit	Hours	Internal	External	Total
1	Education	ICT in Curriculum	Theory	3	45	30	70	100
2	Education	Hindi Language	Practical	1	30	15	35	50
3	Education	General Pedagogy for Mathematics and Science (O)	Theory	3	45	30	70	100
4	Mathematics	Calculus-II	Theory	3	45	30	70	100
5	Mathematics	Co-ordinate Geometry	Theory	3	45	30	70	100
6	Mathematics	Practical: Calculus-II & Co-ordinate Geometry	Practical	3	90	30	70	100
7	Physics	Electricity, Magnetism and Electromagnetic Theory	Theory	3	45	30	70	100
8	Physics	Nuclear Physics	Theory	3	45	30	70	100
9	Physics	Physics Practical III	Practical	3	90	30	70	100
10	Chemistry	Physical Chemistry-I	Theory	3	45	30	70	100
11	Chemistry	Chemistry of Hydrocarbons	Theory	3	45	30	70	100
12	Chemistry	Chemistry Practical-3	Practical	3	90	30	70	100
13	Botany	Gymnosperm and Paleobotany	Theory	3	45	30	70	100
14	Botany	Plant Taxonomy	Theory	3	45	30	70	100
15	Botany	Practicals in Plant Science III	Practical	3	90	30	70	100
16	Zoology	Principles of Evolution & Genetics	Theory	3	45	30	70	100
17	Zoology	Vertebrate Zoology	Theory	3	45	30	70	100
18	Zoology	Practicals in Zoology -3	Practical	3	90	30	70	100

Any two subjects of Science (Mathematics, Physics, Chemistry, Botany and Zoology) will have to be opted by the student.

EDUCATION

Sem III

CuS 4: ICT in Curriculum

Compulsory

Marks : 70 + 30

Objectives

To enable the prospective teachers

- to develop critical understanding of concept & aspects of ICT
- to develop skills for integrating ICT and Pedagogy
- to acquaint them with tools of ICT in education
- to familiarize them with ICT enabled assessment

Unit 1 ICT- Concept & Aspects

1.1 Meaning & Concept: Information, Technology, Information Technology & ICT
1.2 Concept & Use: Internet and browser - basic and advanced search strategies
1.3 Internet Resources: Location and evaluation with reference to authentic content
1.4 Legal & Ethical issues in use of ICT- Hacking, Violation of Copyright, Plagiarism

Unit 2 Integrating ICT and Pedagogy

2.1 Technological Pedagogical Content Knowledge (TPCK) – Concept and Meaning
2.2 Technology integrated learning experiences
2.3 Online Teaching Tools – Google Classrooms, Interactive Virtual Classroom platforms like Google Meet, WebEx , Zoom, Microsoft Team
2.4 Assistive technology: Concept & Tools - Reading & Writing Tools

Unit 3 ICT for Education

3.1 Communication Tools: Email, Chat, Blogging
3.2 Collaboration Tools: Wiki, Social Networking, Web conferencing,
3.3 Content Creation/ Authoring Tools: Learner Management System - Adapt, Xerte & Powtoon
3.4 Delivery & Distribution Tools : EPUB, Podcasting, Audio/Video Streaming, MOOC

Unit 4 ICT Enabled Assessment and Education

4.1 Computer Assisted & Computer Adaptive Assessment: Concept and Use
4.2 Electronic assessment portfolio - Concept and types
4.3 Digital Tools for Assessment: rubrics generator, test generator, google forms & drives
4.4 ICT in Education- National Repository of Open Educational Resources (NROER), SWAYAM, E PATHSHALA, AMRITA O Labs, ANGIRA

Sem III

LPC 3: Hindi Language

Compulsory

Marks : 35 + 15

उदेश्य

- प्रशिक्षणार्थी प्रवृत्ति के माध्यम से श्रवण, कथन, पठन और लेखन कौशल का विकास करें।
- प्रशिक्षणार्थी हिन्दी भाषा का व्यवहारिक जीवन एवं प्रत्यायन में उचित रूप से प्रयोग करें।
- प्रशिक्षणार्थी हिन्दी भाषा में कुशलता प्राप्त करें।
- प्रशिक्षणार्थी हिन्दी भाषा कौशल की अभिवृद्धि के हेतु विभिन्न युक्ति-प्रयुक्ति का प्रयोग करें।

युनिट 1 : श्रवण और लेखन कौशल आधारित प्रवृतियाँ।

1.1 https://youtu.be/1PNVwstst7s , https://youtu.be/JJKpjtr15wk विडिओ क्लिप सुनकर काव्य में प्रस्तुत विचारों पर चिंतन कीजिए।

1.2 https://youtu.be/pCRkOG1LH-I विडियो क्लिप सुनकर कहानी के केन्द्र विचार, पात्र, घटना एवं उद्देश्य पर चिंतन कीजिए।

1.3 https://youtu.be/4nvEfSMvQGE विडियो क्लिप सुनकर हिन्दी भाषा के महत्त्व के संदर्भ में आपकी प्रतिक्रिया प्रस्तुत करें।

1.4 https://youtu.be/GW5GKaGLxBU, विडियो क्लिप सुनकर मुलाकात में प्रस्तुत महानुभव के विचार के संदर्भ में आपकी प्रतिक्रिया दर्शाएं।

1.5 https://youtu.be/LrdrcP2oiyU विडियो क्लिप सुनकर आत्मकथा के बारे में चिंतन कीजिए।

- १ से ५ प्रवृत्तिओ को आपके चिंतन और मनन के आधार पर लिखित रूप में प्रस्तुत करें। (क्रमश: काव्य लेखन, कहानी लेखन, हिन्दी दिवस एवं हिन्दी भाषा का महत्त्व, अहेवाल लेखन, आत्मकथा सुनकर उसके अंतर्गत अपने विचार प्रस्तुत करें। (१ से ५ प्रवृतिओ के आधार पर आप पॉडकास्ट, पावर पॉइंट प्रेजेंटेशन, ब्लॉग स्पॉट के रूपमे प्रस्तुत कर सकते है।

युनिट 2: पठन और कथन कौशल आधारित प्रवृतियाँ।

2.1 हिन्दी साहित्य के दो उत्तम काव्य का पठन करें।

2.2 हिन्दी समाचार-पत्र में प्रस्तुत कोई एक लेखक का साहित्यिक लेख पढ़ें।

2.3 उत्तम कहानियों में से किसी एक कहानी का आदर्श पठन करें।

2.4 हिन्दी साहित्य की कोई एक उत्तम पुस्तक पढ़े जैसे कि मुंशी प्रेमचंद रचित उपन्यास 'रंगभूमि' और कोई एक संशोधनात्मक लेख का पठन करें।

2.5 कोई एक संशोधनात्मक लेख का पठन करें और मनन एवं चिंतन के आधार पर कथनात्मक रूप में प्रस्तुत करें।

- क्रमश: साहित्य की किसी दो उत्तम काव्य के संदर्भ में कथनात्मक अभिव्यक्ति, हिन्दी समाचार-पत्र में प्रस्तुत कोई एक लेखक का साहित्यिक लेख पत्रकारों के अंदाज में कथनात्मक अभिव्यक्ति, उत्तम कहानियों में से किसी एक कहानी की विशिष्ट रूप से कथनात्मक अभिव्यक्ति, कोई एक उत्तम पुस्तक पढ़े जैसे कि मुंशी प्रेमचंद रचित उपन्यास 'रंगभूमि' का पुस्तक परिचय, कोई एक संशोधनात्मक लेख की कथनात्मक अभिव्यक्ति करें। १ से ५ प्रवृतिओ के आधार पर आप पॉडकास्ट, यू ट्यूब, विडिओ, ऑडियो, ब्लॉग स्पॉट के रूपमे प्रस्तुत कर सकते है।

आयोजन का माध्यम:

- प्रवृत्ति आधारित कार्यशाला का आयोजन करना।

सूचना:

- प्रशिक्षणार्थी विभाग - अ एवं विभाग - ब प्रवृत्तियों में से कोई एक एक प्रवृत्ति के आधारित कार्य प्रस्तुत करें। अर्थपूर्ण अभ्यास के हेतु संस्था के स्तर पर तीन प्रवृत्ति पर कार्य प्रस्तुत करना उचित रहेगा।
- प्रयोगात्मक कार्य प्रशिक्षणार्थियों की प्रस्तुत प्रवृत्तियों के आधारित होगा।

Sem III | PS 1 O1 : **General Pedagogy for Mathematics and Science** | Optional | Marks : 70 + 30

Objectives

To enable the prospective teachers

- to comprehend the concepts of faculty and discipline and knowledge as a whole.
- to appreciate values and recognize correlation.
- to understand pedagogical perspectives.
- to develop skills of microteaching, simulation lesson.

Unit 1: Values and Corelation of Mathematics and Science

1.1 Concept of Faculty and Discipline with Reference to Mathematics and Science
1.2 Scope of Science and Mathematics; Values - Disciplinarian, Cultural and Utilitarian
1.3 Corelation: i) Mathematics: with its branches and Social Sciences
ii) Science: with its branches and Social Sciences
iii) Mathematics and Science
1.4 Mathematics and Science in School Curriculum and day to day life: Need and Importance

Unit 2: Pedagogical Perspectives

2.1 Teaching: Concept and Principles
2.2 Maxims of Teaching
2.3 Concept & Examples: Techniques, Methods, Devices, Approaches and Models of teaching
2.4 Concept: Aims, Objectives and Learning Outcomes in Mathematics and Science

Unit 3: Methods of Teaching Mathematics and Science

3.1 Inductive - Deductive, Demonstration
3.2 Comparison, Logical Approach
3.3 Analysis -Synthesis, Experiment Method
3.4 Project, Exhibition

Unit 4: Microteaching, Simulation

4.1 Microteaching: Concept, Steps, and Merits
4.2 Microteaching Skills: Set Induction, Probing Questions, Fluency in Questioning, Explanation, Illustration with Example,
4.3 Microteaching Skills: Board work, Stimulus Variation, Reinforcement, Use of Teaching Aids
4.4 Simulation: Concept, and Characteristics and Steps

MATHEMATICS

Sem III

Calculus-Ii

Compulsory

Marks : 70 + 30

Objectives

- To Understand geometrical approach of coordinate system in R^2 and R^3.
- To Develop the skills of calculation and construction of double integral.
- To acquire the Knowledge of triple integral.
- To Apply the knowledge of integral and vector field.

Learning Outcomes

This course will enable students to:

- Understand concept of vector valued function
- Evaluate double integral and changing the order of it.
- Analyze the geometrical interpretation of double and triple integral
- Verify Green, Stoke's and Gauss divergence theorem.

Unit 1 Parametric Equations and Coordinate system:

1.1 Different types of coordinate systems in R^2 & R^3 and its Relationships with Cartesian coordinates
1.2 Parameterization of plane curve, calculus with parametric curves
1.3 Area and length in polar coordinates
1.4 Concept of vector valued function

Unit 2 Double Integral:

2.1 Definition of gradient, divergence and curl, properties of these operators
2.2 Introduction to double integral, repeated or iterated integral
2.3 Double integral over a closed region, evaluation of double integral
2.4 Changing the order of double integral

Unit 3 Triple Integral

3.1 Triple integrals, Iterated triple integrals
3.2 Geometrical interpretation of double and triple integrals and problems based on it
3.3 Introduction to Jacobian (only definition)
3.4 Transformation of double and triple integrals

Unit 4 Integrals and Vector Fields

4.1 Definition of line integral, Green's theorem, surface and volume integral
4.2 Gauss's divergence theorem (statement only), Examples based on it
4.3 Stoke's theorem (Only examples based on it)
4.4 Verification of the three theorems and problems based on the theorems

Sem
III

Co-Ordinate Geometry

Compulsory
Marks : 70 + 30

Objectives

- To Understand geometrical approach of Sphere, Cone, Conicoid.
- To develop the skills of analyzing the intersection of two cones.
- To study equations of various types of cylinder.
- To Apply the knowledge of intersection of line with conicoid.

Learning Outcomes

This course will enable students to:

- Understand concept of general and Cartesian equation of sphere.
- Evaluate the equation of cone.
- Solve the equation of the right circular cylinder.
- Analyze the nature of elliptic paraboloid and hyperbolic paraboloid.

Unit 1 The Sphere

1.1 Sphere-Definition, Cartesian Equation and General Equation of Sphere Intersection of a Sphere with line and plane, Intersection of two Spheres Tangent plane to a sphere, Plane of contact, Polar plane, Angle of intersection of two spheres

1.2 Orthogonal Spheres and condition for two spheres to be orthogonal

Unit 2 The Cone

2.1 Definition of a cone, vertex, guiding curve, generators

2.2 Equation of the cone, quadratic cone, tangent lines, tangent plane at a point Intersection of a line and cone, Intersection of two cones, right circular cone

2.3 Equation of right circular cone, enveloping cone

Unit 3 The cylinder

3.1 Definition of cylinder, equation of a cylinder

3.2 The right circular cylinder

3.3 Equation of the right circular cylinder

3.4 Enveloping cylinder

Unit 4 The Conicoid

4.1 Introduction and general equation of a conicoid, various examples

4.2 Shape of some surfaces- ellipsoid, hyperboloid of one sheet, hyperboloid of two sheets

4.3 definition and examples of central conicoid, Intersection of line with conicoid

4.4 Paraboloids, nature of elliptic paraboloid and hyperbolic paraboloid

Sem III | **Practical: Calculus-II & Co-ordinate Geometry** | Compulsory Marks : 70 + 30

Practical: Calculus-II & Co-ordinate Geometry

Objectives

- To Understand geometrical approach of Sphere, Cone, Conicoid.
- To develop the skills of analyzing the intersection of two cones.
- To study equations of various types of cylinder.
- To Apply the knowledge of intersection of line with conicoid.

Learning Outcomes

- Evaluate gradient, divergence and curl of point function
- Verify Green, Stoke's and Divergence theorem.
- Find realation between Cartesian and polar co-ordinates
- Obtain the equation of the right circular cylinder.

List of Practicals (Problems)

1. The mutual relation between polar and Cartesian coordinates system in R^2
2. Transformation of equations from one system to another system.
3. The mutual relation among Cartesian, Cylindrical and spherical coordinate systems in R^3, Transformation of equations from one system to another system.
4. Problems on change of the order of integration
5. Examples of Gradient, Divergence and Curl
6. Problems on line integrals and volume integrals
7. Verify Green and Stokes theorem
8. Problems on Sphere.
9. Problems on Cone.
10. Problems on Cylinder.

PHYSICS

Sem
III

Electricity, Magnetism And Electromagnetic Theory

Core Compulsory

Marks : 70 + 30

Objectives

- This paper reviews the concepts of Electricity, Magnetism and Electromagnetic theory learnt at school from a more advanced perspective and goes on to build new concepts.
- It begins static and dynamic electric and magnetic fields, and the principles of electromagnetic induction.
- The students will be able to apply the concepts learnt to several real world problems.

Learning Outcomes

Upon completion of this course, students are expected to understand the following concepts:

- Understand the role of vectors in electrostatic and magnetism and their application to various dynamical situations.
- Demonstrate Gauss law, Coulomb's law for the electric field, and apply it to systems of point charges as well as line, surface, and volume distributions of charges.
- Apply Gauss's law of electrostatics to solve a variety of problems. Articulate knowledge of electric current, resistance and capacitance in terms of electric field and electric potential.

UNIT 1

1.1 Vector Analysis: Review of vector algebra (Scalar and Vector product), Vector Integration, Line, surface, and volume integrals of Vector fields

1.2 Vector theorems: Gauss-divergence theorem and Stoke's theorem of vectors (Statement only).

UNIT 2

2.1 Electrostatics: Introduction, Differential form of Gauss law, Electric potential, Poison and Laplace Equation, Field between Two concentric spheres which have equal and opposite charges.

2.2 Electrostatics Polarization: Laws of electrostatics field in presence of dielectrics, Energy of the field in the presence of a dielectric, Electrostatic Boundary Conditions.

UNIT 3

3.1 Magnetostatics: Biot-Savart's law and its applications- straight conductor, circular coil, solenoid carrying current. Divergence and curl of magnetic field. Magnetic vector potential. Ampere's circuital law, Magnetostatic Boundary Conditions.

3.2 Magnetic properties of materials:
Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of dia-, para- and ferromagnetic materials.

UNIT 4

4.1 Electromagnetic Induction: Faraday's laws of electromagnetic induction, Lenz's law, self and mutual inductance, L of single coil, M of two coils. Energy stored in magnetic field.

4.2 Network Transformations: Introduction, Types of network, Superposition Theorem, the Reciprocity Theorem, Thevenin's Theorem, Norton Theorem, Maximum Power Transfer Theorem, Compensation Theorem.

Sem

III

Nuclear Physics

Core Compulsory

Marks : 70 + 30

Objectives

- To provide an exposure to general properties of nucleus.
- To enable the student to explore the field of nuclear structure and nuclear reactions.
- To create awareness about functions of nuclear detectors and accelerators.
- To allow the student to have a deep knowledge of the fundamentals of nuclear physics and radioactive decay (α, β, γ decay)
- To understand the basics of elementary particles

Learning Outcomes

After the successful completion of the course, the students will be able to understand

- Details of radioactive processes, the basic properties of nucleus and nuclear structure
- Different types of nuclear reaction processes and Q- value equation through which the energy release in nuclear reactions like fission can be estimated.

UNIT 1

1.1 Radioactivity: Stability of the nucleus; Law of radioactive decay; Mean life and half-life; I deal equilibrium, Transient equilibrium and secular equilibrium, Radioactive series, Radioactive isotopes of lighter elements. Artificial radioactivity, Age of earth, Carbon dating.

1.2 Alpha decay: Cause of alpha decay, basic α-decay process, range and energy of α-decay, Geiger Nuttal rules, Qualitative discussion on the theory of α-decay.

1.3 Beta decay: Types of β-decays, conditions of β+ & β- decay and K capture, β-ray spectrum, Pauli's neutrino hypothesis

1.4 Gamma rays: γ-rays and their origin. Interaction of γ-particle with matter. Gamma-ray emission – selection rules, internal conversion, nuclear isomerism

UNIT 2

2.1 General Properties of Nucleus: Constituents of Nuclei and their intrinsic properties, Nuclear size, Nuclear mass, Concept of packing fraction and binding energy, binding energy curve and its significance. Nucleon-nucleon forces – qualitative discussions on nuclear force, Nuclear stability, neutron proton ratio in stable nuclei, stability curve, odd-even rules of nuclear stability.

2.2 Nuclear Models: Properties of nucleus as a charged liquid drop and the success and failures of liquid drop model. Shell Model (basics only), Weizsacher's semi empirical mass formula.

2.3 Nuclear Reactions: Types of Nuclear Reactions, The balance of mass and Energy in Nuclear reactions, The Q Equation, Solution of the Q Equation.

UNIT 3

3.1 Detectors: Introduction, Ionization chamber, Geiger-Muller counter, Cloud chamber, Bubble chamber, Spark chamber.

3.2 Cosmic rays: Origin of cosmic rays, primary & secondary cosmic rays and their composition. The East West effect. Latitude, longitude & altitude effect, Extensive Air Shower (EAS).

UNIT 4

4.1 Nuclear Fission: Nuclear fission and chain reaction, critical size, Neutron induced fission, Asymmetrical fission - mass yield, Emission of delayed neutrons by fission fragments, Energy released in the fission of U235, controlled chain reaction and basic principle of nuclear reactor.

4.2 Nuclear Fusion: Nuclear fusion reaction – basic concepts of fusion reactions, fusion barrier, fusion and thermonuclear reactions driving stellar energy.

4.3 Elementary particles: The four basic forces, Particles and antiparticles, Families of particles, conservation laws, particle interactions and decays

Sem
III

Physics Practical Iii

Core Compulsory

Marks : 70 + 30

Objectives

- To gain practical knowledge by applying the experimental methods to correlate with the Physics theory.
- To learn the usage of electrical systems for various measurements.
- Apply the analytical techniques and graphical analysis to the experimental data.
- To develop intellectual communication skills and discuss the basic principles of scientific concepts in a group.

Learning Outcomes

- At the end of the course, the student will be able to
- Apply the various procedures and techniques for the experiments.
- Use the different measuring devices and meters to record the data with precision
- Apply the mathematical concepts/equations to obtain quantitative results
- Develop basic communication skills through working in groups in performing the laboratory experiments and by interpreting the results
- Apply knowledge of mathematics, science, and engineering

LIST OF EXPERIMENTS

1. To determine an unknown Low Resistance using Potentiometer.
2. To determine an unknown Low Resistance using Carey Foster's Bridge.
3. To verify the Thevenin theorem.
4. To verify Norton theorem.
5. To verify the Superposition and Maximum power transfer theorems.
6. To study response curve of a Series LCR circuit and determine its (a) Resonant frequency, (b) Impedance at resonance, (c) Quality factor Q, and (d) Band width.
7. To study the characteristics of a series RC Circuit.
8. Simulation of Nuclear Radioactive decay using Calculator
9. To determine the half life period of the given radioactive sample using GM counter

CHEMISTRY

Sem

III

Physical Chemistry - I

Compulsory

Marks : 70 + 30

Objectives

- To understand basic concepts of gas law and gas constant.
- To develop understanding for Molecular velocities, Root mean square, average and most probable velocities. Derivation of various laws
- To get knowledge of liquid states and liquid crystals
- To be familiar with Periodic Table and Periodic Properties
- To understand rate law, rate constant, molecularity of reaction and order of reaction
- To understand derivation of first order, second order reaction and determination of method of order of reaction

Learning Outcomes

Learner will be able to:

- Learn basic concepts of gas law and gas constant
- Learn understanding for Molecular velocities, Root mean square, average and most probable velocities. Derivation of various laws
- Learn get knowledge of liquid states and liquid crystals
- Familiar with Periodic Table and Periodic Properties
- Understand rate law, rate constant, molecularity of reaction and order of reaction
- Understand derivation of first order, second order reaction and determination of method of order of reaction

UNIT 1: Gaseous State

1.1 Introduction,
1.2 Gas Laws:-Boyle's Law, Charle's Law, Avogadro's Law, Ideal Gas Law or Gas equation,
1.3 Nature of Gas Constant and its numeric value
1.4 effusion and diffusion
1.5 Molecular velocities: Root mean square, average and most probable velocities.
1.6 Distribution of molecular speeds
1.7 Derivation of Maxwell's distribution law of velocities
1.8 collision number, collision
1.9 frequency, mean free path and collision diameter
1.10 Postulates of kinetic theory of gases, validity of the postulates of kinetic theory of gases

UNIT 2: Liquid State

2.1 Intermolecular forces,
2.2 Structure of liquids (a qualitative description)
2.3 Structural difference between solids, liquids and gases
2.4 Surface tension and viscosity: Determination, properties
2.5 Parachor, Rheochor and refractive index
2.6 Liquid Crystals: An introduction to liquid crystals
2.7 Classification and properties of liquid crystals

UNIT 3 :Surface Chemistry

3.1. Adsorption
3.2. Difference between Adsorption and absorption
3.3. Adsorption principles
3.4. Adsorption by solids
3.5. Types of Adsorption
3.6. Factors influencing adsorption
3.7. Adsorption of solutes from solutions
3.8. Adsorption Isotherm
3.9. Freundlich adsorption isotherm
3.10. Langmuir adsorption isotherm

UNIT 4: Chemical Kinetics

4.1 The concept of reaction rate,
4.2 Rate Laws and Rate constants,
4.3 Factors influencing reaction rates
4.4 Molecularity and order of reaction
4.5 Zero order reactions
4.6 First order rate equation
4.7 Second order rate equation
4.8 Arrhenius equation and significance of activation energy
4.9 Catalysis: Introduction
4.10 Types of catalysis Characteristics of catalysis
4.11 Classification of catalysis
4.12 Michaelis Menton equation

Sem

III

Chemistry Of Hydrocarbons

Compulsory

Marks : 70 + 30

Objectives

- To understand Nomenclature, preparation and mechanisms of formation of alkanes
- To make students familiar with physical and chemical properties of alkenes and can develop understanding of unique reactions of Alkenes
- To develop skill of explanation in mechanism of Nucleophilic and Electrophilic addition reactions
- To understand polyaromatic hydrocarbons and their Chemistry

Learning outcomes

- Learners will be able to:
- Carry out Nomenclature of various types of Hydrocarbons
- Explain mechanism of preparation of various types of Hydrocarbons
- Develop skill to discuss nucleophilic and electrophilic reactions of hydrocarbons
- Describe chemistry of polyaromatic hydrocarbons

UNIT 1: Alkanes

1.1. IUPAC nomenclature of branched and unbranched alkanes
1.2. Methods of formations with reference to Wurtz reaction, Kolbe reaction
1.3. Corey house reaction and decarboxylation of carboxylic acids
1.4. Chemical reaction of alkanes
1.5. Mechanism of free radical halogenations of alkanes
1.6. Reactivity and selectivity
1.7. Cycloalkanes: Nomenclature
1.8. Methods of formation including photochemical [2+2] cycloaddition reaction,
1.9. Dehalogenation of α, β-dihalides
1.10. Pyrolysis of calcium or barium salt of carboxylic acids
1.11. Chemical reactions
1.12. Baeyer's strain theory and its limitations
1.13. Ring strain in small rings (cyclopropane and cyclobutane)
1.14. Theory of strainless rings

UNIT 2: Alkenes

2.1. Nomenclature of alkenes
2.2. Methods of preparation of alkenes
2.3. Mechanism of dehydration of alcohols and dehydrohalogenation of alkyl halides regioselectivity in alcohol dehydration
2.4. The Saytzeff rule
2.5. Hofmann elimination
2.6. Electrophilic and free radical additions Markownikoff's rule
2.7. Hydroboration oxidation
2.8. Oxymercuration-reduction
2.9. Ozonolysis and its applications
2.10. Hydration, hydroxylation and oxidation with $KMnO_4$

UNIT 3: Alkynes

3.1. Nomenclature
3.2. Structure and bonding in alkynes
3.3. Methods of formation
3.4. Chemical reactions and acidity of alkynes
3.5. Mechanism of nucleophilic and Electrophilic addition reactions
3.6. Hydroboration-oxidation of alkynes
3.7. Metal- ammonia reductions
3.8. Oxidation
3.9. Polymerization

UNIT 4: Polynuclear hydrocarbons

4.1. Introduction and Nomenclature
4.2. Establish the structure of Naphthalene
4.3. Synthesis of Naphthalene
4.4. General reactions of Naphthalene such as Addition of hydrogen and halogen, Ozonolysis, Substitution by halogen, Nitration, Sulphonation, Friedel craft reaction,
4.5. Occurrence isomerism and nomenclature of Anthracene
4.6. Establishment of structure of Anthracene
4.7. Chemical properties of Anthracene such as Halogenation, Nitration, sulphonation, Reduction, Oxidation Introduction to phenanthrene

Sem III | **Chemistry Practical-3** | Compulsory Marks : 70 + 30

Objectives

- Can get understanding and knowledge of pH metry
- Can get understanding and knowledge of Potentiometry
- Can get understanding and knowledge of Conductometry
- Can understand about refractive index and surface tension
- Can get understanding and knowledge of Chemical Kinetics, distribution method and adsorption
- Get thorough practice of Organic qualitative analysis

Learning Outcomes

Learners will be able to:

- Operate instruments like pH metry, Potentiometry and Conductometry, Stalgmometer, Refractometer
- understand about refractive index and surface tension
- Carry out experiments for Chemical kinetics with accuracy and required skills
- Carry out experiments for Distribution Coefficient and Adsorption with accuracy and required skills
- Develop observation and analytical skills

Organic qualitative analysis of liquid substances (Minimum: 8)

- Identification of Unknown organic Liquid substance is carried out through systematic process having different stages and determination of boiling point of Liquid substances of following type:

  Acetic acid, Aniline, Acetone, Methyl Alcohol, Ethyl Acetate, Nitrobenzene, Chloroform, Chlorobenzene, Benzaldehyde, Methyl acetate, and Methyl Ethyl Ketone(MEK)

Physical Chemistry Practicals:

Stalagmometer

1. To determine the surface tension of a given liquid at room temperature using stalagmometer by drop number method

Refractometer (Any One)

1. To determine the molar refraction and refractive index of a given salt
2. To determine specific refraction and molar refraction of liquid A, B and its Mixture
3. To study the variation of refractive index with composition of a given liquid and to determine the composition of unknown mixture

pH metry

1. To determine Molarity of strong acid by titrating against 0.1 M NaOH solution
   Potentiometry
2. To determine Molarity of strong acid by titrating against 0.1 M NaOH solution
   Conductometry
3. To determine Molarity of strong acid by titrating against 0.1 M NaOH solution

Chemical Kinetics (Any Three)

1. Study the hydrolysis of ethyl acetate in presence of sodium hydroxide
2. Study the hydrolysis of ethyl acetate in presence of hydrochloric acid
3. Determine the order of reaction of hydrolysis of methyl acetate in acidic medium
4. Determination of kinetics of reaction between sodium thiosulphate and hydrochloric acid by initial rate method
5. Preparation of solutions

Sem III

Gymnosperm & Paleobotany

Compulsory

Marks : 70+ 30

OBJECTIVE

- To enable students to understand the Gymnosperms, the evolutionary trends in external morphology and internal structures, identification and classification.

LEARNING OUTCOME

After successfully completing this paper, students will be able to:

- Memorize general characters of gymnosperms.
- Define fossil and fossil groups.
- Discuss gymnosperms with example of plants Cycas, Pinus and Ephedra.
- Describe morphology of gymnosperms.
- Summarize types and forms of fossils.

UNIT 1: CYCADOPSIDA

1.1 Classification of Cycas
1.2 General Characteristic
1.3 Occurrence, Distribution, Morphology in Cycas
1.4 Life cycle of Cycas

UNIT 2: CONIFEROPSIDA

2.1 Classification of Pinus
2.2 General Characteristic
2.3 Occurrence, Distribution, Morphology of Pinus
2.4 Life cycle of Pinus

UNIT 3: GNETOPSIDA

3.1 Classification of Ephedra
3.2 General Characteristic
3.3 Occurrence, Distribution, Morphology of Ephedra
3.4 Life cycle of Ephedra

UNIT 4: PALEOBOTANY

4.1 Fossils and ideal condition of fossilization
4.2 Types of Fossils
 4.2.1 Impression
 4.2.2 Casts
 4.2.3 Molds
 4.2.4 Petrification
 4.2.5 Coal balls
4.3 Brief study of following fossils
 4.3.1 Lepidodendron
 4.3.2 Lepidocarpon
 4.3.3 Calamites.
4.4 Importance of Paleobotany

Sem **III**

Plant Taxonomy

Compulsory

Marks : 70 + 30

OBJECTIVE

- To enable students to understand angiosperms and to develop the skill of identification and classification.

LEARNING OUTCOMES

- After successfully completing this paper, students will be able to
- Identify morphological characters of plants
- Classify Artificial and natural systems.
- Demonstrate families according Bentham and Hooker's system
- Determine Botanical Nomenclature of angiosperm plants.
- Illustrate floral formula, floral diagram and identification key.
- Identify plant families on the basis of morphological characteristic.
- Apply proper herbarium methods - collecting, mounting, and keeping records.

UNIT 1 MORPHOLOGY

1.1 Types of Leaves
1.1.1 Types of Phyllotaxy
1.1.2 Types of Venation
1.2 Types of Flower

UNIT 2 TYPES OF INFLORESCENCE

2.1 Racemose
 2.1.1 Raceme Spike
 2.1.2 Catkin
 2.1.3 Spadix
 2.1.4 Umbel
 2.1.5 Capitulum
2.2 Cymose
 2.1.1 Solitary terminal
 2.1.2 Solitary axillary
 2.1.3 Helicoid
 2.1.4 Scorpioid
 2.1.5 Biparous
 2.1.6 Multiparous cymes.
2.3 Special Types of Inflorescences
 2.3.1 Hypanthodium
 2.3.2 Verticillaster
 2.3.3 Cyathium

UNIT 3 SYSTEMATIC BOTANY 1

3.1 Outline Classification of Bentham and Hooker's System of Classification.
3.2 Merits and Demerits of Bentham and Hooker's System of Classification
3.3 Type of Aestivation
3.4 Type of Placentation
3.5 Monocotyledons Families
    3.5.1 Amaryllidaceae
    3.5.2 Gramineae

UNIT 4 SYSTEMATIC BOTANY 2

Detailed study of the following families:

4.1 Dicotyledons- Polypetalae
    4.1.1 Malvaceae
    4.1.2 Leguminosae
4.2 Dicotyledons-Gamopetalae
    4.2.1 Solanaceae
    4.2.2 Rubiaceae
4.3 Dicotyledons- Apetalae
    4.3.1 Nyctaginaceae
    4.3.2 Euphorbiaceae

Sem III	Practicals in Plant Science 3	Compulsory Marks : 70 + 30

Objectives

To study flora
To identify morphological characteristics of Angiosperms.
To identify morphological characteristics of Gymnosperms.
To classify the Angiosperm plants.
To correlate the morphological characters with family identification.

Learning Outcome

Learners will be able to:
Develop skill of identification of morphological characters of Angiosperms.
Develop skill of identification of morphological characters of Gymnosperms.
Develop a skill of identification of Angiosperm family.
Develop a skill of taking Transverse and Vertical section of various plant parts.

List of Experiments

PLANT TAXONOMY

1. To study types of Phyllotaxy
2. To study types of Venation
3. To study types of Flower
4. To study types of Inflorescence
5. To study types of Aestivation
6. To study types of Placentation
7. To study outline of the system of classification proposed by Bentham and Hooker
8. To study the family Malvaceae
9. To study the family Leguminosae
10. To study the family Solanaceae
11. To study the family Rubiaceae
12. To study the family Nyctaginaceae
13. To study the family Euphorbiaceae
14. To study the family Amaryllidaceae
15. To study the family Gramineae
16. Mounting of a properly dried and pressed specimen of any wild plant with herbarium label (to be submitted in the record book).

GYMNOSPERM AND PALEOBOTANY

1. Study of Outline classification of Gymnosperm
2. Study of external features of Cycas plants
3. To study external features of male cone in Cycas plant
4. To study the structure of Microsporophyll and microsporangia in Cycas
5. Study of morphology of Pinus plant
6. To study the structure of male cone in Pinus plant
7. To study the structure of female cone of Pinus plant
8. Study of external morphology of Ephedra plant
9. Study of Male strobilus in Ephedra plant
10. Study of female strobilus in Ephedra plant
11. Study of permanent slide of Cycas
12. Study of permanent slide of Pinus
13. Study of permanent slide of Ephedra

Sem
III

Principles Of Evolution and Genetics

Compulsory

Marks : 70 + 30

OBJECTIVE

To enable students to comprehend the modern concepts and applied aspects of genetics and evolution, to create awareness regarding common hereditary diseases. Understanding of the classical aspects of evolution and genetics.

Learn about Mendelian genetics which is necessary for the basic foundation of genetics for students.

Development of the approaches to study the inheritance of traits in progeny.

Acknowledgment of Mendel's contribution towards laying the foundation of our understanding regarding genetics.

Understanding of karyotyping and chromosomal abnormalities.

Clarification of concepts related to pedigree analysis.

LEARNING OUTCOMES

After successfully completing this paper, students will be able to:

- Define the terminologies of Genetics and evolution
- Study of Mendelian Genetics
- Explain the Concept, Characters and Examples of multiple alleles.
- Study of evolution patterns
- Understand the heredity patterns

UNIT-1. POPULATION GENETICS AND EVOLUTION

1.1 Origin of life: Various theories, Oparin Haldane hypothesis and Miller's experiment
1.2 Darwin and Natural Selection
1.3 Evidences of Evolution
1.4 Lamarckism Neo Darwinism
1.5 Speciation : Types and importance

UNIT-2. EVOLUTION AND SPECIATION

2.1 Sex Determination theories
2.2 Hardy-Weinberg genetic equilibrium, Natural selection
2.3 Genetics of Speciation
2.4 Genetic linkage in Drosophila

UNIT 3 : MENDELIAN GENETICS

3.1 Principles of Mendelian genetics
3.2 Incomplete Dominance, Co dominance, polygenic inheritance, pleiotropism and Epistasis
3.3 The Concept of Gene : Gene definition and Gene Cistron relationships
3.4 Gene Structure and Architecture
3.5 DNA constancy and C-value paradox

UNIT-4. STRUCTURAL CHANGES IN DNA MATERIAL AND EXTRA CHROMOSOMAL INHERITANCE

4.1 Chromosomal aberrations : Structural and Numerical abnormalities
4.2 Pedigree analysis
4.3 Molecular basis of spontaneous and induced mutations
4.4 DNA repair mechanisms

Sem III

Vertebrate Zoology

Compulsory

Marks : 70 + 30

OBJECTIVE

- This paper introduces student to the subject. It opens up a new world of classification of organisms under various categories. It gives knowledge about the classification of vertebrates .

LEARNING OUTCOMES

On completion of this paper, students will be able to

- Understand about the classification of vertebrata/chordate.
- Describe the general characteristics of various phyla.
- Describe the general features of various class of vertebrata.
- Explain various internal characteristics and systems of various phyla
- Learning important differentiating features of various phyla/class
- Learn in detail various systems of representative animals of various phyla

UNIT 1 INTRODUCTION TO CHORDATA

1.6 General characteristics and outline classification
1.7 Protochordata- General characteristics of Hemichordata, Urochordata and Cephalochordata.
1.8 Advanced features of vertebrates over protochordata
1.9 Agnatha- General characteristics and classification of cyclostomes up to class

UNIT 2 PISCES , AMPHIBIA AND REPTILIA

2.5 Pisces- General characteristics of Chondrichthyes and Osteichthyes, classification up to order
2.6 Migration, Osmoregulation and parental care in fishes
2.7 Amphibia- General characterisitics and classification up to order, Parental care in Amphibians
2.8 Reptilia- General characteristics and classification up to order, Affinities of Sphendon, Poison apparatus and biting mechanism.

UNIT 3 AVES AND MAMMALS

3.1 Aves- General characteristics and classification, Archeopteryx-a connecting link
3.2 Principles and aerodynamics of flight, Flight adaptation and migration in birds
3.3 Mammals- General characteristics up to order,
3.4 Affinities of Prototheria, Adaptive radiation with reference to locomotory appendages.

UNIT 4 ZOOGEOGRAPHY

4.1 Zoogeological realms
4.2 Theories pertaining to distribution of animals
4.3 Plate tectonic and Continental Drift Theory
4.4 Distribution of Vertebrates in different realms

Sem

III

Practicals in Zoology-3

Compulsory

Marks : 70 + 30

Objectives

- Understanding of the classical aspects of genetics.
- Learn about Mendelian genetics which is necessary for the basic foundation of genetics for students.
- Development of the approaches to study the inheritance of traits in progeny.
- Acknowledgment of Mendel's contribution towards laying the foundation of our understanding regarding genetics.
- Understanding of karyotyping and chromosomal abnormalities
- Clarification of concepts related to pedigree analysis.
- To relate these basics to the higher forms of life.
- Orientation of students to opt for specialized courses based on genetics in later part of their academic career
- Understanding of, and be able to identify in detail, the anatomical characteristics of members of the phylum Chordata

Learning Outcomes

By performing the lab experiments the students will be able to

- To calculate Mendelian ratio and probabilities
- To learn basics of Karyotyping
- To crack and decipher the pedigree charts
- To understand biological databases and other online resources
- To search desired nucleotide sequence in FASTA format from online databases
- To search desired protein sequence in pir format from online databases
- The student will demonstrate an understanding of, and be able to identify in detail, the anatomical characteristics of members of the phylum Chordata. Beginning with the primitive Amphioxus and progressing to the complex mammals.
- The student will demonstrate an understanding of the ontogenic and phylogenic relationships of the three chordate subphyla and several vertebrate classes.
- Establish the body plan of the idealized chordate by describing the following structures and systems; being sure to cite similarities and differences to invertebrate patterns: a. Bilateral symmetry b. Regional differentiation c. Gills d. Notochord e. Nervous system f. Digestive system g. Kidneys h. Reproductive system i. Circulatory system j. Coelom k. Muscles l. Skeleton m. Appendages n. Segmentation
- Characterize the Vertebrata in terms of brain, cranium, vertebrae and foramina. 2. List and describe briefly the major taxonomic categories within the piscine group.

List of Experiments

1. To confirm thalassemia by Necked Eye Single Tube RBCs Osmotic Fragility Test (NESTROFT).
2. To solve problems based on Mendelian Inheritance Patterns.
3. To study Karyotype of Human Chromosomes.
4. Identification of Normal Male and Female Karyotype.
5. Identification of Turner Syndrome using Karyotype.
6. Identification of Klinefelter Syndrome using Karyotype.

7. Identification of Down Syndrome using Karyotype.
8. To perform Pedigree analysis and predict probabilities with suitable examples.
9. Introduction to NCBI web portal (www.ncbi.nlm.nih.gov).
10. To perform search of DNA Sequences from Primary DNA Databases (Genbank, ENA & DDBJ).
11. To perform search of Protein Sequences from Primary Protein Databases (Uniprot, TrEMBL, PIR-PSD).
12. Study of museum specimen and permanent slides relevant to the theory from Cyclostomes to Reptilia.
13. Comparative study of Integument, Digestive Tract and Blood Cells of Vertebrates through observation of permanent slides.
14. Comparative study of Brain of different Vertebrates through demonstration of charts and models.
15. Comparative study of Vertebrate Osteology among Frog, Fowl and Rabbit (Pecimen: Skull, Limb Bones, Girdles, Special Bones, Vertebrae)
16. Comparative study of Heart and Aortic Arches, Respiratory System and Urogenital System of different Vertebrates through demonstration of charts and models.
17. Field visit to Zoological Park for study of Aquatic Vertebrate/Terrestrial Vertebrates.

Semester IV

Semester – IV

			Total Papers	Credit	Hours	Internal	External	Total
Education	Education	Theory/ Practical	3 (2+1)	7	120	75	175	250
B.Sc (Science)	Principal	Theory/ Practical	3 (2+1)	9	180	90	210	300
	First Subsidiary	Theory/ Practical	3 (2+1)	9	180	90	210	300
		Total	**9**	**25**	**480**	**255**	**595**	**850**

Sr. No.	Subject	Title of the paper	T/P	Credit	Hours	Internal	External	Total
1	Education	Classical Sanskrit	Practical	1	30	15	35	50
2	Education	Pedagogy of Mathematics	Theory	3	45	30	70	100
3	Education	Pedagogy of Science	Theory	3	45	30	70	100
4	Mathematics	Differential Equations	Theory	3	45	30	70	100
5	Mathematics	Numerical Analysis	Theory	3	45	30	70	100
6	Mathematics	Practical: Differential Equations & Numerical Analysis	Practical	3	90	30	70	100
7	Physics	Elements of Modern Physics	Theory	3	45	30	70	100
8	Physics	Electronics	Theory	3	45	30	70	100
9	Physics	Physics Practical IV	Practical	3	90	30	70	100
10	Chemistry	Organic Chemistry-I	Theory	3	45	30	70	100
11	Chemistry	Inorganic Chemistry-I	Theory	3	45	30	70	100
12	Chemistry	Chemistry Practical-4	Practical	3	90	30	70	100
13	Botany	Plant Embryology	Theory	3	45	30	70	100
14	Botany	Plant Anatomy	Theory	3	45	30	70	100
15	Botany	Practicals in Plant Science IV	Practical	3	90	30	70	100
16	Zoology	Fundamentals of Microbiology	Theory	3	45	30	70	100
17	Zoology	Immunology & Haematology	Theory	3	45	30	70	100
18	Zoology	Practicals in Zoology -4	Practical	3	90	30	70	100

Any two subjects of Science (Mathematics, Physics, Chemistry, Botany and Zoology) will have to be opted by the student.

EDUCATION

Sem

IV

LPC 5: Classical Sanskrit

Compulsory

Marks : 35 + 15

हेतवः

प्रशिक्षणार्थिनः ...

- विविधप्रवृत्तीनां माध्यमेन संस्कृतभाषायां श्रवणं भाषणं पठनं लेखनं च इति चतुर्षु कौशलेषु सामर्थ्यं प्राप्स्यन्ति ।
- दैनिकजीवने स्वव्यवहारे संस्कृतभाषायाः उपयोगं कर्तुं सामर्थ्यं प्राप्स्यन्ति ।
- संस्कृतभाषायां नैपुण्यं प्राप्तुं सक्षमाः भवेयुः ।
- संस्कृतभाषायाः प्रभावपूर्णप्रयोगार्थं विविधयुक्तिप्रयुक्तीनां प्रयोगं कुर्युः ।

युनिटः 1 श्रवणलेखनकौशलाधारिताः प्रवृत्तयः

1.1 (1) https://www.youtube.com/watch?v=3d64p0Pd04

(2) https://www.youtube.com/watch?v=Jk4ID9W-gno\0

प्रदत्त लिंकमाध्यमेन शिशुगीतद्वयं सावधानं श्रुण्वन्तु ।

1.2 (1)https://www.drive.google.com/file/d/JjBjmjGxyoSviWZCtOJooParlBCI4L/view

(2) https://www.youtube.com/ww/KmaEAv94 प्रदत्तलिंकमाध्यमेन संस्कृतमहत्वं दर्शयती गीतद्वयं सावधानं श्रुण्वन्तु , चिन्तनं कुर्वन्तु, संस्कृतेन लिखन्तु च ।

1.3 संस्कृतवार्ताम् शृण्वन्तु चिन्तनं च कुर्वन्तु ।

1.4 अष्टमकक्षायाम् नवमकक्षायाम् च अभ्यासक्रमे विद्यमानानि सुभाषितानि ध्यानपूर्वकं शृण्वन्तु चिन्तनं च कुर्वन्तु ।

1.5 यु ट्यूब https:youtube/bmqwu-Tlowa youtube जालपुटमाध्यमेन संस्कृतश्लोकान् शृण्वन्तु ध्यानपूर्वकं लेखनं च कुर्वन्तु ।

(प्रशिक्षणार्थिनः १ तः ५ मध्ये विद्यमानाम् प्रवृत्तिम् स्वयमेव चिनुयुः , प्रवृत्तेः वृत्तं PPT/BLOG इत्यादीनाम् माध्यमेन लिखतस्वरूपेण प्रस्तुतं कुर्युः । यत्र श्रवणकौशलस्य प्रवृत्तेः लिंक विषये उल्लेखः कर्तव्यः।)

युनिट : 2 पठनभाषणकौशलाधारिताः प्रवृत्तयः -

2.1 संस्कृते पंचतन्त्रकथायाः पठनं कथनं च कुर्वन्तु । (पंचतन्त्रकथाः - संस्कृतभारती, नव देहली)

2.2 संस्कृते लघुकथायाः पठनं कथनं च कुर्वन्तु । ('सुगन्धः' संस्कृतकथाः - संस्कृतभारती, नव देहली)

2.3 संस्कृते बोधकथायाः पठनं कथनं च कुर्वन्तु । (बोधकथाः-संस्कृतभारती, नव देहली)

2.4 'चरितं हि महात्मनाम्' पुस्तकस्य पठनं कुर्वन्तु , संक्षेपेण स्वशब्देषु वर्णनं च कुर्वन्तु ।

2.5 स्वपरिचयः स्वदिनचरी च ।

(उपरि निर्दिष्टाः1 तः 5 प्रवृत्तीः समाप्य तासां वृत्तं श्राव्य उत दृश्यमाध्यमेन प्रस्तौतव्यम् ।)

विशेषः -

- 'अ' एवं च 'ब' विभागयोः आधारेण कार्यशालायाः उत प्रवृत्तेः आयोजनं कुर्वन्तु ।
- प्रशिक्षणार्थी कांचित् एकां प्रवृत्तीं चित्वा तस्याः वृत्तं संस्थायां समर्पयेत् ।
- अर्थपूर्ण-अभ्यासार्थं एताभ्यां द्वाभ्यां विभागाभ्यां न्यूनातिन्यूनं काश्चन तिस्रःप्रवृत्तयः प्रत्येकं संस्थया कर्तव्याः ।
- प्रशिक्षणार्थिना प्रस्तुतानां प्रवृत्तीनाम् आधारेण एव प्रायोगिककार्यस्य टिप्पणीलेखनं भविष्यति ।

Sem IV

PS2/PS3: Pedagogy of Mathematics

Optional

Marks : 70 + 30

Objectives

To enable the prospective teachers:

- to understand the aims and objectives of teaching Mathematics
- to understand Lesson Planning and Unit Lesson Planning
- to understand Teaching Learning Resources in Mathematics
- to understand Curriculum of Mathematics and Mathematics Textbook

Unit 1: Aims and Objectives of Mathematics

1.1 Concept of Mathematics and Elements of Mathematics: Axioms, Postulates, Propositions and Theorems
1.2 Taxonomy of Educational Objectives
1.3 General and specific Objectives
1.4 Instructional Objectives of Teaching Mathematics

Unit 2: Lesson planning and Unit Lesson Planning

2.1 Lesson planning : Concept, Steps and Advantages
2.2 Characteristics of Ideal lesson plan
2.3 Unit Lesson Planning: Concept, Steps and Advantages
2.4 Techniques: Oral work, Drill and review, Assignment, Brain-storming

Unit 3: Teaching Learning Resources in Mathematics

3.1 Teaching Aids: Concept, Importance, Principles of use and selection
3.2 Classification of Teaching Aids and Improvised teaching aids
3.3 Various Learning and Reference Resources in Mathematics: Journal and Magazine, Reference Books, Virtual lab, Apps, Documentaries and Movies of Mathematics and Mathematicians, Websites and Blogs
3.4 Mathematics Laboratory: Need, Importance, Use and Resources

Unit 4: Curriculum of Mathematics and Mathematics Textbook

4.1 Objectives of Mathematics Curriculum at Various level
4.2 Importance of Textbook, Characteristics of ideal textbook and Evaluation of Mathematics textbook.
4.3 Teacher Handbook: Concept, Characteristics and Importance
4.4 Co-curricular activities: Mathematics Club, Fair, Field Trip, Maths Olympiad

Sem
IV

PS2/PS3: Pedagogy of Science

Optional

Marks : 70 + 30

Objectives

To enable the prospective teachers

- to understand the aims and objectives of teaching Science
- to understand Lesson Planning and Unit Lesson Planning
- to understand Teaching Learning Resources in Science
- to understand Curriculum of Science and Science Textbook

Unit 1: Aims and Objectives of Teaching Science

1.1 Concept of Science and Elements of Science: Facts, Concept, Principles, Hypothesis, Generalization
1.2 Taxonomy of Educational Objectives
1.3 General and Specific Objectives
1.4 Instructional Objectives of Teaching Science

Unit 2: Lesson planning and Unit Lesson Planning

2.1 Lesson planning : Concept, Steps and Advantages
2.2 Characteristics of Ideal lesson plan
2.3 Unit Lesson Planning: Concept, Steps and Advantages
2.4 Techniques: Oral work, Drill and review, Assignment, Brain-storming, Play-way

Unit 3: Teaching Learning Resources in Science

3.1 Teaching Aids: Concept, Importance, Principles of use and selection
3.2 Classification of Teaching Aids and Improvised teaching aids
3.3 Various Learning and Reference Resources in science: Science fiction (Rhymes, Hykus, Drama), Journal and Magazine,Encyclopedia, Reference Books, Virtual lab, Apps, Documentaries and Movies of Science and Scientists, Websites and Blogs
3.4 Science Laboratory: Concept, Types and Importance
- Planning and layout of General Science Laboratory
- Characteristics of Laboratories at Higher Secondary Level
- Maintenance of Science laboratory

Unit 4: Curriculum of Science and Science Textbook

4.1 Objectives of Science Curriculum at Various level
4.2 Importance of Textbook, Characteristics of ideal textbook and Evaluation of Science Textbook.
4.3 Teacher Handbook: Concept, Characteristics and Importance
4.4 Co-curricular activities: Science club, Science fair, Field Trip, National Talent Search exam ination

MATHEMATICS

Sem
IV

Differential Equation

Compulsory

Marks : 70 + 30

Objectives

- To understand the concept of various ordinary differential equations.
- To develop the skills of obtaining solutions of higher ordinary differential equations.
- To acquire knowledge of series solution of differential equations.
- To apply the knowledge of solution of the partial differential equation.

Learning Outcomes

This course will enable students to:

- Find the solution of ordinary differential equation by various methods.
- Evaluate the solution of higher order differential equation by method of undetermined coefficients and variation of parameter.
- Find the series solution by power series method.
- Evaluate the first order partial differential equation.

Unit 1 First Order Differential Equations

1.1 Order and Degree, Methods for solving first order ODE-Variable Separable
1.2 Homogeneous Differential equation
1.3 Exact Differential Equation, Non-exact Differential Equation
1.4 Linear Differential Equation, Bernoulli's differential equation

Unit 2 Higher Order Differential Equations

2.1 Differential operator (D) , Linear homogeneous and non-homogeneous higher order differential equation with constant coefficients, Complementary and particular Integral (solution)
2.2 Wronskian, Methods of Undetermined Coefficients method
2.3 Variation of Parameters of higher order ODE
2.4 Euler-Cauchy Equation

Unit 3 Series Solutions of Differential Equations

3.1 Series solutions of first order equations
3.2 Second order linear equations(Only power series method)
3.3 Ordinary and singular points

Unit 4 Partial Differential Equations

4.1 Formation of Partial differential equations by the elimination of Arbitrary constants and arbitrary functions.
4.2 Partial differential equations of the first order, the complete and particular integrals
4.3 Lagrange's solution of linear equations.
4.4 Some special types of equations which can be solved easily by the method other than Charpit's method.

Sem
IV

Numerical Analysis

Compulsory

Marks : 70 + 30

Objectives

- To solve Non-linear equation by various numerical methods.
- To Develop the skills of comparing Numerical solution and exact solutions.
- To acquire the Knowledge of finite difference operator.
- To Apply the knowledge of solution of system of linear differential equation.

Learning Outcomes

This course will enable students to:

- Find the roots of equation by various methods.
- Evaluate the value of the function using different finite difference operator techniques.
- Evaluate the numerical integration by different techniques.
- Find the solution of system of linear equation and differential equations.

Unit 1 Solution of Nonlinear equation

1.1 Non Linear Equation-Method for finding roots of nonlinear equations, Bisection method
1.2 Secant Method
1.3 Regula-Falsi Method
1.4 Newton-Raphson Method

Unit 2 Interpolation

2.1 Finite Differences, Forward, Backward and Central operators Interpolation by polynomials:
2.2 Newton's forward, Backward interpolation formula
2.3 Newton's divided Gauss & Stirling's central difference formulae Lagrange's interpolation
2.4 formula for unequal intervals

Unit 3 Numerical Integration

3.1 Newton-Cotes formula
3.2 Trapezoidal and Simpson's formulae
3.3 Error formulae
3.4 Gaussian quadrature formulae

Unit 4 Solution of System of Linear Equations and Differential Equations

4.1 Gauss-Jacobi method and Gauss-Seidel method
4.2 Picard's Method, Euler's Method
4.3 Higher order Taylor's Method
4.4 Runge-Kutta Method

Sem
IV

Practical: Differential Equation & Numerical Analysis

Compulsory

Marks : 70 + 30

Objectives

- To understand the concept of various ordinary differential equations.
- To develop the skills of obtaining solutions of higher ordinary differential equations.
- To acquire the Knowledge of Numerical Analysis.
- To Apply the knowledge of Numerical Analysis for any real time problem.

Learning Outcomes

- Solve the exact, linear and nonlinear differential equation
- Find the solution of first order nonlinear partial differential equation
- Obtain the root of the equation using Newton-Raphson method
- Solve the differential equation using Runge-Kutta method

List of Practical's (Problems)

1. Solve the differential equation of order 1 and degree 1
2. Solve the differential equation of order 1 and higher degree
3. Solve the linear differential equation of higher order with constant coefficient
4. Solve the linear differential equation of higher order with variable coefficient
5. Example of first order nonlinear partial differential equation (Langrange's Equation)
6. Finding the roots of an equation using Bisection method and method of false position
7. Example based on Newton Raphson method
8. Newton forward and backward interpolation
9. Lagrange's interpolation and Newton's divided interpolation
10. Solution of system of equation using Gauss elimination method, Gauss Jacobi method and Gauss Seidel method

PHYSICS

Sem
IV

Elements Of Modern Physics

Core Compulsory

Marks : 70 + 30

Objectives

- It introduces basic concepts, theory, and applications of modern physics, with the emphasis on relativistic and quantum physics.
- Provides students with the fundamental understanding of the principles and laws of relativistic and quantum physics.
- Introduces elements of atomic, nuclear, solid-state, and particle physics.
- Teaches problem solving techniques.
- Demonstrates how observation, experiment, and theory work together to continue to expand the frontiers of knowledge of the physical Universe.

Learning Outcomes

Students passing this course should be able to:

- Explain the concepts, principles, and measurement in the quantum theory.
- Use the physics laws and advanced mathematical tools to determine the dynamics of physical bodies at different scales.
- Illustrate how classical physical systems can be described as a limit of relativistic and quantum physical systems at small velocities and large distances.
- Illustrate how observation, experiment, and theory work together to continue to expand the frontiers of knowledge of the physical Universe. Students will also achieve the following.
- The student will be able to evaluate the conduct and/or design of scientific inquiry can apply advanced methods/techniques in conducting scientific inquiry or assess the potential implications of scientific inquiry.

UNIT 1

1.1: Historical origins of quantum theory: Difficulties with Classical Models, optical spectra, Black body radiation, Wien's law, Rayleigh-Jeans Law, Planck's Law of Radiation & Special Cases of Planck's Law, Photoelectric effect, Compton effect.

1.2 Atomic Models: Bohr atom model and its limitations, Wilson-Sommerfeld relativistic atom model, Vector Atom model and associated quantum numbers, Spin orbit interaction and fine structure, total angular momentum for many e atom; L-S & J-J coupling Bohr Magneton, Larmor's precession, Stern Gerlach experiment, Electron Spin and gyro magnetic ratio, Frank- Hertz experiment, Stationary states of atoms. The correspondence principle

UNIT 2

2.1 Wave Particle Duality and Wave Packet: de Broglie hypothesis, Experimental confirmation of matter wave, Davisson Germer Experiment, velocity of de Broglie wave, wave particle duality, Complementarity, Superposition of two waves, phase velocity and group velocity, wave packets, Gaussian Wave Packet, spatial distribution of wave packet, Localization of wave packet in time.

2.2 Introduction of Quantum Mechanics: Heinsenberg's uncertainty relation; Wave function; Schroedinger Equation, Physical interpretation of trapped particles and Probability densities; Particle in a box, rigid rotator, Harmonic oscillator

UNIT 3

3.1 Charge of electron: Millikan's oil drop experiment for electronic charge, Determination of q/m of positive rays, Aston mass spectrograph.

3.2 X Rays: Production, origin and properties, diffraction of X rays, Bragg's law, Moseley's law.

UNIT 4

4.1 Particle accelerators: Linear Accelerators, Van-de- graph generator, Cyclotron, Betatron

4.2 Interaction with external fields: Zeeman Effect, Anomalous Zeeman effect and its application to sodium lines, Paschen-Back effect.

Sem IV

Electronics

Core Compulsory

Marks : 70 + 30

Objectives

- This paper aims to cover the fundamental electronics.
- The concept of electronic circuit is discussed in detail and DC circuits are described.
- Students will learn the physics of semiconductor devices such as Diode, and Transistor.

Learning Outcomes

- Upon completion of this course, students are expected to understand the following concepts:
- Understand the concept of Electronics.
- Characteristics and working of Diode and Transistor.
- Transistor Devices: Characteristics of different configurations, biasing, stabilization and their applications.
- To learn about Field effect transistor & Types: JFET, MOSFET and UJT.

UNIT 1

1.1 Basic electronics and Linear circuits: Electronic components, Basic idea of Passive components (Resistors, Capacitors, Inductors) and Active components, types of capacitors and different type of inductors.

1.2 DC Circuits: RL circuits (Growth and decay of current), RC circuit (Charging and discharging of capacitor) L-C-R circuit in series with DC source.

1.3 Filters: How to get better DC, Shunt capacitor filter, Series inductor filter, Choke - input LC filter, The CLC or PI filter.

UNIT 2

2.1 Diodes : Use of diodes in rectifiers, Half wave rectifier, Full wave rectifier, Ripple factor and rectification efficiency, Performance of half wave rectifier, Performance of full wave rectifier.

2.2 Special-purpose diodes: Types of diodes, Zener diode (Zener effect, Avalanche effect & Voltage regulation), optical diodes: light emitting diode, photo diode, and other diodes: the tunnel diode, the Schottky diode, the PIN diode, Varactor diode, and the silicon-controlled rectifier (SCR).

UNIT 3

3.1 Transistor: Structure of Transistor, Types of BJT. Action of a Transistor, Working of a Transistor, Relation between Different Current in Transistor. Three Configurations of Transistor, Transistor Characteristics (CB and CE Configuration), Comparison between the three configurations, Why CE Configuration is preferred in Circuit

3.2 Transistor amplifier: two diode analogy for a transistor, Transistor input characteristics, 3 biases of transistors (fixed bias, self-bias and potential divider bias)

UNIT 4

4.1 Field Effect Transistor: FET- Types of FET, Construction and Working of JFET, Advantage of JFET and difference between JFET and BJT, Output Characteristics of JFET, Parameters of JFET, J-FET Biasing. UJT- Construction & Working of UJT, Advantages & Applications of UJT. Concept of Decibels, other equations for decibel computation, zero dB reference level, use of voltmeter as dB indicator, voltmeter range correction factor, impedance correction factor.

4.2 Operational Amplifiers: Basic Concepts, Ideal operational amplifier, Practical Inverting and Non-Inverting OP-AMP, Characteristics of OP-AMP, Differential Amplifier, Some Op-AMP Parameters, Effects of offset, Frequency Response and Stability, Applications of OP-AMP: As a Scale Changing- Phase Shifting and Summing amplifier, Voltage Follower, Integrator, Differentiator, Logarithmic and Antilogarithmic amplifier

Sem

IV

Physics Practical IV

Core Compulsory

Marks : 70 + 30

Objectives

- To gain practical knowledge by applying the experimental methods to correlate with the Physics theory.
- To learn the usage of electrical systems for various measurements.
- Apply the analytical techniques and graphical analysis to the experimental data.
- To develop intellectual communication skills and discuss the basic principles of scientific concepts in a group.

Learning Outcomes

At the end of the course, the student will be able to

- Apply the various procedures and techniques for the experiments.
- Use the different measuring devices and meters to record the data with precision
- Apply the mathematical concepts/equations to obtain quantitative results
- Develop basic communication skills through working in groups in performing the laboratory experiments and by interpreting the results
- Apply knowledge of mathematics, science, and engineering

LIST OF EXPERIMENTS

1. To determine value of Boltzmann constant using V-I characteristic of PN diode.
2. To determine value of Planck's constant using LEDs of at least 4 different colours.
3. To determine the wavelength of H-alpha emission line of Hydrogen atom.
4. To find the Rydberg Constant using hydrogen tube.
5. To setup the Millikan oil drop apparatus and determine the charge of an electron.
6. To study energy bandgap of PN junction diode.
7. To study Zener diode as a voltage regulator.
8. To study the characteristics of a Transistor in CE configuration.
9. To study the characteristics of a UJT.
10. To study and draw the characteristics of half wave and full wave rectifiers.
11. To study and draw the characteristics of FET in common drain configuration.
12. To study Semiconductor Diode Characteristics.
13. To study Zener diode Characteristics

CHEMISTRY

Sem
IV

Organic Chemistry-I

Compulsory
Marks : 70 + 30

Objectives

- To understand the phenomenon of establishment of structures of benzene and their derivatives
- To develop understanding of preparation of alkyl and aryl halides
- To get knowledge about the chemistry of mono, di and trihydric alcohols
- To develop understanding nomenclature of Arenes, Alkyl halides, Aryl halides and Alcohols

Learning Outcomes

- Students will have acquired an understanding of Arenes, Alkyl halides, Aryl halides, Alcohols and their preparation, physical and chemical properties.
- Students will get knowledge of nomenclature Arenes, Alkyl halides, Aryl halides, Alcohols and their chemistry
- They learn about various aspects of reaction mechanism in which chemical reactions of Arenes, Alkyl halides, Aryl halides and Alcohols
- They can understand the application of above mentioned compounds in synthetic chemistry

UNIT 1 Arenes

1.1. Structure of benzene: molecular formula and Kekule structure
1.2. Stability and carbon-carbon bond lengths of benzene
1.3. Resonance structure, MO picture
1.4. Nomenclature of benzene derivatives
1.5. Aromatic nucleus and side chain
1.6. Aromatic electrophilic substitution
1.7. General pattern of the mechanism of halogenations, nitration, sulphonation and friedel crafts reaction
1.8. Role of σ-and π- complexes
1.9. Energy profile diagrams
1.10. Activating-deactivating substituents and orientation of reactions and ortho/para ratio
1.11. Side chain reactions of benzene derivatives
1.12. Birch reduction
1.13. Methods of formation and chemical reactions of biphenyl

UNIT 2 Alkyl Halides

2.1. Orbital structure of Methyl Chloride
2.2. Nomenclature and classification of alkyl halides
2.3. Preparation of alkyl halides
2.4. Physical properties of alkyl halides
2.5. Chemical properties of alkyl halides
2.6. SN1 and SN2 mechanisms
2.7. E1 and E2 Mechanisms
2.8. Satzeff Rule
2.9. Vinyl Chloride and Allyl Iodide

UNIT 3 Aryl Halides

3.1. Nomenclature of Aryl halides
3.2. Preparation of aryl halides
3.3. Physical properties of aryl halides
3.4. Chemical properties of aryl halides
3.5. Nucleophilic displacement Reactions
3.6. Reaction of aryl halides with KNH2
3.7. Benzyne Mechanism
3.8. Electrophilic substitution reaction of aryl halides
3.9. Addition-elimination and elimination-addition mechanism of nucleophilic aromatic substitution reactions
3.10. Relative reactivities of alkyl, aryl, vinyl and allylhalides
3.11. Synthesis and uses of chloroform, Benzyl Chloride, carbon tetrachloride, Chlorotoluenes, and DDT

UNIT 4 Alcohols

4.1. Monohydric alcohols
4.2. Classification and nomenclature
4.3. Preparation of monohydric alcohols: methods of formation by reduction of compounds containing carbonyl group, carboxylic acids and esters.
4.4. Hydrogen bonding
4.5. Reactions of alcohols – showing acidic nature
4.6. Reactions involving C--OH and CO--H, cleavage, reactions involving both alkyl and hydroxyl groups
4.7. Distinction and inter conversion of primary, secondary and tertiary alcohols
4.8. Dihydric alcohols Ethylene Glycol: preparation from alkenes, vicinal dihaloalkanes, carbonyl compounds and epoxides
4.9. Trihydric Alcohols: Glycerol- preparation by saponification of oils and fats and from propylene, Chemical reactions of glycerol

Sem IV | **Inorganic Chemistry-I** | Compulsory | Marks : 70 + 30

Objectives

- Able to carry out relations of group 13 and 14 elements. To Understand chemistry of Borohydrides, Hydrides, oxide and oxy-acids and halides of boron, borax, fullerenes, carbides, silanes etc
- Can explain History of discovery of noble gases and isolation of noble gases form air Preparation properties and structure of important compounds of noble gases
- Describe nuclear reactions – fission and fusion. Q- value, natural and artificial radioactivity.
- Understand the theory of Arrhenius, Bronsted and Lowry, Lewis, Lux flood and solvent system concepts of acids and bases

Learning outcome

- The students will be able to understand the group 13, 14 elements and the chemistry of borohydride, Hydride thoroughly
- The students will be able to explain History of discovery of noble gases and isolation of noble gases form air. Preparation properties and structure of important compounds of noble gases
- The students will be able to describe radioactivity, nuclear reactions their applications efficiently
- The students will be able to get idea about the concept of acid and bases (Arrhenius, Bronsted and Lowry, Lux flood)

UNIT 1 p- Block Elements

1.1. Comparative studies including diagonal relationship of group 13 and 14 elements
1.2. Borohydrides
1.3. Hydrides
1.4. oxide and oxy-acids and halides of boron
1.5. borax
1.6. Borazine allotropic forms of carbon, fullerenes, carbides of calcium and silicon
1.7. Silanes, structure of silicate minerals and silicones
1.8. Hydrides, oxides, oxoacids and halides of nitrogen
1.9. Allotropic forms of phosphorous
1.10. Hydrides, halides, oxides and oxyacids of phosphorous
1.11. Basic properties of halogens and inter halogen compounds
1.12. Pseudohalogens and poly halides

UNIT 2 Noble Gases

2.1. Occurrence of noble gases
2.2. History of discovery of noble gases and isolation of noble gases form air
2.3. Preparation properties and structure of important compounds of noble gases
2.4. Fluorides, oxides, oxy fluorides of xenon (valence bond structure only)
2.5. Krypton difluoride and clathrate compounds of noble gases

UNIT 3 Nuclear Chemistry

3.1. Fundamental Particles of Nucleus
3.2. Concept of Nuclides, Isotopes, Isobar, Isotones, Nuclear Forces, Nuclear binding energy and stability
3.3. Nuclear shell model
3.4. Mass defects
3.5. Packing fraction
3.6. Nuclear reactions– fission and fusion
3.7. Q- value
3.8. Natural and artificial radioactivity
3.9. Radioactive isotopes
3.10. Applications of radioisotopes
3.11. Radioactive dating

UNIT 4 Acid and bases

4.1. Arrhenius theory
4.2. Bronsted-Lowry concept
4.3. Lux-Flood theory Lewis Definition, Solvent
4.4. Definition (Cady-Elsey Theory)
4.5. Hard and Soft Acids and Bases
4.6. Symbiosis
4.7. Relative Strength of Acids and Bases
4.8. Effect of Solvents on Acid Base Strength
4.9. Effect of polarity, dielectric constant and substituents on the strength of acids and bases Acid-base Indicators

Sem IV

Chemistry Practical-4

Compulsory

Marks : 70 + 30

Objectives

- To get the knowledge of organic estimation and its importance
- To get idea of preparation of various solutions
- To get familiarize with inorganic preparations
- Formulating and solving problems in the laboratory
- Get the idea of small scale preparation

Learning Outcomes

Learners will be able to:

- Independently perform Estimation of various organic compounds
- Accurately prepare solutions
- Accurately weigh various substances
- Develop small scale production skill
- Deal with Inorganic substances qualitatively and quantitatively

Organic estimations

1. To determine the amount of Aniline in the given solution
2. To determine the amount of Phenol in the given solution
3. To determine the amount of Glucose in the given solution
4. To determine the amount of Acetamide in the given solution
5. To determine the molecular weight of given unknown acid
6. To determine the amount of Ketone in the given solution
7. To determine the amount of Ester in the given solution

Inorganic preparations

1. Preparation of sodium ferrioxalte .$Na_3[Fe(C_2O_4)_3].9H_2O$
2. Preparation of Nickel dimethyl glyoxime complex $[Ni(DMG)_2]$
3. Preparation of Copper tetramine complex $[Cu(NH_3)_4]SO_4$
4. Preparation of Hexathio-urea plumbus nitrate $Pb(NH_2CSNH_2).3H_2O$
5. Preparation of Sodium thiosulphate $Na_2S_2O_3.\ 5H_2O$

BOTANY

Sem

IV

Plant Embryology

Compulsory

Marks : 70 + 30

OBJECTIVE

- To enable students to understand the basic methodology of formation of embryo and endosperm and reproduction mechanism in monocot and dicot plants.

LEARNING OUTCOMES

After successfully completing this paper, students will be able to

- Identify the process of pollination and fertilization.
- Discuss the Structure and development process of male and female gametophyte
- Illustrate the types of microspore, ovules, embryo, seed and endosperm.

UNIT 1 FLOWER, MALE AND FEMALE GAMETOPHYTE

1.1 Reproductive organ of plant: Flower
1.2 Microsporogenesis and Development of male gametophyte
1.3 Megasporogenesis and Development of Female gametophyte
1.4 Types of Ovules
1.5 Types of Embryo sac

UNIT 2 POLLINATION AND FERTILIZATION

2.4 In Vitro Pollen Germination
2.5 Factors affecting pollen germination
2.6 Pollination : Process and types
2.7 Fertilization: Double Fertilisation
2.8 Male Sterility and Methods to Overcome Sterility

UNIT 3 EMBRYO AND ENDOSPERM DEVELOPMENT

3.1 Embryo development in Dicotyledons (Capsella bursa)
3.2 Embryo development in Monocotyledons (Sagittaria sagittaefolia and Zea mays)
3.3 Endosperms: Types and functions of Endosperms

UNIT 4 APOMIXIS, POLYEMBRYONY AND PARTHENOCARPY

4.1 Apomixis
  4.1.1 Agamospermy
  4.1.2 Genetics of apomixis
4.2 Parthenocarpy
4.3 Polyembryony

Sem
IV

Plant Anatomy

Compulsory

Marks : 70 + 30

OBJECTIVE
- To enable students to understand the construction mechanism of plant body.
- Concept of meristematic tissue will help them to recognize the growth pattern of plant.

LEARNING OUTCOME

After successfully completing this paper, students will be able to:
- Develop an understanding of concepts and fundamentals of plant anatomy
- To gain knowledge of plant cells, tissues and their functions.
- Examine the internal anatomy of plant systems and organs
- To make connections between plant anatomy and the other major disciplines of biology.

UNIT 1: INTRODUCTION TO PLANT TISSUES

1.1 Definition
1.2 Scope of plant anatomy
1.3 Types of tissues
    1.3.1 Permanent and meristematic tissues
    1.3.2 Simple and complex tissues

UNIT 2: EPIDERMAL TISSUE SYSTEM

2.1 Structure and function of epidermal tissue system
2.2 Uniseriate and multiseriate epidermis
2.3 Stomata: structure, types and functions
2.4 Epidermal outgrowth: glandular and non-glandular

UNIT 3: IMPORTANT ANATOMICAL ASPECTS IN PLANTS

3.1 Mechanical tissue system
3.2 Secretory tissue system
3.3 Root stem Transition
3.4 Abscission of leaf
3.5 Anatomy of hydrophytes and xerophytes (leaf)

UNIT 4: VASCULAR TISSUE SYSTEM AND PRIMARY STRUCTURE OF PLANT ORGANS

4.1 Structure and function of xylem, phloem and cambium
4.2 Cambium and its role, process in stem
4.3 Primary structure of dicot (Sunflower) root, stem and leaves
4.4 Primary structure of monocot (Maize) root, stem and leaves
4.5 Secondary growth of Dicot stem

Sem
IV

Practicals In Plant Science 4

Compulsory

Marks : 70 + 30

Objectives

- To get training of identification of reproductive floral parts.
- To get training of analyzing various embryological parts of angiosperm seed.
- To get training of dissection of seeds.
- To get training of taking section of different types of leaves.
- To get training of taking section of different types of stem.
- To get training of taking section of different types of roots.

Learning Outcomes

Learners will be able to:

- Develop skill of staining techniques.
- Develop skill of identification of dicot and monocot embryo.
- Develop skill of taking section of different types of leaves.
- Develop skill of taking section of different types of Stem.
- Develop skill of taking section of different types of Root.
- Develop skill of identification of different plant tissues.
- Develop skill of identification of complex tissues.

List of Experiments

PLANT EMBRYOLOGY

1. Study of T.S. of young anther.
2. Study of T.S. of mature anther
3. Characters used for study of pollen Grains
4. The study of pollen grains of some common plants: Canna indica, Datura stramonium, Hibiscus
5. Germination of pollen grains
6. Types of ovules
7. L.S. of ovule showing cellular Endosperm
8. To dissect out globular embryo.
9. To dissect out heart-shaped embryo.
10. To remove mature dicot embryo.
11. L.S. of maize grain showing monocot embryo.
12. Study of embryology through permanent slides.

PLANT ANATOMY

1. Introduction about different types of section and method used for section Cutting.
2. To study about different stains used in staining.
3. To study about different staining procedure used for preparing temporary, Semi-permanent and permanent slide.
4. To study different media used for mounting an object.
5. To study method used for Maceration, peeling and smearing.
6. To study the shoot apex and root apex.
7. To study the simple permanent plant tissues.
8. To study the complex plant tissues.
9. To study the different types of stomata.
10. To study trichomes.
11. Comparative anatomical study of primary Dicot and Monocot roots.
12. Comparative anatomical study of primary Dicot and Monocot stems.
13. Comparative anatomical study of primary Dicot and Monocot leaves.
14. Study of distribution of mechanical tissue in leaves.
15. Study of distribution of mechanical tissue in stems.
16. To study the lenticels.

ZOOLOGY

Sem
IV

Fundamentals Of Microbiology

Compulsory

Marks : 70 + 30

OBJECTIVE

- This paper introduces student to the subject. It opens up a new world of small, tiny creatures of enormous importance which we know as microorganisms. It gives basic information about the existence of microbes and their association with other forms of life.

LEARNING OUTCOMES

On completion of this paper, students will be able to

- Understand about the omnipresence of microorganisms.
- Describe the taxonomic status of microorganisms.
- Describe the general features of microbes.
- Understanding history and scope of microbiology and applied microbiology
- Learning importance of microorganisms in our world
- Understand the use of microscopy to study microbiology
- Understand the use of stains

UNIT 1 SCOPE AND HISTORY OF MICROBIOLOGY

1.1 Microbiology as a field of Biology
1.2 The Place of Microorganisms in the living world
1.3 Introduction to Groups of Microorganisms
1.4 Distribution of Microorganisms in Nature
1.5 Applied areas of Microbiology
1.6 Spontaneous generation versus Biogenesis
1.7 Germ Theory of disease
1.8 Eminent scientists of Microbiology

UNIT 2 MORPHOLOGY OF BACTERIA

2.1 Size, Shape and Arrangement of Bacteria
2.2 Bacterial Structures – External to Cell Wall : Capsule, Flagella, Pili, Prostheca, Sheath & Stalk
2.3 The cell wall of Bacteria – Structure and chemical composition of Gram negative and Gram positive Bacterial cell wall
2.4 Bacterial Structures – Internal to Cell Wall : Cell Membrane, Protoplast, Spheroplast, Membranous intrusions and intracellular membrane system, Cytoplasm, Cytoplasmic inclusions and Vacuoles, Nuclear Material
2.5 Bacterial Spores and Cyst – Types of spore, Structure and formation of Endospores (Sporogenesis).

UNIT 3 CULTIVATION AND REPRODUCTION OF BACTERIA

3.1 Nutritional requirements & Nutritional types of of bacteria
3.2 Bacteriological Media
3.3 Physical conditions & Gaseous requirements for growth
3.4 Selective methods & Cultural characteristics
3.5 Growth of Bacteria: Generation time, Growth rate
3.6 Bacterial Growth Curve, Synchronous growth and Continuous culture of Bacteria.

UNIT 4 VIROLOGY

4.1 Introduction and General Characteristics:
Definition, Structure, Classification
4.2 Cultivation and Enumeration of Viruses
4.3 Bacterial Viruses: Classification, Lytic life cycle (T4 phage), lysogenic life cycle (Lambda phage)
4.4 Plant Viruses: Classification, Structure of TMV, Economic importance, Viroids
4.5 Animal Viruses:
Classification, Cytocidal effects, HIV, HBV, Ebola, Zeka, SARS-CoViD, Prions

Sem
IV

Immunology And Haematology

Compulsory

Marks : 70 + 30

Objectives

- To introduce the students to the concept of immunity , immune system and immunology
- To make students aware about different type of immunity and its mechanisms
- To study different cells, tissues and organs of immune system
- To explain the importance of study of epidemiology, immunization and dysfunctional
- immunity
- To introduce the students to the importance of blood and blood coagulation
- To make students aware about the blood group systems
- To make the students familiar with the procedure of blood donation
- To explain the importance of blood transfusion and its adverse reactions
- To study the trend of blood component therapy

Learning Outcomes

- After successfully completing this paper, students will be able to:
- Differentiate between various types of immunity
- Identify various cells of immune system
- Evaluate the strength of Immune response
- Understand the mechanism of immune response
- Understand various factors affecting immunogenicity of a molecule
- Structure and functions of Antibody
- Mechanisms of Antibody action
- Understand the basis of antibody diversity
- The concept, preparation and importance of Monoclonal antibody
- Understand the different types of dysfunctional immunity reactions
- Distinguish them from other diseases/symptoms
- Identify some of the common dysfunctional Immunity diseases and their mechanisms
- Describe the importance of blood
- Learn the blood coagulation mechanism and its significance in the body
- Describe major human blood group system
- Describe blood group antigens present on RBCs
- Analyse the immunologic reactions in blood banking
- Understand the use of stains

UNIT: 1 IMMUNITY AND IMMUNOGEN

1.1 Types of immunity : Natural, Acquired, herd, Innate, specific
1.2 Cells and organs of immune system : An overview
1.3 Primary response and generation of memory
1.4 Antigen
   a. Immunogenicity versus antigenicity
   b. Factors influencing Immunogenicity
   c. Adjuvant, Epitopes and Haptens
   d. Antigen processing and presentation

UNIT – 2 ANTIBODY `

2.1 Basic structure of Antibody
2.2 Immunoglobulin classes and their Biological activities.
2.3 Epitopes and Receptors on immunoglobulin molecule
2.4 Antibody Diversity and Clonal Selection Theory
2.5 Overview of Monoclonal Antibody

UNIT – 3 DYSFUNCTIONAL IMMUNITY

3.1 Immunodeficiency Diseases
3.2 Hypersensitivity
3.3 Autoimmune diseases
3.4 Overview of Tumor immunity
3.5 Overview of Transplantation immunity

UNIT - 4 HAEMATOLOGY

4.1 Composition of Blood
4.2 Blood Cells : Types and Functions
4.3 Discovery of human blood group systems
4.4 Blood coagulation

Sem

IV

Practicals in Zoology-4

Compulsory

Marks : 70 + 30

Objectives

- Development of awareness about the rules and regulations in microbiological laboratory
- Understanding of the use of stains
- Practice of using microscope to study micro organisms
- Understanding morphology and physiology of bacteria
- Learn about the growth patterns of bacteria
- Learn quantitative measurement of growth
- Understanding of the types and mechanisms of immunity and immune reactions
- Understanding of the distinguishing features of Antigen and Antibody molecules
- Knowledge of various types of reactions between antigen and antibody and their clinical importance
- Understanding of the importance of blood and its vital functions
- Knowledge of composition of blood
- Understanding of the impact of blood coagulation factors on haemostasis
- Understanding of various blood group systems and blood transfusion principles

Learning Outcomes

By performing the laboratory experiments the students will be able to

- Develop skills to prepare and sterilize medium
- Acquire skills to isolate bacteria into pure culture
- Develop proficiency in staining & Being able to perform different staining procedures to gain knowledge of micro organisms
- Development of observation skills to observe symptoms and signs of patients with
- different diseases and correlate it with the status of their immune system
- Understanding of the mechanisms of failure and mal functioning of immune system and their consequences.
- Development of analytical skills to correlate the various components of blood and their functions
- Knowledge of blood banking with respect to blood group systems, criteria of blood donor, blood transfusion and its adverse reactions
- Orientation of students to opt for specialized courses on blood banking in later part of their academic career

List of Experiments

1. Study of bacterial motility by hanging drop method.
2. To perform Monochrome Staining (Positive Staining) for study of Bacilli and Yeast.
3. To perform Monochrome Staining (Negative Staining) of Tooth Tarter sample for study of Spirochetes.
4. To perform Gram's Staining of Bacterial Culture using Differential Staining technique.
5. Isolation of bacteria using Streak Plate/Pour Plate and Spread Plate techniques.
6. Enumeration of Bacterial Number using Viable Count technique.
7. Study of Human Blood Groups using Agglutination Test.
8. To perform Widal Test for Serological diagnosis of Enteric Fever.
9. To carry out total count of RBC and WBC using Haemocytometer.
10. To carry out Differential Count of WBC.
11. Estimation of Haemoglobin by Sahli's method.
12. Determination of Bleeding Time by Filter Paper technique and Clotting Time by Capillary method.
13. Estimation of Blood Sugar by GOD/POD method to understand biochemistry of blood.

Semester V

Semester – V

			Total Papers	Credit	Hours	Internal	External	Total
Education	Education	Theory	3	9	135	90	210	300
	School Internship	Practical	1	5	150	200	00	200
B.Sc (Science)	Principal	Theory/ Practical	4 (3+1)	12	225	120	280	400
		Total	8	26	510	410	490	900

Sr. No.	Subject	Title of the paper	T/P	Nature	Credit	Hours	Internal	External	Total
1	Education	Curriculum Development Principles	Theory	Compulsory	3	45	30	70	100
2	Education	Language Across Curriculum	Theory	Compulsory	3	45	30	70	100
3	Education	Assessment and Evaluation in Learning	Theory	Compulsory	3	45	30	70	100
4	Education	Pre-Practice Teaching (Micro-Simulation, School Exposure)	Practical	Compulsory	5	150	200	00	200
5	Mathematics	Mathematical Analysis-I	Theory	Compulsory	3	45	30	70	100
6	Mathematics	Abstract Algebra-I	Theory	Compulsory	3	45	30	70	100
7	Mathematics	Practical: Mathematical Analysis-I & Abstract Algebra-I	Practical	Compulsory	3	90	30	70	100
8	Mathematics	Probability and Statistics	Theory	Optional	3	45	30	70	100
9	Mathematics	Graph Theory	Theory	Optional	3	45	30	70	100
10	Physics	Solid State Physics	Theory	Compulsory	3	45	30	70	100
11	Physics	Thermodynamics and Statistical Physics	Theory	Compulsory	3	45	30	70	100
12	Physics	Physics Practical V	Practical	Compulsory	3	90	30	70	100
13	Physics	Atmospheric and Space Science	Theory	Optional	3	45	30	70	100
14	Physics	Elements of Experimental Physics	Theory	Optional	3	45	30	70	100
15	Chemistry	Organic Chemistry-II	Theory	Compulsory	3	45	30	70	100
16	Chemistry	Physical chemistry-II	Theory	Compulsory	3	45	30	70	100
17	Chemistry	Chemistry Practical-5	Practical	Compulsory	3	90	30	70	100
18	Chemistry	Polymer Chemistry	Theory	Optional	3	45	30	70	100
19	Chemistry	Inorganic Chemistry-II	Theory	Optional	3	45	30	70	100
20	Botany	Fundamentals of Microbiology	Theory	Compulsory	3	45	30	70	100
21	Botany	Cell Biology	Theory	Compulsory	3	45	30	70	100
22	Botany	Practicals in Plant Science V	Practical	Compulsory	3	90	30	70	100
23	Botany	Biostatistics &Bioinformatics	Theory	Optional	3	45	30	70	100
24	Botany	Biodiversity	Theory	Optional	3	45	30	70	100
25	Zoology	Animal Anatomy	Theory	Compulsory	3	45	30	70	100
26	Zoology	Applied Zoology	Theory	Compulsory	3	45	30	70	100
27	Zoology	Practicals in Zoology -5	Practical	Compulsory	3	90	30	70	100
28	Zoology	Biostatistics and Bioinformatics	Theory	Optional	3	45	30	70	100
30	Zoology	Animal Diversity in India	Theory	Optional	3	45	30	70	100

Any one subjects of Science (Mathematics, Physics, Chemistry and Botany) will have to be opted by the student.

EDUCATION

Sem V

CuS 1 : Curriculum Development Principles

Compulsory

Marks : 70 + 30

Objectives

To enable the prospective teachers

- to understand Concept and Principles of Curriculum
- to develop an understanding of Types and Approaches to Curriculum
- to understand various foundations of Curriculum
- to comprehend the process of Curriculum Development

Unit 1 Curriculum: Concept & Principles

1.1 Concept of Syllabus & Curriculum
1.2 Aims and Characteristics of Curriculum
1.3 Difference: Curriculum Framework, Curriculum, Syllabus and Text-book
1.4 Principles of Curriculum Development

Unit 2 Types & Approaches of Curriculum

2.1 Types of Curriculum: Subject Centered, Student Centered, Objective Centered, Experience Centered and Integrated Curriculum
2.2 Concept of Overt (Explicit), Hidden (Implicit) and Null
2.3 Approaches to Curriculum: Behavioural- Rational Approach, System-Managerial Approach, Intellectual-Academic Approach, Humanistic-Aesthetic Approach
2.4 Determinants of Curriculum: Societal Diversity, Political and Economic Factors, Professional Organisation, Environment and Institutional Consideration

Unit 3 Foundations of Curriculum Development

3.1 Source of Curriculum Design: State, Science, Society, Moral Doctrine, Knowledge, Learner
3.2 Philosophical Foundations of Curriculum Development
3.3 Psychological Foundations of Curriculum Development
3.4 Sociological Foundation of Curriculum Development

Unit 4 Process of Curriculum Development

4.1 Establishing Philosophy and Need Assessment
4.2 Formation of Goals and Objectives
4.3 Selection and Organisation of Content & Learning Experiences
4.4 Evaluation of Curriculum

Sem V

Language Across Curriculum

Compulsory

Marks : 70 + 30

Objectives

To enable the prospective teacher educators

- to understand language, its various roles in society and its various shades
- to be familiar with theoretical issues of the language acquisition
- to develop the language skills of the students and analyze their reading and writing
- to know how oral and written language can be used in the classroom to ensure optimal learning of the subject area

Unit 1 Language and Society

1.1 Concept of Language Across Curriculum; Meaning of Dialect and Standard Language
1.2 Role of Language in Life (Intellectual, Emotional, Social and Cultural Development)
1.3 Deficit Theory and Discontinuity Theory
1.4 Cultural Reference in the Text

Unit 2 Language Acquisition

2.1 Factors Affecting Language Learning (Physical, Psychological and Social)
2.2 Stages of Language acquisition: First Language and Second Language acquisition
2.3 Principles of language development: Nativist and Interactionist and Theories (behavioral and cognitive)
2.4 Meta Linguistics: Meaning, Concept and awareness; changing context of listening, speaking, reading, capturing and writing

Unit 3 Reading, Writing and Analysis

3.1 Reading strategies for children, Techniques to enhance Reading comprehension (Scanning, Skimming, Columnar reading, Key word reading).
3.2 Nature of Expository Texts vs. Narrative Texts, Transactional vs. Reflexive Texts
3.3 Writing: The concept of register and style (Note-making, summarizing; making reading-writing connections; process writing)
3.4 Analyzing Children's writings to understand conceptions, Writing with a sense of purpose –writing to learn and understand

Unit 4 Classroom and Language

4.1 Language as a tool of communication in the classroom, Language of textbook in different subjects
4.2 Language Diversity in Indian Classroom
4.3 The nature of classroom discourse (describing/reporting, naming/defining, explaining,exemplifying, arguing/supporting, assessing, evaluating) and oral language in the classroom
4.4 Language as an aspect of teacher-child relationship, Multilingualism in the classroom and its effect

Sem
V

Assessment and Evaluation in Learning

Compulsory
Marks : 70+30

Objectives

To enable the prospective teacher educators

- to understand concept of assessment and evaluation
- to understand and differentiate tools of assessment and evaluation
- to understand about elementary statistics in evaluation
- to develop ability to critically review current trends in evaluation

Unit 1 Assessment & Evaluation

1.1 Meaning of testing, measurement, assessment and evaluation
1.2 Steps of Evaluation Process, Principles of Evaluation, Importance of Evaluation
1.3 Meaning of assessment of learning, assessment for learning and assessment as learning
1.4 Formative, Summative, Continuous and Comprehensive Evaluation

Unit 2 Tools of Assessment and Evaluation

2.1 Types of Examinatin: Written, Oral and Performance base
2.2 Preperation of Blue Print based Question Paper and Characteristics of Ideal Question Paper
2.3 Techniques of Assessment (Concept,Merit & Demerit): Observation, Interview, self-assessment, peer-assessment and Sociometry
2.4 Tools of Assessment (Concept, Merit & Demerit) : Questionnaire, Checklist, Scales, Anecdotal Records, Achievement test, Diagnostic Test and Psychological Test

Unit 3 Elementary Statistics

3.1 Nature of Data: Grouped and ungrouped, Frequency distribution
3.2 Measure of central tendency: Mean , Median and Mode
3.3 Measure of dispersion: Average Deviation, Standard Deviation
3.4 Concept of correlation, Spearman's Rank Difference Correlation, Percentile and Percentile Rank

Unit 4 Current Trends in Evaluation

4.1 Examination Reforms- Scrapping of CCE by CBSE, Choice Based Credit System
4.2 Uniform system of Assessment, Standardized testing- ASSET and Olympiad
4.3 On-Line Examination and Open-Book Examination: Concept, need, benefits
4.4 Grade and Grading System: Meaning, Types (Absolute and Comparative or Relative Grading), Merits and limitations

Sem V

SI 1 : Pre Practice Teaching

Compulsory

Marks : 200

Objectives

To enable the prospective teachers

- to understand the concept of microteaching skills and simulation
- to develop the proficiency in application of microteaching skills
- to develop the proficiency in delivering simulation lessons
- to develop the ability to use online medium and give lessons through online mode.
- to be exposed to school environment and gain multiple experiences

<table>
<tr><th rowspan="3">Type of Activity</th><th rowspan="3">Credit</th><th rowspan="3">Hrs.</th><th colspan="2">Lessons</th><th rowspan="3">Total</th><th colspan="3">Marks</th></tr>
<tr><th rowspan="2">M 1</th><th rowspan="2">M 2</th><th rowspan="2">Int.</th><th rowspan="2">Ext.</th><th rowspan="2">Total</th></tr>
<tr></tr>
<tr><td>Micro Lesson</td><td rowspan="2">1.5</td><td rowspan="2">45</td><td>3</td><td>3</td><td>6</td><td rowspan="2">60</td><td rowspan="2">-</td><td rowspan="6">100</td></tr>
<tr><td>Observation</td><td>6</td><td>6</td><td>12</td></tr>
<tr><td>Simulation (Face to Face)</td><td rowspan="4">2.5</td><td rowspan="4">75</td><td>3</td><td>3</td><td>6</td><td rowspan="2">60</td><td rowspan="2">-</td></tr>
<tr><td>Observation</td><td>3</td><td>3</td><td>6</td></tr>
<tr><td>Simulation (Digital)</td><td>2</td><td>2</td><td>4</td><td rowspan="2">40</td><td rowspan="2">-</td></tr>
<tr><td>Observation</td><td>2</td><td>2</td><td>4</td></tr>
<tr><td rowspan="2">School Exposure</td><td rowspan="2">1.0</td><td rowspan="2">30</td><td colspan="3">Report writing & Reflective journal</td><td>20</td><td>-</td><td rowspan="2">40</td></tr>
<tr><td colspan="3">Film Review and Reflective writing</td><td>20</td><td>-</td></tr>
<tr><td></td><td>5.0</td><td>150</td><td colspan="3">Total</td><td>200</td><td>-</td><td>200</td></tr>
</table>

List of Microteaching Skills (Any six skills should be selected out of the following skills.

1. Fluency in Questioning
2. Explanation
3. Illusration with Example
4. Probing Questions
5. Board work
6. Skill of assessment
7. Set Induction
8. Reinforcement
9. Stimulus Variation
10. Use of Teaching Aids
11. Skill of Nonverbal cues

List of Simulation Methods (Any six Methods should be selected out of the following Methods.

1. Inductive Deductive
2. Demonstration
3. Experiment
4. Story Telling
5. Structural Approach
6. Direct
7. CLT Approch
8. Source Method
9. Translation
10. Project
11. Analysis Synthesis
12. Logical Approach
13. Comparative
14. Narration cum DisCuSsion
15. Bilingual
16. Paraphrasing (Khandanvya)
17. Regional Method
18. Questioning Method
19. Exhibition

Minimum Two different Apps should be used by the trainee for Online Simulation Lessons

1. Zoom App
2. Microsoft Team
3. Google Meet
4. Cisco WebEx
5. Any other Online Platform

Minimum One Educational Movie should be selected for Film review

1. Not one less
2. Chalk and Duster
3. English Vinglish
4. Bhaag Milkha Bhaag
5. Social Network
6. Mohenjo Daro
7. 127 Hours
8. Aankhon Dekhi
9. Madam Geeta Rani
10. Sur
11. Queen
12. Zindagi Na Milegi Dobara
13. Bumm Bumm Bole
14. Three Idiots
15. Hindi Medium
16. Lage raho munnabhai
17. Drishyam
18. BubbleGum
19. Chillar Party
20. The Ultimate Gift
21. Roll No. 21
22. Angrezi Medium
23. Dangal
24. Mary kom
25. Rock On!!
26. Iqbal
27. Hicchki
28. Nil Battey sanatta
29. I am Kalam
30. Chak De India
31. Blue Umbrella
32. Mission Mangal
33. Bhul Bhulaiya
34. Ship of Theseus
35. Lilkee
36. The Karate Kid
37. Faltu
38. Black
39. Pathshala

MATHEMATICS

Sem
V

Mathematical Analysis-I

Compulsory

Marks : 70 + 30

Objectives

- To Understand the concept of countable and uncountable set.
- To Develop the skills of finding limit inferior and superior of a sequence.
- To acquire the Knowledge of uniform continuity and Lipschitz function.
- To Apply the knowledge of finding limits of a function using L'Hospital rule.

Course Learning Outcomes

This course will enable students to:

- Check countable and uncountable set.
- Evaluate the limit superior and inferior of the sequence.
- Verify the uniform and Lipschitz continuity of the function.
- Find the limit of the function using L'Hospital rule.

Unit 1 Basics of Real Numbers

1.1 Function, Inverse function, composition of functions, bijective function, mathematical induction
1.2 countable and uncountable sets, real numbers, algebraic and ordered properties of R
1.3 Bounded and Unbounded sets
1.4 Supremum and infimum of a set

Unit 2 Sequence

2.1 Sequences and their limits, convergent sequence, divergent and bounded sequences, monotone sequence
2.2 Subsequences and Bolzano-Weierstrass theorem
2.3 Cauchy sequence and results based on it
2.4 Limit superior, limit inferior

Unit 3 Continuous Functions

3.1 Limits of functions, Continuous functions, example and results on it Continuous
3.2 functions on intervals
3.3 Uniform continuity
3.4 Lipschitz function

Unit 4 Differentiation

4.1 Derivative of a function, the mean value theorem
4.2 nverse function theorem
4.3 Intermediate value property for derivative
4.4 L'Hospital rule

Sem
V

Abstract Algebra-I

Compulsory

Marks : 70 + 30

Objectives

- To understand the concept of groups & subgroup.
- To develop the skills of finding of order of group and order of element.
- To acquire the knowledge of permutation and normal subgroup.
- To apply the knowledge of homomorphism and isomorphism of group.

Learning Outcomes

This course will enable students to:

- Check abelian and non-abelian groups.
- Verify Lagrange's theorem.
- Evaluate order of permutation.
- Check whether the given group is homomorphism or isomorphism.

Unit 1 Groups

1.1 Basic Concepts- Set, Relation, Equivalence relation, Function & Binary operation on set
1.2 Definition and examples of Group, Basic property of group
1.3 Equivalent definition of group, finite group and their tables
1.4 Abelian and Non-abelian groups

Unit 2 Sub Group

2.1 Sub group-Definition & Examples, Order of a group and order of an element
2.2 Cyclic subgroup generated by an element, cosets and its properties
2.3 Lagrange's theorem and its applications
2.4 Euler's theorem, Fermat theorem

Unit 3 Permutations and normal subgroup

3.1 Definition and example of Permutations, cycle, transposition, even and odd permutation,
3.2 Order of permutation, inverse of permutation.
3.3 Normal subgroup: definition and examples,
3.4 Results on normal subgroups.

Unit 4 Homomorphism and isomorphism of Groups

4.1 Isomorphism of groups, Properties of cyclic groups, isomorphism of cyclic groups,
4.3 Homomorphism of groups & their properties,
4.2 Kernel of homomorphism.
4.4 Fundamental theorem for homomorphism.

Sem

V

Practical: Mathematical Analysis-I & Abstract Algebra-I

Compulsory

Marks : 70 + 30

Objectives

- To Understand the concept of countable and uncountable set.
- To Develop the skills of finding limit superior and inferior of sequence.
- To develop the skills of finding of order of group and order of element.
- To acquire the knowledge of permutation and normal subgroup.

Learning Outcomes

This course will enable students to:

- Evaluate limit supremum and infimum of the sequence of the function
- Check the uniform continuity of the function
- Find the subgroup, cyclic group, permutation group
- Evaluate the kernel of homomorphism of the group

List of Practical's (Problems)

1. Limit of sequences including inductivity defined sequences, limit inferior and superior
2. Example based on Cauchy sequence
3. Types of discontinuity-discussion and examples
4. Example of Uniform continuous function
5. Example of Lipschitz continuous function
6. Problem based on mean value theorem
7. L'Hospital's Rule: Theorems and problems
8. Example of permutation or symmetric group
9. Example of cyclic group and its subgroups and lattice diagram.
10. Example based on normal subgroup.

Sem
V

Probability and Statistics

Optional

Marks : 70 + 30

Objectives

- To make the students familiar with the basic statistical concepts and tools
- To render the students to several examples and exercises that blends their everyday experiences with their scientific interests.
- To acquire knowledge of descriptive statistics.
- To apply the knowledge of various kinds of distributions.

Learning Outcomes

This course will enable students to:

- Find Range, Quartile deviation, Mean Deviation, Standard deviation, Coefficient of variation (C.V) of given data.
- Know properties of probability.
- Evaluate Mean and Variance of a discrete random variable
- Evaluate Mean and Variance of a continuous random variable

Unit 1 Descriptive Statistics

1.1 Measure of central tendency: Mean, Median and Mode
1.2 Geometric and Harmonic mean, Weighted mean
1.3 Measures of Dispersion: Range, Quartile deviation, Mean Deviation, Standard deviation, Coefficient of variation(C.V)
1.4 Moments, Skewness, Kurtosis

Unit 2 Introduction to Probability

2.1 Random Experiment, Sample space, Events, Properties of Probability, Unions of Events and addition rules
2.2 Conditional probability, Intersection of Events and Multiplication and Total probability rules
2.3 Bayes' rule, Independent events
2.4 Introduction to random variables

Unit 3 Discrete Random variables and Probability distributions

3.1 Probability mass functions of a discrete random variable and probability distribution Cumulative distribution function
3.2 Mean and Variance of a discrete random variable
3.3 Special discrete probability distributions: Uniform distribution, Binomial distribution,
3.4 Poisson distribution, Geometric distribution

Unit 4 Continuous Random variables and Probability distributions

4.1 Probability density functions of a continuous random variable and probability distribution
4.2 Cumulative distribution function,
4.3 Mean and Variance of a continuous random variable
4.4 Special continuous probability distributions: Normal distribution, Normal approximation to the Binomial and Poisson distributions, Exponential and Gamma distributions

Sem
V

Graph Theory

Optional

Marks : 70 + 30

Objectives

- To understand the concept of graph theory.
- To study various graphs, digraphs & its operations.
- To acquire the knowledge of tree.
- To apply the knowledge of directed graph and network flow.

Learning Outcomes

This course will enable students to:

- Find matrix representation of graphs.
- Know different kinds of graph operations.
- Understand various parameter of tree.
- Solve example of directed graphs.

Unit 1 Fundamental Graph Theory

1.1 Basic Concepts-Graph, Various other definitions, Elementary theorems on undirected graph

1.2 Walk path cycle, sub graph and various types of sub graphs. Special Graphs-Eularian graph, Hamiltonian graph, Bipartite Graph, Weighted graph, Line graph

1.3 Connectivity and cut sets, Matrix representation of graph

1.4 Distance and diameter of a graph

Unit 2 Various Graph Parameters and Graph Operations

2.1 Graph Parameters- Dominating set , vertex cover, edge cover, matching set, independent set

2.2 Proper coloring and chromatic partition

2.3 Theorems on various graph parameters

2.4 Graph Operations- Union, Intersection, Fusion, Product, Join, sub division and their prop erties

Unit 3 Tree

3.1 Definition, examples, properties of tree

3.2 Some results on tree, spanning tree, binary tree, rooted tree

3.3 Cayley's theorem (without proof)

3.4 Forest, labeling on tree. Various parameters of the tree

Unit 4 Directed Graph & Network Flow

4.1 Directed Graph- Definition, Examples

4.2 Elementary theorems on Directed graph. Orientation, tournament, Eulerian digraph

4.3 Network Flow- Definition, Maximal flow

4.4 Problems on Network Flow

PHYSICS

Sem V | **Solid State Physics** | Core Compulsory | Marks : 70 + 30

Objectives

- This course introduces the basic concepts and principles required to understand the various properties exhibited by condensed matter, especially solids. It enables the students to appreciate how the interesting and wonderful properties exhibited by matter depend upon its atomic and molecular constituents.
- The gained knowledge helps to solve problems in solid-state physics using relevant mathematical tools. It also communicates the importance of solid-state physics in modern society.

Learning Outcomes

Upon completion of this course, students are expected to understand the following concepts:

- To learn nature of materials along with various properties.
- Describe the main features of the physics of electrons in solids: origin of energy bands, and their influence electronic behavior.
- Understand the elementary lattice dynamics and its influence on the properties of materials.
- Understand the phenomena of new state of materials i.e. superconductivity and its properties in details.
- Explain the origin of the dielectric properties exhibited by solids and the concept of polarizability.

UNIT 1

1.1 Crystal Structure: Solids: Amorphous and Crystalline Materials. Lattice Translation Vectors. Lattice with a Basis. Unit Cell.

1.2 Types of lattices: Miller Indices, Reciprocal Lattice, Brillouin Zones, Diffraction of X-rays by Crystals, Bragg's Law.

UNIT 2

2.1 Elementary Lattice Dynamics: Lattice Vibrations and Phonons: Linear Monoatomic and Diatomic Chains. Acoustical and Optical Phonons. Qualitative Description of the Phonon Spectrum in Solids.

2.2 Specific Heat pf Solids: Dulong and Petit's Law, Einstein and Debye theories of specific heat of solids (qualitative only). T_3 law.

UNIT 3

3.1 Free electron theory: Electrons in metals- Drude Model (Basic concept), Elementary band theory: Kronig Penney model. Band Gap. Classification of solids based on band gap into conductors, semiconductors and insulators, P-and N- type Semiconductors.

3.2 Conductivity of Semiconductors: Mobility, Hall effect in metal and Semiconductor, Hall coefficient, Application of Hall effect.

UNIT 4

4.1 Dielectric Properties of Materials: Polarization. Local Electric Field in solids. Depolarization Field. Electric Susceptibility. Polarizability. Clausius Mossoti Equation. Classical Theory of Electric Polarizability. Normal and Anomalous Dispersion.

4.2 Superconductivity: Definition, Properties, Meissner effect, Type I and II Superconductors.

Sem
V

Thermodynamics And Statistical Physics

Core Compulsory

Marks : 70 + 30

Objective:

- The aim of the course is to teach the theoretical basis of thermodynamics and Statistical Physics and to show how it provides the crucial link between the microscopic quantum world and the behaviour of macroscopic material, which is amenable to experiment.
- Concepts and methods appropriate for the description of systems containing very many distinguishable or indistinguishable particles will be presented and the distinction of dealing with systems of closely or widely spaced quantum levels.

Learning Outcomes

By the end of the course, students are expected to be able to:

- Utilize the terms and basic methods of Statistical Physics,
- Derive expressions for the variation of various properties of macroscopic amounts of material,
- Appreciate the different statistics arising from distinguishable and indistinguishable particles and relate these to the behaviour of solids and gases,
- Calculate and manipulate Partition Functions and to derive Thermodynamic state functions analytically in some specific cases,
- Analyse the distinction between Fermi Dirac, Bose-Einstein and Maxwell-Boltzmann statistics, and the origin of these differences.
- Summarize non-classical behaviours such as Electron Degeneracy pressure and Bose-Einstein Condensation.

UNIT 1

1.1 Basics of Thermodynamics: Laws of thermodynamics and their consequences. Thermodynamic potentials, Maxwell relations, chemical potential, phase equilibria. Phase space, Helmholtz Function, Thermodynamically Potential, Gibbs Function, Enthalpy

1.2 Phase Transitions: First-order phase transitions, Second-order phase transitions, The T dS Equations, Related Numerical, micro- and macro-states. Micro-canonical, canonical and grand-canonical ensembles and partition functions

UNIT 2

2.1 Bosons and Fermions: Ideal Bose and Fermi gases. Principle of detailed balance. Blackbody radiation and Planck's distribution law. Ideal Bose and Fermi gases. Principle of detailed balance. Blackbody radiation and Planck's distribution law.

2.2 Macroscopic and microscopic states: Macroscopic states, Microscopic states, Phase spaces, μ-space, Γ-space, Postulate of equal a priori probabilities, Ergodic hypothesis, Condition for statistical equilibrium

UNIT 3

3.1 Statistical ensemble: Micro canonical ensemble, Canonical ensemble, Mean value and fluctuations, Grand canonical ensemble, Fluctuations in the number of particles of a system in a grand canonical ensemble.

3.2 Three Distributions: Maxwell-Boltzmann Distribution, Fermi-Dirac distribution, Bose-Einstein Distribution

UNIT 4

4.1 Some applications of Statistical mechanics: Thermodynamics, Statistical interpretation of basic thermodynamic variables, Ideal gas, Gibbs paradox, the equipartition theorem

Sem
V

Physics Practical V

Core Compulsory

Marks : 70 + 30

Objectives

- To study different experiments in electronics.

Learning Outcomes

- After learning the course, students will be able to learn practically a lot in electronics, which would help clearing the concepts, and in further studies.

LIST OF EXPERIMENTS

1. To study the variation of thermos emf and sensitivity of thermocouple.
2. To determine Absorption co-efficient of liquid using photocell
3. To determine Planck's constant by solar cell
4. To determine the Hall voltage and calculate the Hall coefficient and the carrier concentration of the sample material using Hall effect
5. To determine the resistivity of semiconductors by Four probe Method.
6. Measurement of dielectric constant of given sample.
7. To study the variation of resistance of a Thermistor with temperature.
8. To study the characteristics of RTD (Resistance Temperature Detector).

Sem
V

Atmospheric and Space Science

Core optional

Marks : 70 + 30

Objectives

- To study layers of atmosphere chemistry of different layers.
- To study Ionosphere layer and signal propagation.
- To study Sensors and remote sensing device concept and theory

Learning Outcomes

- After successful completion of the course, students will be able to understand
- The basics of elementary processes like ionization of molecule at different layers of atmosphere.
- How study of Atmospheric Physics is important in many fields e.g, trace analysis, plasma and gas discharge physics, gaseous delay in the signal pressing and working of remote sensors.

UNIT 1

1.1 Basic Concepts of Earth's Atmosphere: Atmosphere nomenclature, Hydrostatic equations scale height, Geopotential height, Chemical concepts of atmosphere, Thermodynamic considerations, elementary chemical kinetics composition and chemistry of middle atmosphere and thermosphere. Thermal balance in the atmosphere, models of neutral atmosphere (CIRA, US Standard atmosphere)

1.2 Solar Radiation and its Effects on the Atmosphere: Solar radiation at the top of the atmosphere, Attenuation of solar radiation in the atmosphere, radiative transfer, thermal effect of radiation, photochemical effects of radiation, Airglow

UNIT 2

2.1 Structure and Variability of Earth's Ionosphere: Introduction to ionosphere, photochemical processes, Chapman's theory of photo ionization, production of ionospheric layers, loss mechanisms and chemistry of ionospheric regions, morphology of the ionosphere

2.2 Ionosphere Propagation and Measurement Techniques: Effect of Ionosphere on radiowave propagation, Refraction, Dispersion and polarization, Magnetoionic theory, critical frequency and virtual height, Oblique propagation and maximum usable frequency, Ground based techniques: ionosondes, radars, scintillation and TEC, ionospheric absorption, rocket and satellite borne techniques: Langmuir probe, electric field probe mass spectrometer

UNIT 3

3.1 Elements of Solar Physics: Structure and composition of the Sun, sun as a source of radiation, sunspots an solar cycles, solar flares, coronal mass ejection

3.2 Magnetosphere: Circulation in the magnetosphere, magentospheric electric fields, particles in the magnetosphere, plasmasphere and its dynamics, magnetospheric current system, magneto pause current tail current ring current and Birlkeland current. Solar wind and its characteristics, Interplanetary magnetic field and sector structure, Formation of geomagnetic cavity, magnetopause, magnetosheath and bow shock, polar cusp and magnetotail, Plasmasphere and Van Allen radiation belts

UNIT 4

4.1 Concepts and Foundations of Remote Sensing: Energy sources and Radiation principles, Energy interactions in the atmosphere, energy interactions with earth surface features, Data acquisition and Interpretations, Reference data, The Global Positioning System An ideal remote sensing system, Characteristics of real remote sensing system, Practical applications of remote sensing, Land and Geographic Information System

4.2 Aurora and Airglow: Night glow, Dayglow, Twilight glow, Aurora, Photometer for airglow measurement, applications of Airglow measurement for ionospheric dynamics and composition

Sem

V

Elements Of Experimental Physics

Core Compulsory

Marks : 70 + 30

Objectives

- To understand different ways of numerical analysis in physical measurement.
- To understand the basics of different transducers and industrial instrumentation.
- To understand the basics of different noises, shielding and grounding
- To understand the basics of different Vacuum Techniques.

Learning Outcomes

After learning this paper, students will be able to:

- Describe the errors in measurement and statistical analysis of data required while performing an experiment.
- Students will learn the working principle, efficiency and applications of transducers & industrial instruments
- They will be able to learn a lot about different vacuum techniques.

UNIT 1

1.1 Numerical analysis in physical Measurements: Measurement, The result of a measurement, Sources of uncertainty and experimental error, Accuracy and precision. Significant figures. Types of errors: Gross error, systematic error, random error.

1.2 Statistical analysis of data: (Arithmetic mean, deviation from mean, average deviation, standard deviation, chi-square) and curve fitting. Gaussian distribution.

UNIT 2

2.1 Transducers & industrial instrumentation: Static and dynamic characteristics of measurement Systems. Generalized performance of systems, Zero order first order, second order and higher order systems. Electrical, Thermal and Mechanical systems. Calibration. Qualitative difference between Transducers and sensors. Types of sensors (Physical, Chemical and Biological), Characteristics of Transducers. Transducers as electrical element and their signal conditioning.

2.2 Temperature transducers: RTD, Thermistor, Thermocouples, Semiconductor type temperature sensors (AD590, LM35, LM75) and signal conditioning. Linear Position transducer: Strain gauge, Piezoelectric. Inductance change transducer: Linear variable differential transformer (LVDT), Capacitance change transducers.

UNIT 3

3.1 Signals and Systems: Fluctuations and Noise in measurement system. S/N ratio and Noise figure. Noise in frequency domain. Sources of Noise: Inherent fluctuations, Thermal noise, Shot noise, 1/f noise

3.2 Shielding and Grounding: Methods of safety grounding. Energy coupling. Grounding. Shielding: lectrostatic shielding. Electromagnetic Interference

UNIT 4

4.1 Vacuum Techniques: Units of pressure measurement, Characteristics of vacuum, Applications of vacuum, Vacuum systems, Vacuum pumps: mechanical rotary pump, multistage diffusion pump,

4.2 Vacuum gauges: Pirani gauge, penning cold cathode gauge, capacitance gauge, pumping speed for a vacuum system, leak testing.

CHEMISTRY

Sem
V

Organic Chemistry-II

Compulsory

Marks : 70 + 30

Objectives

- To understand classification of Phenol, preparation of phenol and important reactions of phenol
- To make students familiar with chemistry of Ethers
- To understand Nomenclature, construct structures and understand nature of reactions of carbonyl group i.e. Synthesis of aldehydes and ketones
- To get knowledge about reactions of Carboxylic Acids and name reactions based on Carboxylic Acid

Learning Outcomes

Learners will be able to:

- Independently carry out Nomenclature, classification, preparation and important reactions of phenols
- Explain chemistry and reactions of different Ethers
- Develop skill to discuss Nomenclature, construct structures and understand nature of reactions of carbonyl group i.e. Synthesis of aldehydes and ketones
- Discuss chemistry and name reactions based on Carboxylic Acids

UNIT 1 Phenols

1.1. Preparation by Dow's process, from diazonium salt, from cumene & from sulphonic acid
1.2. Acidic nature of Phenols and their comparative strength with alcohols and acids
1.3. Electrophilic aromatic substitution reactions
1.4. acylation reaction
1.5. carboxylation reaction
1.6. Fries rearrangement
1.7. Claisen rearrangement
1.8. Reimer-Tiemann reaction
1.9. Kolbe reaction
1.10. Schotten-Baumann reaction
1.11. Lederer - Manasse reaction
1.12. and Hauben - Hoesch reaction

UNIT 2 Ethers

2.1. Nomenclature of ethers and methods of their formation such as Dehydration of alcohols
2.2. using Diazomethane, Williamsons synthesis
2.3. Epoxidation method, Ziesel's method
2.4. Physical properties
2.5. Chemical properties such as formation of oxonium salts, cleavage by acids, autoxidation (peroxides)
2.6. Halogenation
2.7. Electrophilic substitution with orientation concept, Hydrolysis of epoxides etc

UNIT 3 Aldehydes and ketones

3.1. Nomenclature
3.2. Structure and nature of reactions of carbonyl group
3.3. Synthesis of aldehydes and ketones from alcohols, carboxylic acids and nitriles
3.4. Etard reaction
3.5. Reimer-Tiemann reaction
3.6. Friedal crafts reaction
3.7. Physical properties
3.8. Nucleophilic addition reactions with mechanism
3.9. Aldol condensation
3.10. Perkin condensation
3.11. Benzoin and Knoevenagel condensation
3.12. Wittig reaction
3.13. Mannich reaction
3.14. Oxidation of aldehydes
3.15. Baeyer Villiger oxidation of ketones
3.16. Cannizzaro reaction

UNIT 4 Carboxylic Acids and its derivatives

4.1. Nomenclature
4.2. Structure and bonding
4.3. Synthesis from primary alcohols, from aldehydes, from alkyl benzene and alkenes, from nitriles, from carbonation of organometallics
4.4. Baeyer Villiger oxidation
4.5. Physical properties
4.6. Acidic nature, effect of substituents on acidic strength
4.7. Chemical reactions – reactions showing acidic character
4.8. Reactions involving –OH group and -COOH group
4.9. Hell Volhard Zelinsky reaction
4.10. Synthesis of acid chlorides, esters amides and anhydrides

Sem

V

Physical Chemistry-II

Compulsory

Marks : 70 + 30

Objectives

- To study Ostwald's dilution law and pH Scale
- To know the hydrolysis of salt, buffer solutions and acid base indicators
- To understand Fugacity and method of determination of fugacity of real gases
- To understand of Chemical equilibria and Equilibrium constant
- To know different physical properties like refractive index, dipole moment and determine of chemical constitution

Learning Outcomes

Learner will be able to

- To study Ostwald's dilution law and pH Scale
- To know the hydrolysis of salt, buffer solutions and acid base indicators
- To understand Fugacity and method of determination of fugacity of real gases
- To understand of Chemical equilibria and Equilibrium constant
- To know different physical properties like refractive index, dipole moment and determine of chemical constitution

UNIT 1 Ionic Equilibrium

1.1. Introduction
1.2. Dynamic equilibrium between the ions and the Unionized molecules,
1.3. Ostwald's dilution law and its limitations
1.4. Ionic product of the water
1.5. pH scale
1.6. Hydrolysis of salts- salts of weak acids and strong bases
1.7. Salts of weak bases and strong acids
1.8. Salts of weak acids and weak bases
1.9. Buffer solutions
1.10. Acid-Base indicators
1.11. Theory of acid-base indicators
1.12. Action of phenolphthalein
1.13. Action of methyl orange

UNIT 2 Electromotive force

2.1. Electromotive Force of Electrochemical Cells
2.2. Electrodes, cell, emf and free energy
2.3. Standard electrode potentials
2.4. emf and activities
2.5. Activity coefficients from emf
2.6. Equilibrium constant from emf
2.7. Electrode concentration cells
2.8. Electrolyte concentration cells
2.9. Thermodynamic properties from cell emf

UNIT 3 Chemical Equilibrium

3.1. Equilibrium constant and free energy
3.2. thermodynamic derivation of law of mass action and its application
3.3. Dissociation of HI
3.4. Dissociation of N_2O_4, Synthesis of ammonia
3.5. Le Chatellier's principle
3.6. Van't Hoff reaction isotherms and reaction isochors

UNIT 4 Physical Properties and Chemical Structure

4.1. Introduction,
4.2. Refractive Index
4.3. Optical Activity & Chemical constitution
4.4. Electrical properties elucidating the molecular structure
4.5. Dipole moments
4.6. Electrical polarization of molecules
4.7. Dipole moments and dielectric constant
4.8. Dielectric polarization and dielectric constant
4.9. Clausius-mosotti equation
4.10. Determination of dipole moments
4.11. vapour-temperature method
4.12. Dilute solution method
4.13. Bond moments and molecular dipole moments
4.14. Dipole moments and structure of molecules
4.15. Numericals

Sem

V

Chemistry Practical-5

Compulsory

Marks : 70 + 30

Objectives

- Can get understanding of binary organic mixture separation
- Can get familiarize with various steps of systematic binary organic mixture separation
- Can get understanding of instruments such as viscometer, colorimeter etc.
- Get idea about polymers and resins and their viscosity
- To get knowledge about inorganic complexes preparation

Learning Outcomes

Learners will be able to:

- Independently Separate binary organic mixture and identify separated components
- Operate viscometer and determine viscosity of various chemicals and resins
- Determine molecular weight of polymer
- Develop analytical skills
- Deal with Inorganic substances qualitatively and quantitatively

Organic solid binary mixture separation: (Minimum : 6)

To carryout separation of binary organic mixtures (solid + solid) and qualitative analysis of separated substances. Mixture of following types can be given for separation and identification purpose.

1.Acid –base	2.Acid –neutral	3.Base-neutral
4.Acid-phenol	5. Base-phenol	6. Neutral -phenol

Physical Chemistry

Viscometer

1. To determine absolute viscosities of liquid A, B and its Mixture

Colorimetry

To verify Lambert-Beer's Law for Potassium Chromate, Copper Sulphate, potassium permanganate ($KMnO_4$)

1. To determine the concentration of Fe^{3+} in the given solution by Colourimetry

Conductometry

1. Verification of DHO equation for strong electrolytes HCl, KCl, NaCl
2. Test of validity of Ostwald's dilution law and determine dissociation constant of weak electrolytes like acetic acid, monochloro acetic acid

Elective 1: polymer chemistry (Any Four)

1. To determine the viscosity of various resins
2. Determination of molecular weight of a polymer (Polystyrene) by viscometry
3. Determination of molecular weight of a polymer (Polyvinyl alcohol) by viscometry
4. Determination of molecular weight of a polymer (PEG-400) by viscometry
5. Determination of molecular weight of a polymer (PEG-6000) by viscometry
6. Determination of molecular weight of a polymer (Gelatine) by viscometry
7. Determination of molecular weight of a polymer (Starch) by viscometry

Elective 2: Inorganic chemistry

Preparation of any two of the following complexes and measurement of their conductivity:

1. tetraamminecarbonatocobalt (III) nitrate
2. tetraamminecopper (II) sulphate
3. potassium trioxalatoferrate (III) trihydrate Compare the conductance of the complexes with that of M/1000 solution of NaCl, $MgCl_2$

Volumetric Analysis:

1. Determination of acetic acid in commercial vinegar using NaOH
2. Determination of alkali content – antacid tablet using HCl
3. Estimation of calcium content in chalk as calcium oxalate by permanganometry

Chromatography of metal ions Principles involved in chromatographic separations. Paper chromatographic separation of following metal ions:

1. Ni^{+2} and Co^{+2}
2. Fe^{+3} and Al^{+3}

Sem
V

Polymer Chemistry

Optional

Marks : 70 + 30

Objectives

- To understand basic concepts of polymers and classification of polymers
- To know about types of polymerization e.g. addition and condensation polymerisation
- To get knowledge of molecular weight determination techniques of polymers
- To get knowledge about dissolution of polymers and its thermodynamics behaviour, nature of polymer molecule in solution

Learning Outcomes

Learners will be able to

- to understand basic concepts of polymers and classification of polymers
- to know about types of polymerization e.g. addition and condensation polymerisation
- to study of molecular weight determination techniques of polymers in detail
- to get knowledge about dissolution of polymers and its thermodynamics behaviour, nature of polymer molecule in solution

UNIT 1 Basic concepts of polymer chemistry

1.1. Introduction
1.2. Monomer
1.3. Polymer
1.4. Degree of Polymerisation
1.5. Constitutional Repeating Unit (CRU)
1.6. Functionality
1.7. Classification of polymers on basis of (i) Source (ii) type of polymerisation process used in synthesis (iii) nature and type of chain (iv) Solid state behaviour of polymer chains
1.8. Isomerism in Polymer chains
1.9. Intermolecular forces in Polymers
1.10. Polymer waste disposal and remedies

UNIT 2 Types of Polymerization

2.1. Introduction
2.2. Distinction between Chain Growth Polymerisation (Addition Polymerisation) and Step Growth Polymerisation (Polycondensation Polymerisation)
2.3. Mechanism of Polymerisation (Free Radical, Cationic and Anionic)
2.4. Coordination Polymerisation
2.5. Kinetics of Free Radical Addition (Chain) Polymerisation
2.6. Kinetics of Cationic Polymerisation
2.7. Kinetics of Anionic Polymerisation

UNIT 3 Molecular weight of Polymers

3.1. Concepts of mass, number
3.2. Viscosity and sedimentation average molecular weights
3.3. Polydispersity and molecular weight distribution
3.4. Measurements of molecular weights
3.5. End group

3.6. Viscosity
3.7. Light scattering
3.8. Osmotic and ultracentrifugation method
3.9. Gel permeation chromatography
3.10. Polymer fractionation
3.11. The practical significance of molecular weights

UNIT 4 Polymer solutions

4.1. Polymer dissolution process
4.2. Thermodynamics of polymer dissolution
4.3. Deviations from Raoult's law
4.4. Flory-Huggins theory of entropy and enthalpy of mixing
4.5. Nature of polymer molecules in solution

Sem
V

Inorganic Chemistry-II

Optional

Marks : 70 + 30

Objectives

- To get knowledge for Chemistry of d-Block Elements
- To understand Chemistry of Lanthanide Elements
- To understand Chemistry of Actinides Elements
- How to explain Chemistry of Coordination compounds

Learning Outcomes

- The students will be able to understand d-block elements and their applications efficiently.
- The students will be able to understand lanthanides elements and their applications efficiently.
- The students will be able to understand actinides elements and their applications efficiently.
- The students will be able to get idea about the structural properties and stability of Coordination compounds.

UNIT 1 Chemistry of d-Block Elements

1.1. Transition elements, definition, position in periodic table, electronic configuration of atoms and ions
1.2. General characteristics such as oxidation state, size, melting and boiling points
1.3. Reactivity
1.4. Ionization energies
1.5. Magnetic behavior
1.6. Colour
1.7. Tendency to form complexes
1.8. Comparison of properties of first transition series with second and third transition series

Unit 2 Chemistry of Lanthanide Elements

2.1. Electronic structure
2.2. Oxidation state
2.3. Ionic radii and lanthanide contraction
2.4. Complex formation
2.5. Spectral properties
2.6. Occurrence of lanthanides
2.7. Separation of lanthanides by ion exchange method

UNIT 3 Chemistry of Actinide Elements

3.1. General features and chemistry of actinides
3.2. Electronic structure
3.3. oxidation state
3.4. ionic radii
3.5. complex formation of actinides
3.6. chemistry of extraction of Thorium and Uranium from their ores
3.7. Similarities between actinides and lanthanides

UNIT 4 Chemistry of Coordination Compounds

4.1. Werner's coordination theory and its experimental verification
4.2. Effective atomic number concept
4.3. Chelates
4.4. Nomenclature of coordination compounds
4.5. Thermodynamic and kinetic stability of coordination compounds
4.6. Isomerism (structural, stereo and geometrical isomerism in 4 and 6 coordination number compounds)
4.7. Optical isomerism in four and six coordination number compounds

BOTANY

Sem
V

Fundamentals Of Microbiology

Compulsory

Marks : 70 + 30

OBJECTIVE

- This paper introduces student to the subject. It opens up a new world of small, tiny creatures of enormous importance which we know as microorganisms. It gives basic information about the existence of microbes and their association with other forms of life

LEARNING OUTCOMES

On completion of this paper, students will be able to

- Understand about the omnipresence of microorganisms
- Describe the taxonomic status of microorganisms.
- Describe the general features of microbes.
- Understanding history and scope of microbiology and applied microbiology
- Learning importance of microorganisms in our world
- Understand the use of microscopy to study microbiology
- Understand the use of stains

UNIT 1 SCOPE AND HISTORY OF MICROBIOLOGY

1.1 Microbiology as a field of Biology
1.2 The Place of Microorganisms in the living world
1.3 Introduction to Groups of Microorganisms
1.4 Distribution of Microorganisms in Nature
1.5 Applied areas of Microbiology
1.6 Spontaneous generation versus Biogenesis
1.7 Germ Theory of disease
1.8 Eminent scientists of Microbiology

UNIT 2 MORPHOLOGY OF BACTERIA

2.5 Size, Shape and Arrangement of Bacteria
2.6 Bacterial Structures – External to Cell Wall : Capsule, Flagella, Pili, Prostheca, Sheath & Stalk
2.7 The cell wall of Bacteria – Structure and chemical composition of Gram negative and Gram positive Bacterial cell wall
2.8 Bacterial Structures – Internal to Cell Wall : Cell Membrane, Protoplast, Spheroplast, Membranous intrusions and intracellula membrane system, Cytoplasm, Cytoplasmic inclusions and Vacuoles, Nuclear Material
2.9 Bacterial Spores and Cyst – Types of spore, Structure and formation of Endospores (Sporogenesis).

UNIT 3 CULTIVATION AND REPRODUCTION OF BACTERIA

3.1 Nutritional requirements & Nutritional types of of bacteria
3.2 Bacteriological Media
3.3 Physical conditions & Gaseous requirements for growth
3.4 Selective methods & Cultural characteristics
3.5 Growth of Bacteria: Generation time, Growth rate

3.6 Bacterial Growth Curve, Synchronous growth and Continuous culture of Bacteria.

UNIT 4 VIROLOGY

4.1 Introduction and General Characteristics:
Definition, Structure, Classification
4.2 Cultivation and Enumeration of Viruses
4.3 Bacterial Viruses: Classification, Lytic life cycle (T4 phage), lysogenic life cycle (Lambda phage)
4.4 Plant Viruses: Classification, Structure of TMV, Economic importance, Viroids
4.5 Animal Viruses:
Classification, Cytocidal effects, HIV, HBV, Ebola, Zeka, SARS-CoViD, Prions

Sem
V

Cell Biology

Compulsory

Marks : 70 + 30

OBJECTIVE

- To enable students with the applied aspects of cell biology and microscopy
- Experiments with the utilization of microscope will make students technically sound in the field of cell biology.

LEARNING OUTCOMES

On completion of the Paper, students are able to understand

- Define terminologies related to cell biology.
- Identify localization and describe all cell organelles.
- Discuss the dynamics of plant cell structure and function.
- The eukaryotic cell cycle and mitotic and meiotic cell division
- Structure and organization of cell membrane
- Process of membrane transport and membrane models
- Structure and function of various cell organelles
- Cell division process

UNIT 1 TECHNIQUES IN BIOLOGY

1.1 Principles of microscopy
1.2 Light Microscopy
1.3 Electron microscopy (EM)
1.4 Scanning EM and Transmission TEM (TEM)
1.5 Sample Preparation for electron microscopy

UNIT 2 CELL AS A UNIT OF LIFE

2.1 The Cell Theory
2.2 Prokaryotic and eukaryotic cells
2.3 Cell wall: Ultra structure and functions
2.4 Plasma membrane: Ultra structure, Models and Functions

UNIT 3 CELL ORGANELLES

3.1 Mitochondria
3.2 Chloroplast
3.3 Nucleus
3.4 Endoplasmic Reticulum
3.5 Golgi complex and lysosome

UNIT 4 CELL CYCLE AND DIVISION

4.1 Cell cycle
4.2 Mitosis
4.3 Meiosis
4.4 Chromosome Structure

Sem
V

Practicals In Plant Science 5

Compulsory

Marks : 70 + 30

Objectives

- Development of awareness about the rules and regulations in microbiological laboratory
- Understanding of the use of stains
- Practice of using microscope to study micro organisms
- Understanding morphology and physiology of bacteria
- Learn about the growth patterns of bacteria
- Learn quantitative measurement of growth
- To demonstrate significant cell biological principles, quantitative and analytical approaches that enable the students to translate the theoretical foundation in cell biology to be translated into practical understanding.
- Build on the fundamental concepts of cell structure and function from previous study to include: a. the relationship between molecular structure and function. b. the dynamic character of cellular organelles. c. unity and diversity at the macromolecular and cellular levels and the relationship to adaptation through time.

Learning Outcomes

- By performing the laboratory experiments the students will be able to
- Develop skills to prepare and sterilize medium
- Acquire skills to isolate bacteria into pure culture
- Develop proficiency in staining & Being able to perform different staining procedures to gain knowledge of micro organisms.
- After the practical course, students will be able to differentiate the cells of various living organisms and get awareness of physiological processes of cell e.g. cell divisions.
- Students will be able to observe and correctly identify different cell types, cellular structures using different microscopic techniques.
- Relate experimental processes and evidence to the knowledge of cell structure and function that is being learned.
- Relate the molecular and sub-cellular components of a cell to a framework of heredity and evolution.
- Students will understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles
- Students will understand how these cellular components are used to generate and utilize energy in cells
- Students will understand the cellular components underlying mitotic cell division.

FUNDAMENTALS OF MICROBIOLOGY

1. Preparation of glassware for sterilization and disposal of laboratory media and cultures
2. Study of bacterial motility by hanging drop method.
3. Monochrome Staining: Positive Staining of Bacilli and Yeast
4. Monochrome Staining : Negative Staining of Tooth Tarter sample
5. Differential Staining : Gram's Staining
6. Isolation of bacteria by streak plate/pour plate and spread plate technique
7. Enumeration of bacterial number by viable count technique.
8. Growth curve of Bacteria by colorimetric method and determination of Generation time and Growth rate of E. coli by colorimetric method.

CELL BIOLOGY

1. To understand the working of compound light microscope.
2. Preparation of Stains and Staining Reagents
3. To study the cell wall.
4. To study various models of plasma membrane through chart
5. To study various shape of chloroplast.
6. To locate nucleus in different cells.
7. To study various stages of mitosis in onion root tip.
8. To study various stages of meiosis in onion bud.
9. To study various stage of meiosis in hibiscus bud.
10. To study mitosis through permanent slides
11. To study meiosis through permanent slides
12. To study electron micrograph of various cell organelles.

BIOSTATISTICS AND BIOINFORMATICS

1. Review of NCBI Portal
2. Review of Biological Data Bases
3. Search the give sequence of Nucleic acid and Protein based on Accession number, Keywords and Author name from GeneBank, ENA, Uniprot and PIR.
4. Search 3 D Protein structure from MMDB.
5. Perform local and global alignment using EMBOSS.
6. Demonstration on BLAST analysis

BIODIVERSITY

1. To locate the hotspots, phyto geographical regions and distribution of endemic plants in the map of India.
2. The following practical should be conducted in the Field/lab with the help of photographs, herbarium, Floras, Red data book- Study of endangered plants species, critically endangered plants species, vulnerable plant species and monotypic endemic genera of India.
3. To study Types of biodiversity.
4. To Study threats to biodiversity
5. Study and application of diversity indices to suitable ecosystem/ area.
6. To study significance of Tissue culture and Botanical gardens in conservation of Biodiversity
7. To measure the latitude, longitude and altitude by using GPS
8. To study significance of Seed bank and Gene bank in conservation of Biodiversity.
9. To study the role of NBA, BMC, PBR and IUCN in conservation of plant Biodiversity
10. Visit to nearby conservation institutes/sacred groove and report writing.

Sem V

Biostatistics And Bioinformatics

Optional

Marks : 70 + 30

OBJECTIVE

- To make students understand the statistical analysis of data used in biological research.

LEARNING OUTCOMES

After successfully completing this paper, students will be able to:

- Study the statistics in relation to botany.
- Define scope and limitations of biostatistics.
- Apply statistical terms and measures of central tendency of grouped and ungrouped data.
- Apply computation of seed testing & biostatistics and test of significance for the data.
- Classify data and methods of representation in biology.
- Understand how theoretical approaches can be used to analyze biological systems
- Obtain knowledge on applications of bioinformatics

UNIT 1 DATA COLLECTION AND REPRESENTATION

1.1 Basic definitions and concepts
1.2 Discrete and continuous random variables
1.3 Data - types of biological data - Quantitative and Qualitative, Tabulation and graphical representation
1.4 Methods of data collection - Experimental and survey, Descriptive statistics
1.5 Measures of central tendency, Mean, Median, Mode

UNIT 2 MEASURE OF DISPERSION

2.1 Range
2.2 Mean deviation
2.3 Standard deviation
2.4 Standard error
2.5 Variability
2.6 Probability Distribution: Normal, Binomial and Poisson

UNIT 3 COMPUTATIONAL BIOLOGY AND DATABASES

3.1 Introduction and applications of Bioinformatics
3.2 Databases, DBMS, Biological database: Primary and Secondary databases
3.3 Structure databases, miscellaneous databases,
3.4 Overview of NCBI, ENTREZ, SRS and DBGET
3.4 File formats

UNIT 4 SEQUENCE ALIGNMENT: BLAST and EMBOSS

4.1 Sequence alignment: Local alignment, Global alignment, multiple alignment and Motif match
4.2 Algorithms: Smith Waterman Algorithm and Needleman Wunsch Algorithm,
4.3 Gap Penalty
4.4 BLAST : Types and Applications, EMBOSS Needle and EMBOSS Water

Sem
V

Biodiversity

Optional

Marks : 70 + 30

OBJECTIVE

- To enable students to understand the diversity among the different forms of plant world and conservation techniques in India

LEARNING OUTCOMES

After successfully completing this paper, students will be able to:

- Elaborate the characterization of biodiversity.
- Illustrate social approach to biodiversity conservation
- The ability to demonstrate the differences between the different layers in the red list
- An enhanced recognition of the complexities of environmental conservation

UNIT 1 INTRODUCTION TO BIODIVERSITY

1.1 Biodiversity: Concepts and components of biodiversity, genetic, species and ecosystem diversity, Values and Importance of biodiversity.
1.2 Types of Biodiversity: Alpha, Beta and Gamma
1.3 Cryptogams and Phanerogams
1.4 Diversity in plant kingdom – habit, habitat, duration of life
1.5 Position of plants in five kingdom system

UNIT 2 BIODIVERSITY OF INDIA

2.1 Biogeographical classification of India
2.2 Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values
2.3 Biodiversity at global, National and State levels. India as a mega-diversity nation

UNIT 3 THREATS AND CONSERVATION INITIATIVES FOR BIODIVERSITY

3.1 Hot-spots of biodiversity.
3.2 Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.
3.3 Endangered and endemic species of India
3.4 NBA, BMC, PBR and IUCN

UNIT 4 BIODIVERSITY CONSERVATION

4.1 Conservation, principles, strategies–In situ and Ex situ Conservation.
4.2 National Parks and Sanctuaries
4.3 Biosphere Reserve Programs
4.4 Tissue culture and Botanical gardens Importance
4.5 Seed bank and Gene bank

Semester VI

Semester – VI								
			Total Papers	Credit	Hours	Internal	External	Total
Education	Education	Theory	3	9	135	90	210	300
	Education (EPC)	Practical	1	1	30	15	35	50
	School Internship	Practical	1	4	120	100	00	100
B.Sc (Science)	Principal	Theory/Practical	4 (3+1)	12	225	120	280	400
		Total	9	26	510	325	525	850

Sr. No.	Subject	Title of the paper	T/P	Nature	Credit	Hours	Internal	External	Total
1	Education	Teacher and Learner in Society	Theory	Compulsory	3	45	30	70	100
2	Education	Knowledge and Curriculum	Theory	Compulsory	3	45	30	70	100
3	Education	Advanced pedagogy	Theory	Compulsory	3	45	30	70	100
4	Education	Optional Paper (Any One) 1. Environment Education 2. Yoga in Education 3. Educational Management	Practical	Compulsory	1	30	15	35	50
5	Education	Practice Teaching	Practical	Compulsory	4	120	100	00	100
5	Mathematics	Complex Analysis-I	Theory	Compulsory	3	45	30	70	100
6	Mathematics	Metric Space	Theory	Compulsory	3	45	30	70	100
7	Mathematics	Practical: Complex Analysis-I & Metric Space	Practical	Compulsory	3	90	30	70	100
8	Mathematics	Elementary Number Theory	Theory	Optional	3	45	30	70	100
9	Mathematics	Combinatorics and Fuzzy Set	Theory	Optional	3	45	30	70	100
10	Physics	Classical Mechanics and Relativity	Theory	Compulsory	3	45	30	70	100
11	Physics	Electrodynamics and Plasma Physics	Theory	Compulsory	3	45	30	70	100
12	Physics	Physics Practical VI	Practical	Compulsory	3	90	30	70	100
13	Physics	Introduction to Nanoscience and Applications	Theory	Optional	3	45	30	70	100
14	Physics	Instrumentation and Sensors	Theory	Optional	3	45	30	70	100
15	Chemistry	Organic Chemistry-III	Theory	Compulsory	3	45	30	70	100
16	Chemistry	Thermodynamics	Theory	Compulsory	3	45	30	70	100
17	Chemistry	Chemistry Practical-6	Practical	Compulsory	3	90	30	70	100
18	Chemistry	Environmental Chemistry	Theory	Optional	3	45	30	70	100
19	Chemistry	Advanced Inorganic Chemistry-I	Theory	Optional	3	45	30	70	100
20	Botany	Biochemistry and Enzymology	Theory	Compulsory	3	45	30	70	100
21	Botany	Plant Physiology & Metabolism	Theory	Compulsory	3	45	30	70	100
22	Botany	Practicals in Plant Science VI	Practical	Compulsory	3	90	30	70	100
23	Botany	Plant Pathology	Theory	Optional	3	45	30	70	100
24	Botany	Economic Botany	Theory	Optional	3	45	30	70	100
25	Zoology	Reproductive and Developmental Biology	Theory	Compulsory	3	45	30	70	100
26	Zoology	Basics of Biochemistry	Theory	Compulsory	3	45	30	70	100
27	Zoology	Practicals in Zoology -6	Practical	Compulsory	3	90	30	70	100
28	Zoology	Endocrinology	Theory	Optional	3	45	30	70	100
29	Zoology	Mammalian Physiology	Theory	Optional	3	45	30	70	100

Any one subjects of Science (Mathematics, Physics, Chemistry and Botany) will have to be opted by the student.

EDUCATION

Sem VI

CoS 1: Teacher and Learner in Society

Compulsory

Marks : 70 + 30

Objectives

To enable the prospective teachers

- to develop an understanding of aspects related with nation and learner
- to develop an understanding about their roles and responsibilities
- to develop an understanding of teaching as a profession, roles and challenges
- to develop the realization about the roles of teachers in 21st century

Unit 1 Learners and Nation

1.1 Concept of National Integration in India and its Importance
1.2 Constitutional Values, Rights and Duties
1.3 Pluralistic Society: Social, Cultural, Linguistic and Religious Diversity and Learners
1.4 Identity Formation, Identity Crisis and National Integration

Unit 2 Roles and Responsibilities of Learner

2.1 Developing responsible citizenship
2.2 Adolescent Health and concerns
2.3 Ensuring cyber safety and security
2.4 Conflict, Peace and learner

Unit 3 Teaching as a Profession, Roles, Challenges

3.1 Teaching as a Profession: Indian and Western Perspectives and Characteristics
3.2 Teacher as an agent of the Social Change in the Society
3.3 Challenges in Teaching Profession
3.4 Real Life Stories of Effective Teachers
(Any three famous/innovative teachers at respective district level)

Unit 4 Being a Teacher in 21st Century

4.1 Characteristics of 21st Century Learners
4.2 Skills required in a 21st Century for Teachers
4.3 Code of Conduct of a Teacher
4.4 Roles of a Teacher in Online Education: A Paradigm Shift

Sem **VI**

CuS 2 : Knowledge and Curriculum

Compulsory

Marks : 70 + 30

Objectives

To enable the prospective teachers

- to describe meanings of knowledge
- to understand abstract nature of knowledge
- to identify different facets of knowledge
- to classify knowledge into different forms and identify different ways of knowing

Unit 1 Epistemology and Basics of Knowledge

1.1 Epistemology: Meaning and Concept

1.2 Knowledge: Meaning, Concept, Nature, Scope and Characteristics

1.3 Sources and Types of Knowledge

1.4 Distinction between: Knowledge and Information, Knowledge and Belief, Knowledge and Skill, Local and Universal; Concrete and Abstract; Theoretical and Practical; Contextual and Textual; School and out of School Knowledge

Unit 2 Process of Knowledge

2.1 Components of Knowledge Process

2.2 Approaches to Acquiring Knowledge

2.3 Process of Knowing and Knowledge: The Indian Way

2.4 Process of Construction of Knowledge and Factors involved in Construction of Knowledge

Unit 3 Translating Knowledge to Curriculum

3.1 Knowledge as a Foundation of Curriculum and Knowledge Activation through Curriculum

3.2 Infusing Knowledge Processes in Curriculum Development

3.3 The responsibility of selection and Legitimacy of inclusion of knowledge in School Curriculum

3.4 Evaluating Knowledge Potential in Curriculum

Unit 4 Issues and Trends in Knowledge and Curriculum

4.1 Dimensions of Curriculum Design: Articulation, Balance, Continuity, Scope Sequence, Integration

4.2 Curriculum Planning – Concept and Levels

4.3 Autonomy in Curriculum Development – Meaning and Effect

4.4 Benchmarking in Curriculum – Concept and Importance

Sem

VI

PS 4 : Advance Pedagogy

Compulsory

Marks : 70 + 30

Objectives

To enable the prospective teachers

- to understand the concept of advance pedagogy
- to understand concept and need of different advance pedagogies
- to use rubrics, portfolio as an assessment tool
- to understand use remedial measures

Unit 1 Introduction to Advance Pedagogy

1.1 Advance Pedagogy: Concept, Need and Importance

1.2 Principles of Advance Pedagogy

1.3 STEAM (Science,Technology, Engineering,Arts,Maths) learning: Concept, Need and Importance

1.4 Experiential learning and Project based learning

Unit 2 Advance Pedagogy-1

2.1 Constructivist Approach: Concept, Principles and Role of Teacher

2.2 5E Model: Steps and Role of Teacher

2.3 Concept Mapping: Concept,Types, Importance and Role of Teacher

2.4 Reflective Learning: Concept, Gibb's Cycle and Role of Teacher

Unit 3 Advance Pedagogy-2

3.1 Cooperative Learning: Concept, Strategies and Role of Teacher

3.2 Collaborative Learning:Concept, Strategies and Role of Teacher

3.3. Techno pedagogy: Concept, Skills and Role of teacher

3.4 Integrated Pedagogy: Concept

Unit 4 Assessment and Evaluation

4.1 Rubrics: Concept, types, Development and its effective use

4.2 Portfolio: Concept, types, Development and its effective use

4.3 Diagnosis and Remedial measures , Action Research

4.4 Modern tools and techniques for formative assessment

Sem VI

EPC 3 O1 : Environmental Education

Optional

Marks : 35 + 15

Objectives

To enable the prospective teachers

- to understand functions of various Environmental Education centers
- to conduct case study on Environmental Education and NGO or Academic organization
- to prepare report on implementation Environmental policies
- to conduct interview for Environmental Education activities at the school
- to develop an understanding of concepts and issues related to environment as depicted in curriculum

Section A

1. Study of students' understanding of the environmental concepts depicted in the text books
2. Activities for developing environmental friendly life style
3. Visit to any Environmental Education Centre and prepare report based on its activities
4. A study of Environmental issues by interviewing student, parents and educator.
5. A case study of any NGO, Academic organization such as special institution for Environmental Education with reference to their activities
6. Report on implementation of Environmental policies with reference to provisions for Environmental Education in the school.
7. Interviewing and preparing report to find out Environmental Education activities at the school by interviewing associated personnel (school principal, teachers, parents and students).
8. One day camping in a village or in Forest
9. Prepare a report on pollution in your place and inform the local authority.

Section B

1. Study of students' understanding of the images, graphs and figures related to environmental concepts as depicted in the text books.
2. A study on representation of concepts of environment across the curriculum (different subjects in same class or same subject in different classes)
3. Administration of Environmental awareness test on school students and preparing report
4. Group discussion on significance of Panch Mahabhoota in the wellbeing of people.
5. Administration of Environment awareness inventory on school students and preparing report
6. Administration of Environmental awareness checklist/ rating scale/observation on students and preparing report
7. Administration of Environmental awareness interview on teachers and preparing report
8. Reflection on the policies and practices related to environment issues
9. Movie/ documentary review with reference to Environmental Education.

Mode of Transaction: Workshops of one day to describe the idea and the activity.
Activities to be conducted (any one from section A and B respectively)

Note: Trainees will select one activity from each section for submission BUT for better exposure minimum three activities from each unit will be carried out at institutional level.

Sem VI

EPC 3 O2 : Yoga in Education

Optional

Marks : 35 + 15

Objectives

To enable the prospective teachers

- to perform various Asanas and Pranayam
- to understand the power of meditation
- to understand the impact of yoga on health
- to apply the knowledge yoga in the well being of self and scoiety

Section A

1. Perform any five Paranayama and prepare a video of it
   Anulom vilom, Bhrastika, Kapalbhanti, Shitali, Sitkari, Bhramari, Surya bhedan and Chandra bhedan
2. Organize Yoga awareness camp in the practice teaching school and prepare a report of it.
3. Undertake a project on scientific parameters of Yoga and prepare a report of it
4. Conduct a survey about the awareness towards yoga and prepare a report
5. Participate in any one seminar or workshop related to yoga and health and prepare a report
6. Visit a Yoga University or any Yoga centre and prepare reoprt
7. Interview any regular yoga practitioner and prepare report on their daily routine and their views about Yoga
8. International Yoga day Celebration and report preparation

Section B

1. Perform Asanas (Any Twelve) and prepare a video of it
   a) Sitting Posture : Matsyendrasana, Kukkutasana, Vakrasana, JanuShirshasana, Bakasana
   b) Sleeping Posture: Ardha Salbhasana, Navkasana, Mandukasana, Matsyasana, Setubandhasana
   c) Standing Posture : Katichakrasana, Ustrasana, Garudasana, Virbhadrasana, Adho mukhasana
2. Visit any two certified yoga teacher and conduct interview about the impact of yoga on health and submit a report
3. Prepare a detailed report on different styles of meditation
4. Visit any yoga training Centre and prepare a report
5. Organize an interview with any five well known personalities of the city and find out their views about yoga.
6. Prepare a study paper on Emotional disorders and yoga
7. Taking precautions while doing Yoga-Prepare a report
8. Perform Shudhdhikriya (Jal Neti, Sutra Neti, Tratak) and prepare a video

Mode of Transaction: Workshops of one day to describe the idea and the activity
Activities to be conducted (any one from section A and B respectively)

Note: Trainees will select one activity from each section for submission BUT for better exposure minimum three activities from each unit will be carried out at institutional level

Sem **VI**

EPC 3 O3 : Educational Management

Optional

Marks : 35 + 15

Objectives

To enable the prospective teachers

- to understand functions of various educational agencies
- to suggest way to improvise functioning of the school
- to develop understanding regarding functioning of various types of schools
- to acquire resource management skill

Section A

1. Group discussion on difference between management and administration
2. A case study of any reputed/model educational institution with reference to its nature, structure, ethos, communication channel, function, branding policy (Public Relation Policy), leadership style adopted, record maintained, etc.
3. Familiarizing with various records maintained by self-financed school and government school following various educational boards
4. SWOT analysis of any educational institution
5. Visit to Pragna School, BaLa School, KGBV, Eklavya Model School, Special School
6. Visit to NCERT/SCERT/ DIET/ BRC/CRC and prepare report on its function
7. A Study of school culture by adopting sociometry or any other technique

Section B

1. Preparing report on leadership style adopting by principal in the school with reference to its im pact on HR relations, productivity, etc
2. Preparing workload of any educational institution based on HR available
3. Conducting any co-curricular activities with available resources in the school (Resource management)
4. Prepare various type of time table (academic time table, teacher wise time table, class wise ime table) for school
5. Prepare schedule to conduct examination in the school with reference to available resources
6. Prepare a comparative report about the evaluation pattern of different school board
7. Study of a school using the School Evaluation Format developed by GCERT

Mode of Transaction: Workshops of one day to describe the idea and the activity
Activities to be conducted (any one from section A and B respectively)

Note: Trainees will select one activity from each section for submission BUT for better exposure minimum three activities from each unit will be carried out at institutional level

Sem
VI

SI2 : Practice Teaching

Compulsory

Marks : 100

Objectives

To enable the prospective teachers

- to understand the concept of stray lessons
- to develop the proficiency in delivering stray lessons
- to develop the ability to reflect on the lessons delivered by them
- to develop skills for preparing TLM

Type of Activity	Credit	Hrs.	Lessons		Total	Marks		
			M1	M2		Int.	Ext.	Total
Stray Lessons	3	90	3	3	6	60	-	60
Observation			6	6	12			
Submissions	1	30	Reflective Journal for Stray Lessons			20	-	20
			Preparation of TLM in First Method			20	-	20
			Total			**100**	**-**	**100**

MATHEMATICS

Sem
VI

COMPLEX ANALYSIS-I

COMPULSORY

Marks : 70 + 30

Objectives

- To understand the concept of complex numbers, complex function & analytic function.
- To develop the skills of calculation and construction of graphs of complex function.
- To acquire the knowledge of elementary function of complex number.
- To apply the knowledge of Bilinear map.

Course Learning Outcomes

This course will enable students to:

- Find roots of a complex number.
- Verify the Cauchy-Riemann condition.
- Know exponential and logarithm function of a complex number.
- Evaluate bilinear transformation of a complex function.

Unit 1Complex Number:

1.1 Sum and Products, Basic algebraic properties, Vectors and Moduli, Complex conjugate
1.2 Exponential Form, Products and Quotients in exponential forms
1.3 Roots of Complex Numbers
1.4 Regions in the complex plane

Unit 2 Analytic Function:

2.1 Functions of complex variables, mappings, mappings by the exponential function
2.2 Theorems on limits, continuity, derivatives, differentiation formulas Cauchy-Riemann
2.3 equations, sufficient condition for differentiability, polar coordinates
2.4 Analytic functions and harmonic functions

Unit 3 Elementary Function:

3.1 Exponential function
3.2 Logarithmic function, Branches and derivatives of logarithms, some identities involving logarithms, complex exponents
3.3 Trigonometric functions
3.4 Hyperbolic functions, inverse trigonometric and hyperbolic functions.

Unit 4 Conformal Mapping:

4.1 Bilinear map
4.2 The transformation W=1/Z
4.3 Conformal Mapping.

Sem
VI

Metric Space

COMPULSORY

Marks : 70 + 30

Objectives

- To understand the basic concept of sets and functions.
- To develop the skills of calculation and identifying of metric space.
- To acquire the knowledge of continuous function.
- To apply the knowledge of compact and connected metric space.

Learning Outcomes

This course will enable students to:

- Know partially ordered set.
- Solve the examples related to metric space.
- Know the concept of continuity in metric space.
- Evaluate compact and connected sets of metric space.

Unit 1 Sets and Functions:

1.1 Sets and inclusions, the algebra of sets
1.2 Functions, product of set
1.3 Partitions and relation, equivalence relations
1.4 Partially ordered sets

Unit 2 Metric space:

2.1 Definition of metric space, examples
2.2 Open sphere, open set, closed set, examples
2.3 Closure and interior of a set in a metric space, convergence, completeness Baire's
2.4 theorem

Unit 3 Continuous function:

3.1 Definition and examples
3.2 Results on continuity
3.3 Space of continuous functions

Unit 4 Compact and Connected Metric space:

4.1 Compact metric space
4.2 Connected metric space
4.3 Results on compact and Connected metric spaces

Sem VI

Practical: Complex Analysis-I & Metric Space

COMPULSORY

Marks : 70 + 30

Objectives

- To understand the concept of complex numbers, complex function & analytic function.
- To develop the skills of calculation and construction of graphs of complex function.
- To develop the skills of identifying continuous functions and construct more continuous functions.
- To acquire the knowledge of metric space and relate the same with geometry.

Learning Outcomes

- Check analytic function using Cauchy-Riemann equation
- Evaluate bilinear transformation of complex function
- Solve example of metric space
- Solve examples of compact and connected metric space

List of Practical's (Problems)

1. Application of De-Moivere's theorem (to find the roots of an equation)
2. Verification of Cauchy Riemann equations (Cartesian and Polar form)
3. Find the harmonic conjugate of a function and hence find corresponding analytic function
4. If is an analytic function then find when or is given
5. Problems on transformation under function
6. Countable and uncountable sets examples
7. Metric spaces examples
8. Topological Spaces: Definition and examples
9. Examples of a door space and dense set
10. Problems based on compact and connected spaces.

Sem VI

Elementary Number Theory

OPTIONAL

Marks : 70 + 30

Objectives

- To understand the concept of divisibility, congruence & arithmetic functions.
- To develop the skills of calculation of divisibility & congruence's and the skills of identifying the role of arithmetic functions.
- To acquire the knowledge of Chinese remainder theorem.
- To apply the knowledge of Fermat and Euler's theorem to find remainders.

Learning Outcomes

This course will enable students to:

- Find GCD and LCM of an integers.
- Verify prime number using the Sieve of Eratosthenes.
- Find smallest solution of system of congruence equation using Chinese remainder theorem.
- Evaluate the remainder using Fermat's and Euler's equation.

Unit 1 Divisibility Theory

1.1 The division algorithm, divisor, remainder, prime, relatively prime
1.2 The greatest common divisor (GCD) and least common multiple (LCM)
1.3 The Euclidean algorithm (without proof)
1.4 Diophantine equation and its solution

Unit 2 Prime Numbers

2.1 Prime and composite numbers
2.2 The fundamental theorem of arithmetic (without proof)
2.3 Canonical form of a number
2.4 The Sieve of Eratosthenes

Unit 3 Theory of Congruence

3.1 Basic Concepts- Definition, examples & Properties. CRS and RRS (Only definitions)
3.2 Linear congruence, solution of congruence equation
3.3 Special divisibility test
3.4 Chinese Remainder theorem (without proof) and its examples

Unit 4 Euler's and Fermat's Theorem

4.1 Fermat's factorization method, Fermat's little theorem
4.2 Wilson theorem
4.3 Example based on Fermat's theorem and Wilson theorems
4.4 Euler's Phi-function and its formula, Euler's theorem (without proof) and only problems on Euler's theorem

Sem
VI

Combinatorics And Fuzzy Sets

OPTIONAL

Marks : 70 + 30

Objectives

- To introduce the concepts of theory of fuzzy sets.
- To develop the skills of calculating coefficients.
- To acquire the knowledge of permutation and combination.
- To apply the knowledge of combinatorics for any real time problem.

Learning Outcomes

This course will enable students to:

- Find permutation and combination.
- Analyze some properties of Binomial coefficients.
- Solve Ramsey type problems.
- Know basic concepts of Fuzzy sets.

Unit 1 Permutation and Combination

1.1 Permutation, Circular permutation
1.2 Combination
1.3 Injection and Bijection principles
1.4 Arrangements and selection with repetitions, Distribution problems

Unit 2 The Binomial Theorem

2.1 The Binomial theorem, Combinatorial identities
2.2 The Pascal's Triangle
2.3 Chu Shin Chie's identity, Shortest routes in a rectangular grid
2.4 Some properties of Binomial coefficients, Multinomial coefficients and the multinomial Theorem

Unit 3 Ramsey Numbers

3.1 The pigeonhole principle and examples
3.2 Ramsey type problems and Ramsey Numbers
3.3 Bounds for Ramsey Number
3.4 The principle of inclusion and exclusion, Integer solutions and shortest problems

Unit 4 Theory of Fuzzy Sets

4.1 Fuzzy sets
4.2 Basic concepts
4.3 set theoretic operations on fuzzy sets
4.4 Fuzzy relations

PHYSICS

Sem

VI

Classical Mechanics And Relativity

Core Compulsory

Marks : 70 + 30

Objectives

- To understand the general principles of Classical Mechanics and special theory of relativity.
- To comprehend the mathematical formulation involved.
- To apply the concepts in solving problems.
- To emphasize the significance of classical mechanics in real time situations.

Learning Outcomes

After successful completion of the course, students will be able to understand

- Concepts of central force field,
- Working of Rigid body dynamics,
- Lagrangian formulation and Variational Principle and special theory of relativity.

UNIT 1

1.1 Motion in a Central force field: General features of the motion, Motion in an inverse square law force field, Equation of the orbit, Kepler's laws of planetary motion.

1.2 Motion of a Rigid Body: Introduction, Euler's theorem, Angular momentum and kinetic energy, The inertia tensor, Euler's equations of motion, Torque free motion, Euler's Angles, Motion of a symmetric top, Nutational motion.

UNIT 2

2.1 Collision of particles: Elastic & inelastic scattering, Elastic Scattering : Laboratory & Centre of mass system, Kinematics of elastic scattering in the laboratory system, inelastic scattering, cross-section, The Rutherford formula

2.2 Moving Co-ordinate System: Rotating co-ordinate system, The Coriolis force, Motion on the earth, Effect of Coriolis force on freely falling particles

UNIT 3

3.1 Lagrangian Formulation: Introduction, Constraints, holonomic and non-holonomic constraints, scleronomous and rheonomous constraints, generalized coordinates, D'Alembert's principle, Lagrange's equations.

3.2 Variational principle: Applications of the variational principle, Hamilton's principle, Hamilton's equations of motion, some applications of the Hamiltonian formulation, Phase space, Comments on the Hamiltonian formulation.

UNIT 4

4.1 Special Theory of Relativity: The Michelson- Morley experiment, Postulates of the special theory of relativity, The Gallelian Transformation, The Lorentz transformation, The Lorentz Fitzerald Contraction, Time dilation, Relativity of mass, mass & energy, some relativistic formulas, velocity addition, Doppler Effect in light

Sem **VI**

Electrodynamics And Plasma Physics

Core Compulsory

Marks : 70 + 30

Objectives

- To evaluate fields and forces in Electrodynamics and Magneto dynamics using basic scientific method.
- To provide concepts of relativistic electrodynamics and its applications in branches of Physical Sciences.

Learning Outcomes

- To explain and solve advanced problems based on classical electrodynamics using Maxwell's equation.
- The students will be able to analyze s radiation systems in which the electric dipole, magnetic dipole or electric quadruple dominate.
- The students will have an understanding of the covariant formulation of electrodynamics and the concept of retarded time for charges undergoing acceleration.

UNIT 1

1.1 Basics of Electrodynamics: Gauss's law, Boundary value problems, Multipoles, dielectrics, Ampere's law, Faraday's law, Displacement current, Maxwell's equations, Wave propagation in Conductors and Dielectrics. Boundary Value Problems (as a specific problem from Maxwell's equation, Helmholtz condition)

1.2 Minkowski Space: Four vectors, Concepts of Four velocity Four Acceleration and higher rank tensors, Action principle and Electromagnetic energy momentum Tensor, related numerical

UNIT 2

2.1 Plane Electromagnetic Waves and Wave Propagation: Plane Waves in Non-conducting Medium Linear and Circular Polarization, Stokes Parameter, Reflection and Refraction of Electromagnetic Waves at a Plane Interface between Dielectrics

2.2 Fresnel Equation: Group Velocity Dispersion (GVD), Light-Matter Interaction: Classical Kramers-Kronig Relations.

UNIT 3

3.1 Wave Guides and Resonant Cavities: Fields at the surface of and within a Conductor; Cylindrical Cavities and Wave Guides, Resonant Cavities, Power losses in a Cavity and Q of a Cavity.

3.2 Simple Radiating Systems and Diffraction: Fields of Radiation of localized oscillating Source, Electric Dipole fields and radiation and its application to radio waves.

Unit 4

4.1 Introduction to Plasma Physics: Definition of Plasma, Plasma parameters, criteria for plasma, Applications of Plasma Motion of Charged particle in Uniform B and E fields, non uniform B and E fields, time varying E field, adiabatic invariants, Dielectric constant of Plasma, Fluid equation of Plasma, convective derivative, fluid drifts perpendicular to B, plasma instabilities

Sem VI

Physics Practical VI

Core Compulsory

Marks : 70 + 30

Objectives

- To learn about different experiments involving pendulums.
- To learn about different experiments in mechanics involving stress and moment of inertia
- To learn about different experiments in heat and thermodynamics.

Learning Outcomes

- After completion of the course, students will be able to hold a firm understanding of different problems in mechanics.

LIST OF EXPERIMENTS

1. Young's modulus by Koeing's method
2. Determination of Specific heat of liquids by Newton's law of cooling
3. Demonstration of Wind energy trainer.
4. To determine the temperature coefficient using Platinum resistance thermometer
5. Determination of 'g' using Kater's Pendulum
6. Determination of Moment of inertia of a flywheel
7. To verify Stefan's law using electrical method
8. Thermal expansion coefficient of metal and semiconductor
9. To study probability distribution of identical particles

Sem VI

Introduction To Nanoscience and Applications

CORE OPTIONAL

Marks : 70 + 30

Objectives

- This course introduces briefly the basic concepts of nanotechnology and principles required to understand nanomaterials.
- Various nanomaterial synthesis/growth methods and characterizations techniques are discussed to explore the field in detail.
- Various Characterization techniques for nanomaterials and its applications are discussed.

Learning Outcomes

On successful completion of the module, students should be able to

- Explain the difference between nanomaterials and bulk materials and their properties.
- Explain the role of confinement on the density of state function and so on the various properties exhibited by nanomaterials compared to bulk materials.
- Explain various methods for the synthesis/growth of nanomaterials including top down and bottom up approaches.
- Explain various applications of nanomaterials.

UNIT 1

1.1 Introduction to Nanomaterials: Introduction to nano-sized materials and structures, Definitions of nanomaterials, Brief history of Nanomaterials and challenges in Nanotechnology

1.2 Properties of Nanomaterials: Effect of reduction of dimensions, quantum size effects, Mechanical, Thermal, Optical and Magnetic properties of nanomaterials

UNIT 2

2.1 Synthesis of Nanomaterials: Bottom-up and Top-down approaches – Mechanical method: High Energy Ball Milling, Methods based on evaporation (Physical Vapour Deposition), Chemical Vapour Deposition, Chemical Methods: Colloidal Method and Sol-gel Method

UNIT 3

3.1 Carbon in the Nanoworld: Introduction, Graphite, Diamond, Fullerenes, Graphene, Carbon Nanotubes – Structure, Types, Properties, Growth and Applications

UNIT 4

4.1 Nanomaterial Characterization techniques and Application: Structural Characterizations, X-ray Diffraction (XRD),Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Atomic Force Microscopy (AFM).

4.2 Applications: Electronics, Biotechnology and Medical, Automobiles, Space, Defence, Sports, Cosmetics, Cloth Industry, Physics of thin films

Sem
VI

Instrumentation and Sensors

CORE OPTIONAL

Marks : 70 + 30

Objectives

- To illustrate the working of CRO and transducer elements.
- To understand different techniques of temperature and pressure measurements.
- To study acoustic measurements.
- To study optical fibre sensors

Learning Outcomes

- After learning the paper, students will be able to grasp the details of
- Handling the CRO,
- Different pressure measurement, acoustic measurement and temperature measurement techniques,
- The transducer elements and optical fibre sensors.
- This paper would help in any field of physics research in the later years.

UNIT 1

1.1 CRO and Transducer Elements: Introduction to Cathode Ray Oscilloscope, Cathode Ray Tube, Deflection system in CRT,

1.2 Transducers: Analog Transducers, Electromechanical Type Transducer, Potentiometric resistance type, Inductive Type, Capacitive Type, Ionization Transducers, Mechno-Electronic Transducer, Opto-Electrical Transducer, Photo-emissive Transducer, Photoconductive Transducer, Photo-voltaic Transducer

1.3 Piezo- Electric Transducer: Dynamic Characteristics of Piezo-Electric Transducers

UNIT 2

2.1 Strain Gauges: Resistance Strain Gauges, Unbounded Strain Gauge, Bonded Strain Gauge, Resistance Strain Gauge Bridges, Balanced Bridge, Unbalanced Bridge

2.2 Pressure Measurements: Introduction, Moderate Pressure Measurements, Manometers, High Pressure Measurements, Low Pressure (Vacuum) measurements, McLeod Gauge, Thermal conductivity or Pirani Gauge, Ionization Gauge, Knudsen Gauge.

UNIT 3

3.1 Temperature Measurements: Measurements of Temperature, Non-Electrical Methods, Solid Rod Thermometer, Bimetallic Thermometer, Electrical Methods, Electrical Resistance Thermometer, Metallic Resistance Thermometers,

3.2 Temperature Sensors: Semiconductor Resistance Sensors, Thermoelectric Sensors, Thermoelectric materials, Radiation Methods, Total radiation pyrometer, Selective radiation pyrometer.

UNIT 4

4.1 Acoustic Measurements: Microphones, Capacitor type microphone, Piezo-electric crystal type microphone, Electrodynamic type microphone, Carbon microphone, Measurements of environmental air pollution parameters, Orsat apparatus for exhaust gas analysis, Gas chromatography, Non—dispersive infrared gas analyzer, Smoke density measurements,

4.2 Optical Fiber Sensors: Advantages of Optical Fiber Sensors, Types of Optical Fiber Sensors, Biosensors, Smart Sensors

CHEMISTRY

Sem
VI

Organic Chemistry-III

Compulsory

Marks : 70 + 30

Objectives

- To understand preparation and chemical properties of Nitro compounds
- To get familiarize with preparation and separation of various amines
- To develop skill of explanation of open chain & cyclic structure of D-glucose and D-fructose
- To get the knowledge of photochemistry and various photochemical reactions

Learning Outcomes

Learners will be able to

- Illustrate preparation and reactions of Nitro compounds
- Explain methods of separation of various amines
- Discuss Classification, structure and synthesis of different sugar molecules
- Describe photochemistry and demonstrate various photochemical reactions

UNIT 1 Nitro Compounds

1.1. Introduction and Nomenclature of nitro compounds
1.2. Various methods for the preparation of aliphatic nitro compounds
1.3. Chemical properties of aliphatic nitroalkanes such as Acidic nature, Reduction, Hydrolysis, Nitrous acid, Halogenation, Reaction with aldehydes
1.4. Method for the preparation of aromatic nitro compounds with mechanism
1.5. Chemical properties of aromatic nitroalkanes such as electrophilic and Nucleophilic substitution reactions, Reduction etc
1.6. Preparation of Di nitro compounds
1.7. Preparation of Halogeno nitro compounds

UNIT 2 Amines

2.1. Structure and nomenclature of amines
2.2. Physical properties
2.3. Methods of separation of mixture of primary, secondary and tertiary amines
2.4. Structural features affecting basicity of amines
2.5. Preparation of alkyl and aryl amines
2.6. Reduction of nitro compounds
2.7. Nitriles
2.8. Reductive amination of carbonyl compounds
2.9. Gabriel phthalimide reaction
2.10. Hofmann bromide reaction
2.11. Reactions of amines
2.12. Electrophilic aromatic substitution in aryl amines
2.13. Reactions of amines with nitrous acids

UNIT 3 Carbohydrates

3.1. Classification & nomenclature monosaccharides
3.2. Mechanism of osazone formation
3.3. Interconversion of glucose and fructose

3.4. Chain lengthening & chain shortening of aldoses
3.5. Configuration of monosaccharides
3.6. Conversion of glucose into mannose
3.7. Determination of ring size of glucose, open chain and cyclic structure of D (+) glucose & D (-) fructose
3.8. Mechanism of mutarotation
3.9. An introduction to disaccharides (maltose, sucrose & lactose) & polysaccharides (starch and cellulose) without involving structure determination

UNIT 4 Photochemistry

4.1. Difference between thermal and photochemical processes
4.2. Laws of photochemistry: Grothus- Drapper law, Stark Einstein Law
4.3. Jablonski diagram depicting various processes occurring in the excited state (Qualitative description of fluorescence, phosphorescence)
4.4. Quantum yield
4.5. Norrish type I reaction, Norrish type II reaction
4.6. Paterno buchi Reaction
4.7. Application of Photochemistry

Sem
VI

Thermodynamics

Compulsory
Marks : 70 + 30

Objectives

- To understand general introduction of thermodynamics and basic concepts of thermochemistry
- To know and understand the concept of First law of thermodynamics
- To Understand the Second law of thermodynamics and its necessity and know the concept of entropy and Carnot theorem
- To understand the laws of thermodynamics and derive Gibbs - Helmholtz equation
- To understand Partial Molar properties and derive Gibbs-Duhem equation

Learning Outcomes

Learner will be able to

- Understand general introduction of thermodynamics and basic concepts of thermochemistry
- Know and understand the concept of First law of thermodynamics
- Understand the Second law of thermodynamics and its necessity and know the concept of entropy and Carnot theorem
- Carry out thermodynamic derivation of law of mass action and its application
- Understand the laws of thermodynamics and derive Gibbs - Helmholtz equation
- Understand Partial Molar properties and derive Gibbs-Duhem equation

UNIT 1 General Introduction of Thermodynamics

1.1. Definition of thermodynamic terms: System, surrounding, reversible and irreversible processes
1.2. Types of systems, intensive and extensive properties
1.3. state and path functions
1.4. thermodynamic processes
1.5. concept of heat and work
1.6. Thermochemistry
    1.6.1. Standard state
    1.6.2. standard enthalpy of formation
    1.6.3. Endothermic Reaction
    1.6.4. Exothermic Reaction
    1.6.5. Hess's law of heat summation and its applications
    1.6.6. Bond dissociation energy and its calculation from thermo- chemical data
    1.6.7. Temperature dependence of enthalpy (Kirchhoff's equation)

UNIT 2 First Law of thermodynamics

2.1. Statement, definition of internal energy and enthalpy
2.2. Heat capacity and heat capacities at constant volume and constant pressure and their relationship
2.3. Joule's law, Joule-Thomson coefficient and inversion temperature
2.4. Calculation of w, q, dU & dH for expansion of ideal gases under isothermal and adiabatic conditions for reversible and irreversible processes

UNIT 3 Second Law of Thermodynamics and Entropy

3.1. The second law of Thermodynamics
3.2. Second law of thermodynamics and its necessity
3.3. Carnot cycle and its efficiency
3.4. Carnot theorem
3.5. Thermodynamic scale of temperature
3.6. Concept of Entropy
  3.6.1. The evaluation of entropy and changes in reversible and irreversible processes for ideal gases
  3.6.2. Variation of entropy with T and V, T and P & P and V. Entropy change during phase changes
  3.6.3. Clausius inequality
  3.6.4. Entropy as a criterion for thermodynamic equilibrium. Thermodynamics of mixing of gases

UNIT 4 Free energy and work function

4.1. Gibb's function (G) and Helmholtz function (A) as thermodynamic state functions
4.2. Variation of free energy change with temperature and pressure
4.3. A and G as criteria for thermodynamic equilibrium and spontaneity
4.4. Maxwell relations
4.5. Gibbs - Helmholtz equation and its applications
4.6. Free energy changes in chemical reaction
4.7. Van't Hoff Isotherms
4.8. Partial Molar Properties
4.9. Chemical Potential
4.10. Gibbs-Duhem equation

Sem
VI

Chemistry Practical-6

Compulsory

Marks : 70 + 30

Objectives

- Get practical idea about redox titrations
- Can get familiarize with distillation process for binary organic mixture separation
- Can get understanding of instruments such as pH meter, conductometer etc. and their use in water and soil analysis
- Get knowledge of partial molar volume and determination method

Learning Outcomes

Learners will be able to:

- Independently Separate binary organic mixture using distillation process
- Carry out water analysis and soil analysis
- Determine partial molar volume of different solutions
- Develop observation, analytical and time management skills
- Perform Redox titrations accurately

Organic binary mixture separation (Minimum: 6)

To carryout separation of binary organic mixtures {(solid + liquid) & (liquid + liquid)} and qualitative analysis of separated substance. Mixture of following types can be given for separation and identification purpose.

1. Volatile liquid + Solid
2. Non-volatile liquid + Solid
3. Liquid + Liquid

Environmental chemistry (Any Five)

1. Determination of Total Dissolved Solid from given samples
2. Determination of pH in drinking water samples
3. Determination of pH in soil samples
4. Determination of total residual chloride in water samples
5. Determination of ammonia in water samples
6. Determination of free CO2 in water samples

Elective 1 Thermodynamics (Any Five)

1. To determine the heat of solution of the given acid by solubility method
2. To determine partial molar volume of sodium chloride in aqueous solution at room temperature
3. To determine partial molar volume of solute (e.g. KCl) and solvent in binary mixture
4. Determination of the temperature dependence of the solubility of a compound in two solvents having similar intermolecular interactions (benzoic acid in water and in DMSO-water mixture) and calculate the partial molar heat of solution
5. To determine the partial molar volume and the composition of unknown mixture of ethanol and water
6. To determine the partial molar volume and the composition of unknown mixture of methanol and water
7. To determine the solubility and heat of solution of the benzoic acid in toluene

Elective 2 Inorganic Chemistry (Titrimetric Analysis)
Acidimetry and Alkalimetry(Any Two)

1. To determine the strength of NaOH and Na_2CO_3 present in a solution
2. To determine the strength of Na_2CO_3 and $NaHCO_3$ present in a solution
3. To determine the percentage of ammonia in an ammonium salt

Oxidation-reduction (redox) titrations (Any Three)

1. To determine the strength of oxalic acid solution
2. To determine the strength of ferrous ammonium sulphate (Mohr's salt) solution
3. To estimate ferrous (Fe^{+2}) and ferric (Fe^{+3}) ions present in mixture
4. To determine calcium in a calcium chloride solution
5. To determine the strength of ferrous ammonium sulphate solution by using potassium ferricyanide as an external indicator

SEM VI

ENVIRONMENTAL CHEMISTRY

OPTIONAL

MARKS : 70 + 30

Objectives

- To get knowledge of Environment, composition of atmosphere, chemical composition of water bodies
- To get thorough knowledge of pollution and types of pollution
- Conceptualize importance of ozone layer and mechanism of ozone formation and depletion
- To get knowledge of Analytical Methods for Monitoring Air Pollutants

Learning Outcomes

- Learner will get knowledge of Environment, composition of atmosphere, chemical composition of water bodies
- Student will get thorough knowledge of pollution and types of pollution
- Student will get conceptualize importance of ozone layer and mechanism of ozone formation and depletion
- Learner will be able to get knowledge of Analytical Methods for Monitoring Air Pollutants

UNIT 1 Environment

1.1. Composition of atmosphere
1.2. Chemical composition of water bodies (lakes, streams, rivers etc.)
1.3. Hydrological cycle
1.4. Soil composition
1.5. Analytical methods of measuring Dissolve oxygen, Biochemical oxygen demand (BOD), Chemical oxygen demand (COD)
1.6. Analytical examination of sewage and sewage purification
1.7. Pollution due to pesticides, its bio- chemical effects and control

UNIT 2 Pollution

2.1. Air pollution
2.2. Types of air pollution
2.3. Major sources of air pollution
2.4. Air pollution control methods
2.5. Water pollution, Definition
2.6. Classification of water pollution
2.7. Soil pollution
2.8. Source
2.9. Detrimental effect of soil pollutants

UNIT 3 Ozone layer

3.1. The earth's protective umbrella
3.2. Creation of ozone layer
3.3. Mechanism of ozone formation and depletion
3.4. CFC
3.5. Harmful effect of CFC

UNIT 4 Analytical Methods for Monitoring Air Pollutants

4.1. Sampling
4.2. Sampling of Gas and Vapors
4.3. Sampling of Particulates
4.4. Stack sampling
4.5. Monitoring of Air pollutants
4.6. Instrumental techniques for Monitoring Air Pollutants, Monitoring of NOx Monitoring of Hydrogen supplied, Monitoring of Oxidants and Ozone

Sem **VI**

Advanced Inorganic Chemistry-I

Optional

Marks : 70 + 30

Objectives

- Understand the theory of Arrhenius, Bronsted and Lowry, Lewis, Lux flood and solvent system concepts of acids and bases
- Discuss CFT theory in detail
- Understand the color appeared in transition metal complexes
- Describe Magneto-chemistry Origin and type of magnetic behavior shown by transition elements and compounds

Learning Outcomes

- The students will be able to understand the molecular symmetry and point group thoroughly
- The students will be able to understand the crystal field stabilization energy
- The students will be able to explain the color and spectral properties of transition complexes their applications efficiently
- The students will be able to get idea about origin of magnetism in transition metal with potential applications

UNIT 1 Symmetry and Group Theory

1.1. Representation of groups –some properties of matrices & vectors
1.2. The Great orthogonality theorem and its consequences
1.3. Character table
1.4. Wave functions as basis for irreducible representations
1.5. Direct product
1.6. Identifying non zero matrix elements

UNIT 2 Metal- Ligand bonding in transition metal complexes

2.1. Limitations of valence bond theory
2.2. Splitting of d-orbitals in different fields (Octahedral, tetrahedral, tetragonal distorted octahedral, square planner, trigonal bi-pyramidal)
2.3. Crystal field theory (CFT)
2.4. Calculations of crystal field stabilization energy for d^1-d^9 configuration

UNIT 3 Spectral Properties of transition compounds

3.1. Electronic transition in complexes with d1-d9 configuration
3.2. Consequences and applications of orbital splitting
3.3. Magnetic properties
3.4. Factor affecting extent of splitting
3.5. Spectrochemical series
3.6. colour of transition metal complexes in terms of d-orbital splitting

UNIT 4 Magneto Chemistry

4.1. Origin and type of magnetic behavior shown by transition elements and compounds
4.2. Magnetic susceptibility
4.3. Gouy's methods for measuring magnetic susceptibility
4.4. Application of magnetic susceptibility measurement to first row metal complexes
4.5. Qualitative idea of orbital contribution and abnormal magnetic moments

BOTANY

Sem VI

Biochemistry And Enzymology

Compulsory

Marks : 70 + 30

OBJECTIVE

- To enable students to understand structure, classification and function of biomolecules.

LEARNING OUTCOMES

On completion of the paper, students are able to:

- Understand the Biochemical nature of cell
- Know the chemical nature of biomolecules
- Understand the different types of interaction in Biomolecules
- Structure and general features of enzymes
- Concept of enzyme activity and enzyme inhibition

UNIT 1 INTRODUCTORY BIOCHEMISTRY

1.1 Introduction to Biochemistry
1.2 Cells: The Bio of Biochemistry
1.3 Structure and Properties of Water
1.4 Chemical bonding: Types and characteristics
1.5 pH and Buffer
1.6 Protoplasm as a colloidal system

UNIT 2 CARBOHYDRATES AND LIPIDS

2.1 Definition, Nomenclature and classification of carbohydrates
2.2 Monosaccharides, Oligosaccharides, Polysaccharides
2.3 Biological role of carbohydrates
2.4 Fatty acids: Structure and Types
2.5 General Properties
2.6 Waxes
2.7 Biological role of Lipids

UNIT 3 PROTEIN AND NUCLEIC ACID

3.1 Amino acids
3.2 Protein: Peptide bond formation and Structural configuration
3.3 Classification of proteins
3.4 Biological role of proteins
3.5 Nucleosides and nucleotides
3.6 Structure of nucleic acids (DNA and RNA)

UNIT 4 ENZYMES

4.1 Definition
4.2 Nomenclature and classification of enzymes
4.3 Chemical nature of enzymes
4.4 Properties of enzymes
4.5 Mechanism of enzyme action
4.6 Factors affecting enzyme activity: Km, Vmax and MM Equation

Sem
VI

Plant Physiology And Metabolism

Compulsory

Marks : 70 + 30

OBJECTIVE

- To enable students to know photochemical metabolic activities of plants. Students will have in depth understanding of physical and chemical phenomenon of plant body.

LEARNING OUTCOMES

After successfully completing this paper, students will be able to:

- Define plant physiological concepts and biochemical terms.
- Explanation of the physiological processes like photosynthesis, respiration, transpiration and vernalization
- Demonstrate various physiological and metabolic pathways in plant.
- Learn about the movement of sap and absorption of water in plant body

UNIT 1 PLANT-WATER RELATIONS

1.1 Physical properties of water, Importance of water to plant life
1.2 Ion Uptake
1.3 Diffusion, imbibition and osmosis; concept & components of Water potential
1.4 Absorption and transport of water (Ascent of sap)
1.5 Transpiration –Definition, types of transpiration, structure and opening and closing mechanism of stomata.

UNIT 2 PHOTOSYNTHESIS

2.1 Photosynthetic Pigments (Chl a, b, xanthophylls, carotene)
2.2 Photosystem I and II, reaction center, antenna molecules
2.3 Electron transport and mechanism of ATP synthesis
2.4 C3, C4 and CAM pathways of Carbon fixation

UNIT 3 RESPIRATION

3.1 Glycolysis (EMP) and its significance
3.2 TCA Cycle and its significance, Calculation of ATP
3.3 ETS in Mitochondria: Carriers and Complexes
3.4 Pentose phosphate pathway (HMP Shunt) and Glyoxylate Cycle

UNIT 4 PHOTOMORPHOGENESIS

4.1 Photoperiodism (SDP, LDP, Day Neutral plants)
4.2 Phytochrome, Cryptochrome and Phototropins
4.3 Red and far red light responses on photo morphogenesis
4.4 Vernalization: role of low temperature in flowering

Sem
VI

Practicals In Plant Science 6

Compulsory

Marks : 70 + 30

Objectives

- To get training of conducting of experiments of different types of solutions.
- To get training of conducting of experiments of different types of buffers.
- To get training of quantitative and qualitative tests of protein, carbohydrates and lipid.

Learning Outcomes

- Learners will be able to:
- Develop skill of quantitative analysis of protein, carbohydrates and lipid.
- Develop skill of qualitative analysis of protein, carbohydrates and lipid.
- Develop a skill of identifying enzyme activities.
- Develop a skill of dissecting out stomata from different types of leaves.
- Develop a skill of identifying various types of dicot stomata.

List of Experiments

BIOCHEMISTRY AND ENZYMOLOGY

1. Measurement of pH of different samples using pH paper, pH meter and universal indicator
2. Preparation of solutions and buffers
3. Qualitative determination of carbohydrates from plant material
4. Detection of the nature of carbohydrate – glucose, fructose , sucrose and starch from laboratory samples
5. Estimation of glucose by Benedicts quantitative reagent.
6. Qualitative determination of proteins from plant material
7. Separation of amino acids in a mixture by paper chromatography & their identification by comparison with standard Rf value
8. Test for the presence of fats from oil seeds.
9. Demonstrate the activity of catalase and study the effect of pH and enzyme concentration

PLANT PHYSIOLOGY AND METABOLISM

1. Demonstration of imbibition
2. To determine the water potential of given tissue (Any tuber)
3. Study of tissue water potential through potato
4. To study of transpiration in leaves.
5. To study the evolution of oxygen during photosynthesis in aquatic plants
6. Estimation of chlorophyll-a and chlorophyll-b by spectrometric or colorimetric method
7. To demonstrate the phenomenon of plasmolysis.
8. To demonstrate that Xylem is the Path of Conduction of Water
9. Measurement of stomata index on leaf.
10. To study impact of light on seed germination and plant growth.

PLANT PATHOLOGY

1. To study different symptoms observed in surrounding plants.
2. To study Classification of plant diseases
3. To study Disease triangle

4. To study Disease cycle
5. Study of symptoms of white rust of crucifers
6. Study of symptoms of covered smut of Barley
7. Study the symptoms of citrus canker
8. Study of symptoms of black stem rust of wheat
9. Study of symptoms of tikka disease
10. Powdery mildew of grapevine
11. Seed moisture testing by hot air oven method.

ECONOMIC BOTANY

1. To study spices: Cardamom, Cinnamon and Turmeric.
2. To study dye yielding plants: Henna, Indigo and Bixa.
3. To study cereals: Wheat, Rice and Maize.
4. To study pulses: Pigeon pea, Green gram and Chick pea.
5. To study oil yielding plants: Sesame, Ground nut and Castor.
6. To study Beverages: Tea and Coffee.
7. To study medicinal plants: Ashwagandha, Rauvolfia serpentina and Adhatoda vasica.
8. To study fiber yielding plants: Jute, Cotton and Coconut

Sem **VI**

Plant Pathology

Optional

Marks : 70 + 30

OBJECTIVE

- To enable students to understand the symptoms, disease development mechanism and pest control.

LEARNING OUTCOMES

After completion of this paper students will be able to

- Understand the process of disease development
- Interrelation of pathogen, host and environment
- Identify the disease symptoms
- Understand the seed health and learn the seed health analysis
- Define terminologies related plant diseases
- The economic importance of plant diseases
- Host-parasite interaction
- Control measures for plant diseases

UNIT 1 PRINCIPLES OF PLANT PATHOLOGY

1.1 Importance, definitions and concepts of plant diseases
1.2 Classification of Disease
1.3 Disease triangle
1.4 Disease Cycle
1.5 Host Parasite relationship

UNIT 2 PRINCIPLES OF PLANT DISEASE MANAGEMENT

2.1 Biological and chemical disease management.
2.2 Foliage, seed and soil application of chemicals spreaders and other adjuvants.
2.3 Fungicides, bactericides, antibiotics,
2.4 Importance of remote sensing in disease management

UNIT 3 SEED HEALTH TECHNOLOGY

3.1 Role of Weather and Soil fertility on disease development.
3.2 Seed certification and tolerance limits, types of losses caused by seed-borne diseases
3.3 Seed health testing
3.4 Methods for detecting microorganism.

UNIT 4 IMPORTANT DISEASES

4.1 White rust of crucifers
4.2 Powdery mildew of grapes
4.3 Wheat rust
4.4 Citrus canker
4.5 Corn smut

Sem
VI

Economic Botany

Optional

Marks : 70 + 30

Objectives

- To learn the diverse human uses of plants and plant products.
- To learn the taxonomic diversity of useful plants.
- To learn the biological reasons why certain plant resources are important.
- To acquire an increased awareness and appreciation of plants and plant products encountered in everyday life.
- To recognize geographic, historical, & cultural differences in the uses and importance of plants.

LEARNING OUTCOMES

- After successfully completing this paper, students will be able to:
- Identify the economically important crops of India
- Define concept and scope of economic botany.
- To detect adulteration, methods of extraction and evaluation.
- Discuss the process of cultivation, collection and processing of herbal drugs.

UNIT 1 SPICES AND DYE YIELDING PLANTS

Scientific Name, Cultivation and Economic importance and medicinal value of following

1.1 Spices

1.1.1 Elettaria cadamomum
1.1.2 Cinnamomum verum
1.1.3 Curcuma longa

1.2 Dye Yielding Plant

1.2.1 Lawsonia inermis
1.2.2 Indigofera tinctoria
1.2.3 Bixa orellana

UNIT 2 CEREALS AND PULSES (LEGUMES)

Scientific Name, Cultivation and Economic importance of following

2.1 Cereals

2.1.1 wheat- Triticum aestivum
2.1.2 Rice – Oryza sativa
2.1.3 Maize- Zea mays

2.2 Pulses

2.2.1 Pigeon pea- Cajanus cajan
2.2.2 Green gram- Vigna radiata
2.2.3 Chick pea- Cicer arietivum

UNIT 3 OIL AND BEVERAGES

Scientific Name, Extraction and Economic importance of following

3.1 Oil

3.1.1 Sesame –Sesanum indicum
3.1.2 Ground nut- Arachis hypogaea

3.1.3 Castor –Ricinus communis

3.2 Beverages

3.2.1 Tea- Camellia sinensis

3.2.2 Coffee - Coffea specis.

UNIT 4 MEDICINAL PLANTS AND FIBRES

4.1 Medicinal plants

4.1.1 Ashwagandha- Withania somnifera

4.1.2 Serpgandha- Rauvolfia serpentina

4.1.3 Ardusi - Adhatoda vasica

4.2 Fibres

4.2.1 Jute- Chorchorus species

4.2.2 Cotton- Gossypium species

4.2.3 Coconut- Cocos nucifera

Semester VII

SEMESTER VII

			Total Papers	Credit	Hours	Internal	External	Total
Education	Education	Theory	1	3	45	30	70	100
	Education (EPC)	Practical	1	1	30	15	35	50
	Education (EPC)	Practical	1	1	30	15	35	50
	Internship	Practical	1	7	210	200	00	200
B.Sc (Science)	Principal	Theory/Practical	4 (3+1)	12	225	120	280	400
		Total	**8**	**24**	**540**	**380**	**420**	**800**

Sr. No.	**Subject**	**Title of the paper**	**T/P**	**Nature**	**Credit**	**Hours**	**Internal**	**External**	**Total**
1	Education	Inclusive Education	Theory	Compulsory	3	45	30	70	100
2	Education	Reflective Reading	Practical	Compulsory	1	30	15	35	50
3	Education	Art in Education	Practical	Compulsory	1	30	15	35	50
4	Education	Internship	Practical	Compulsory	7	210	200	00	200
5	Mathematics	Mathematical Analysis-II	Theory	Compulsory	3	45	30	70	100
6	Mathematics	Abstract Algebra-II	Theory	Compulsory	3	45	30	70	100
7	Mathematics	Practical: Mathematical Analysis-II & Abstract Algebra-II	Practical	Compulsory	3	90	30	70	100
8	Mathematics	Mathematical Modeling	Theory	Optional	3	45	30	70	100
9	Mathematics	Transform Theory	Theory	Optional	3	45	30	70	100
10	Physics	Mathematical Physics	Theory	Compulsory	3	45	30	70	100
11	Physics	Solid State and Digital Electronics	Theory	Compulsory	3	45	30	70	100
12	Physics	Physics Practical VII	Practical	Compulsory	3	90	30	70	100
13	Physics	Applied Crystallography and Bio Physics	Theory	Optional	3	45	30	70	100
14	Physics	Astronomy and Astrophysics	Theory	Optional	3	45	30	70	100
15	Chemistry	Heterocyclic and Organometallic Chemistry	Theory	Compulsory	3	45	30	70	100
16	Chemistry	Separation Techniques	Theory	Compulsory	3	45	30	70	100
17	Chemistry	Chemistry Practical-7	Practical	Compulsory	3	90	30	70	100
18	Chemistry	Industrial Chemistry-I	Theory	Optional	3	45	30	70	100
19	Chemistry	Advanced Inorganic Chemistry-II	Theory	Optional	3	45	30	70	100
20	Botany	Genetics and Evolution	Theory	Compulsory	3	45	30	70	100
21	Botany	Plant Ecology	Theory	Compulsory	3	45	30	70	100
22	Botany	Practicals in Plant Science II	Practical	Compulsory	3	90	30	70	100
23	Botany	Horticulture	Theory	Optional	3	45	30	70	100
24	Botany	Environmental Biology	Theory	Optional	3	45	30	70	100
25	Zoology	Animal Husbandary	Theory	Compulsory	3	45	30	70	100
26	Zoology	Wildlife and Conservation Biology	Theory	Compulsory	3	45	30	70	100
27	Zoology	Practicals in Zoology -7	Practical	Compulsory	3	90	30	70	100
28	Zoology	Ecology and Environmental Science	Theory	Optional	3	45	30	70	100
29	Zoology	Fisheries and Marine biology	Theory	Optional	3	45	30	70	100

Any one subjects of Science (Mathematics, Physics, Chemistry and Botany) will have to be opted by the student.

EDUCATION

Sem

VII

CuS 3 : Inclusive Education

Compulsory

Marks : 70 + 30

Objectives

To enable the prospective teachers

- to understand concept of Inclusive Education
- to develop competencies for understanding disabilities
- to acquaint and understand instructional strategies for inclusive education
- to develop knowledge about policies and framework for inclusive education

Unit 1 Introduction of Inclusive Education

1.1 Inclusive education: Meaning, concept and needs
1.2 History of inclusion –paradigm shift from segregation to inclusion
1.3 Social Inclusion: Meaning, Concept and needs
1.4 Principles of Inclusive Education: Access, Equity, Relevance, Participation & Empowerment

Unit 2 Understanding to Disabilities

2.1 Introduction to Neuro-Developmental Disabilities (SLD, ID, ASD)
2.2 Introduction to Sensory Disabilities (HI, VI, Deafblind)
2.3 Introduction to Physical Disabilities (CP and Locomotor disabilities)
2.4 Introduction to other disabilities as per the RPwD Act-2016

Unit 3 Instruction strategies for Inclusive Education

3.1 Definition and concept of Adaptation, Accommodation and Modification
3.2 Universal Design for Learning (UDL)
3.3 Differentiated Instruction for Person with Disabilities
3.3 ICT for Instructions

Unit 4 Policies and Framework Facilitating Inclusive Education

4.1 Rehabilitation Council of India Act 1992
4.2 Rights of Person with Disabilities 2016
4.3 National Trust Act-1999
4.4 State and Central Government Provisions for Inclusive education

Sem

VII

EPC 1 : Reflective Reading

Compulsory

Marks : 35 + 15

Objectives

To enable the prospective teachers

- to identify and relate to the context and diversity exhibited in the text book
- develop skill of interpretation and reflection in relation with the text
- to relate to the purpose of conducting various microteaching, curricular and co-curricular activities
- to develop skills and ability to reflect in action and on action

Section A : Context And Diversity In Text

(This section foCuS on developing the reading and comprehending ability of the teacher trainee with reference to text and develop skills for verbally, visually kinesthetically reflecting on the same.)

1.1 Conceptual Understanding: Text, Diversity, Context, Comprehension, Reading Strategies

1.2 Davis's nine potential component skills of comprehension

1.Word meanings 2. Word meanings in context 3. Follow passage organization 4. Main thought 5. Answer specific text-based questions 6. Text-based questions with paraphrase 7. Draw inferences about content 8. Literary devices 9. Author's purpose.

1.3 Reading Strategies-Previewing, Skimming, Scanning, Inferring, Reflecting, Predicting, Paraphrasing and Expansion of ideas

Section B : Reflections On Curricuular Practices

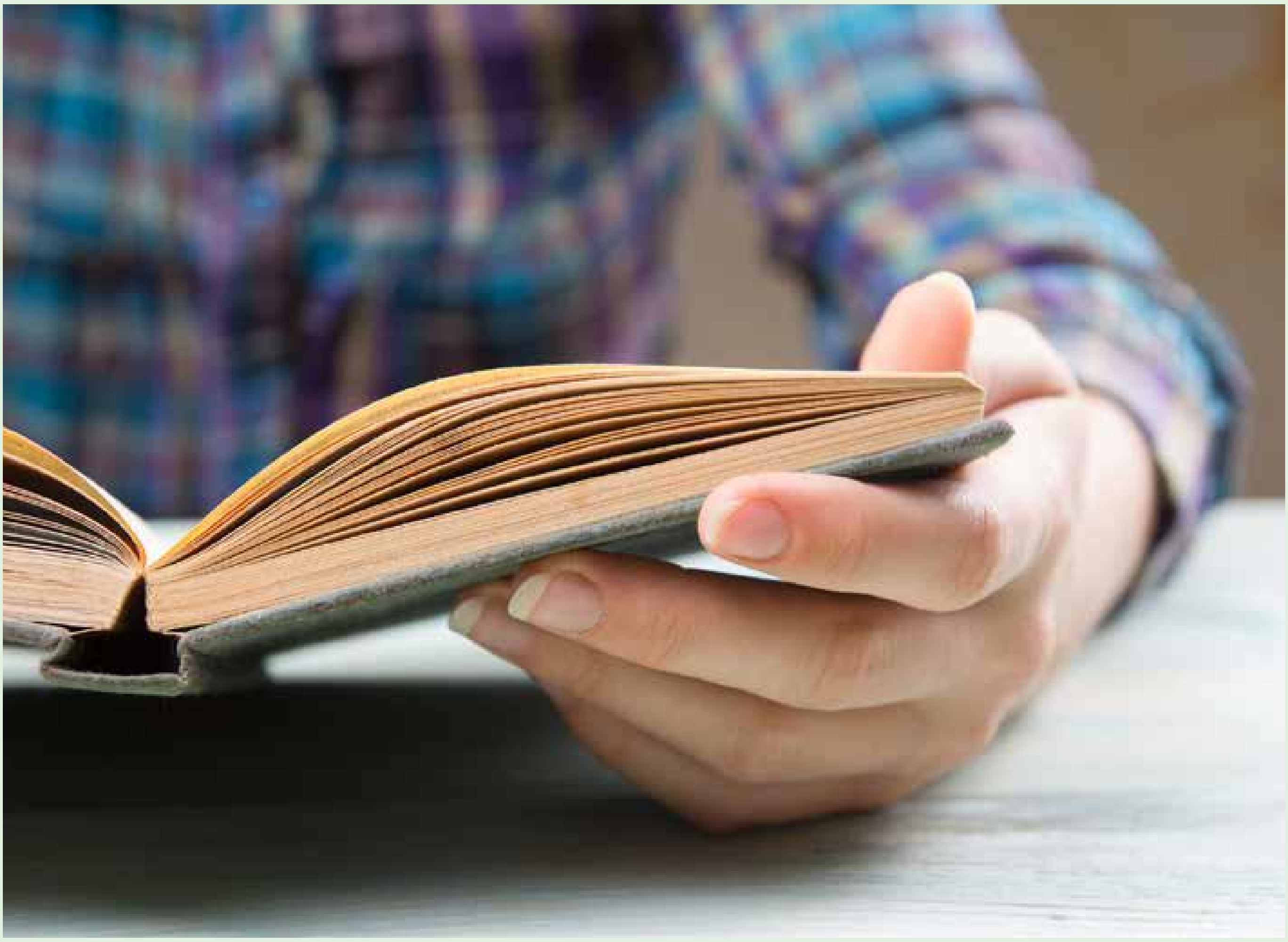
(This section focuS on providing opportunities of reflection to teacher trainee with reference to curricular practices and school internship activities and develop skills for verbally, visually kinesthetically reflecting on the same.)

2.1 Conceptual Understanding: Reflective learning, Reflective Diary, stages of reflection

2.2 Reflection in action, reflection on action –Donald Schon

Activities for Section A :

1. Select a text (at least a lesson of 4-5 pages) from the text book of your choice. Identify the context, diversity and values inherent in the text. State the authors purpose of the text and Reflect upon your understanding for the same.
2. Select a text (at least a lesson of 4-5 pages) from the text book of your choice. Paraphrase the text and redesign the pages of the text in creative ways.
3. Narrate a story with true events (a current news piece from newspaper related to current events or any incidence can be selected). Re-telling the account - in one 's own words/ reflect your views / allow different viewpoints to be presented. from different points of view (taking turns in a smaller group)
4. Select a text from school text book which describes an event /case study/narration etc. Identify the cultural/social/gender relations prevalent during the describe period and present it in audio/visual/ audio-visual form other than the text.
5. Select an event based text from school text book and elaborate on the history before the events listed in the book. Identify the cultural/gender/social biases/thoughts/ideas inherent during the given period. Present it in audio/visual/audio-visual form other than the text.



Activities for Section B :

1. Select a text analyses the structure of the article, identifying sub-headings, key words, sequencing of ideas, use of concrete details, illustrations and/or statistical representations (guided working in pairs)

2. Reflect upon your experiences that helped you in transforming the theory taught to you and practice that you adopted related with microteaching skills

3. Select an event related to microteaching and reflect upon the experiences of preparing and presenting the skill and the process of thinking at the time of teaching

4. Select an event related to any curricular or co- curricular activity in which you have participated. List down the sequence of the events and elaborate at least one / two events during the process which might have weakened / strengthen/ changed changed your thoughts/ attitudes

5. Researching and select an article of your choice. Research on the chain of events and develop a journal related to the event

Note: Trainees will select one activity from each unit for submission BUT for better exposure minimum three activities from each unit will be carried out at institutional level.

Sem

VII

EPC 2 : Art in Education

Compulsory

Marks : 35 + 15

Objectives

To enable the prospective teachers

- to identify and relate to the components related to music, fine arts, dance and drama inherent in the school curriculum
- to develop skills of identifying and appreciating values related to music, fine arts, dance and drama in the school textbooks
- to relate the textbooks to the purpose of conducting various celebrations in the form of curricular and co-curricular activities through the various forms of art
- to develop skills and abilities to identify art in the curriculum and relate it to the day-to-day teaching and learning and lifelong learning

Section A : Music and Fine Arts in Education (Conceptual Understanding)

1.1 Fine Arts : Elements (Line, form, tone, shape, color, texture) and its various expres sions (Drawing, Painting, Poster Making, Collage, Rangoli, Clay Modeling etc.)

1.2 Music (Sanskrit Hymns, Shlokas, Stotras, Prayers, Patriotic Songs, Folk Songs, Light Vocals)

Section B : Dance and Drama in Education (Conceptual Understanding)

2.1 Dance: Taal, Laya, Matra, Sam, Tali, Khali and Avartan with example of different Taals. Writing of Taals, Folk, Traditional and Regional Dances, Classical dance forms

2.2 Drama : Theatre, Mono Acting, Mimicry, Skit, One Act Play, Mime, Dialogues and Dialogue Delivery

Activity of Section A

Music

1. Select a text from your textbooks and identify any Sanskrit Hymns, Shloks, Stotra, Prayers, Patriotic Songs, Folk Songs, Light Vocal with which you can present the content or the text in a better way. Prepare a report with guidelines for the teacher showing the process
2. Select a concept or text from your textbook. Develop Sanskrit Hymns/ Shloks/ Stotra / Prayer/ Patriotic Song / small poems for teaching the concept. Prepare a detailed report
3. Find out a text or a topic related to any folk song pertaining to any region. Learn how to perform it in the classroom for the better understanding of the topic. How will you relate it and explain it? Prepare a detailed report
4. Find out a song related to Bhakti Sangeet of India pertaining to any religion that is related to one or more topics of any textbooks. Learn to sing it appropriately in the classroom and relate it to disCuSs your topic. Prepare a detailed report
5. Can music be used to teach science and mathematics? If yes, how? Find out the ways and sources. Prepare or create your own poem, song or instrumental tune and perform before your teacher educators and teacher trainees. Prepare a detailed report of the project

Fine Arts

1. Select a concept or topic from the school textbooks and prepare a drawing or painting Prepare an outline of how to use that in the teaching of that topic in the class. Perform it and Prepare a report
2. Select a concept or topic related to raising social awareness regarding any social or national or global issue from the school textbooks and prepare a poster. Prepare an outline of how to use that in the teaching of that topic in the class. Perform it and Prepare a report

Sem VII

SI 3 : Internship

Compulsory

Marks : 200

Objectives

To enable the prospective teachers

- to develop ability to handle school activities independently
- to develop the proficiency in imparting lessons
- to develop the proficiency in conducting curricular and co-curricular activities
- to develop the ability to analyze and review books and literary texts
- to develop skills for identifying problem and conducting action research
- to develop the ability to report the administrative and management system of school
- to develop the ability to reflect on their daily routine in schools

Type of Activity	Credit	Hrs.	Lessons		Total	Marks		
			M1	M2		Int.	Ext.	Total
Lessons	5	150	4	4	8	80		80
Curricular and Co-Curricular Activities			Participation in school activities and completing all work assigned by Intern school			20		20
Submissions	2	60	Book Review			20		20
			Action Research in Intern School			20		20
			Case Study			20		20
			Report on Administration and Management of School			20		20
			Reflective Journal			20		20
			Total			**200**		**200**

MATHEMATICS

Sem
VII

Mathematatical Analysis-II

COMPULSORY

Marks : 70 + 30

Objectives

- To understand the geometric interpretation of integrable functions.
- To develop the skills of checking the convergence of series, absolute and conditionally convergent series.
- To acquire the knowledge of uniform convergence of sequence and series of function.
- To apply the knowledge of radius of convergence of series of a function.

Learning Outcomes

This course will enable students to:

- Find Riemann integrable function
- Test absolute convergence of sequence and series of a function
- Solve example using Dirichlet's and Abel's test.
- Know pointwise and uniform convergence of sequence and series of a function.

Unit 1 The Riemann Integral

1.1 Lower and upper Riemann sum
1.2 Definition and examples of Riemann integration
1.3 Properties and some results on it
1.4 Riemann integrable functions, the fundamental theorem of calculus

Unit 2 Infinite Series

2.1 Convergent series
2.2 Tests for absolute convergence
2.3 Limit comparison test, root test, ratio test, the integral
2.4 Absolute convergent and conditionally convergent series

Unit 3 Infinite Series contd.

3.1 Rearrangements of series
3.2 Multiplication of series
3.3 Tests for nonabsolute convergence, alternating series, alternating series test
3.4 Dirichlet's test, Abel's test

Unit 4 Uniform Convergence

4.1 Pointwise convergence, Uniform convergence, Cauchy criterion, Weierstrass
4.2 M-test, M_n test
4.3 Uniform convergence and continuity, uniform convergence and differentiation and integration
4.4 Power series, radius of convergence

Sem
VII

Abstract Algebra-II

COMPULSORY

Marks : 70 + 30

Objectives

- To Understand the concept of ring theory.
- To Develop the skills of calculation and Identifying ring and field.
- To acquire the Knowledge of polynomial ring
- To Apply the knowledge of maximal and prime ideals.

Learning Outcomes

This course will enable students to:

- Find characteristics of ring
- Find homomorphism and isomorphism of ring.
- Evaluate irreducibility using Eisenstein's criterion.
- Know concept of extension field.

Unit 1 Rings

1.1 Basic Concepts- Definition, Properties and Examples
1.2 Commutative ring, division ring, unity and unit element of ring
1.3 Boolean ring and finite ring
1.4 Integral domain, zero divisor, definition and example of finite and infinite order integral domain, characteristic of ring

Unit 2 Subrings

2.1 Definition and Examples of subrings, necessary and sufficient condition for subring
2.2 Ideals, necessary and sufficient condition for ideal, principal ideal ring, Quotient ring and its operation tables
2.3 Homomorphism: definition and examples, kernel of homomorphism, isomorphism of rings,
2.4 Fundamental theorem on homomorphism

Unit 3 Polynomial Ring

3.1 Basic Concepts- Definition, Properties and Examples, degree of polynomial, Types of polynomials & Various operations between polynomials
3.2 Factorization of polynomials. Division algorithm and theorems on polynomials
3.3 Irreducibility of polynomials over field, remainder and factor theorem, solution of polynomial equation
3.4 Eisenstein's criterion for irreducibility

Unit 4 Fields

4.1 Basic Concepts- Definition
4.2 Subfield, Prime field, extension field
4.3 Maximal ideals
4.4 Prime ideals & their properties

Sem
VII

Practical: Mathematical Analysis-Ii & Abstract Algebra-II

COMPULSORY

Marks : 70 + 30

Objectives

- To understand the geometric interpretation of integrable functions.
- To develop the skills of checking the convergence of series, absolute and conditionally convergent series.
- To acquire the Knowledge of polynomial ring
- To Apply the knowledge of maximal and prime ideals.

Learning Outcomes

- Evaluate upper and lower Riemann sum
- Check the uniform convergence of a sequence and series of a function
- Find g.c.d of the polynomials
- Check the irreducibility of polynomial over the given field

List of Practical's (Problems)

1. Definition and evaluation of Riemann integrals by various methods
2. Verifying MVTs and problems based on Fundamental Theorem of Integration
3. Convergence of infinite series of positive terms
4. Absolute convergence, root and ratio tests using limit inferior and superior
5. Power series solutions of differential equations
6. Verification of Rings, Commutative ring and ring with unity.
7. Examples of Ideals and Integral Domain.
8. Find the g.c.d. of two given polynomials and express it as a linear combination of these two polynomials.
9. Check the irreducibility of polynomial over the given field (By different methods)
10. Example of Maximal and prime ideal

Sem
VII

Mathematical Modeling

OPTIONAL

Marks : 70 + 30

Objectives

- To introduce the students to the exciting world of Mathematical Modeling and their applications.
- To understand the basics of mathematical modeling.
- To develop the skills of formulation and analysis of various models.
- To apply the knowledge of mathematical modeling to any real-time problem

Learning Outcomes

This course will enable students to:

- Know the geometrical interpretation of logistic growth function.
- Know SI model, SIS model with constant coefficient
- Learn Age-Scale population models
- Know Single-species population models – non-age structured.

Unit 1 Introduction to the subject:

1.1 Its scope and limitation, classification of models. Dimensional Homogeneity
1.2 Technique of dimensional analysis, an arithmetic model of Gravity
1.3 Simple population growth model
1.4 Logistic population growth model, Geometric interpretation of logistic growth function

Unit 2 Mathematical Models in epidemiology:

2.1 Basic concepts, SI model, SIS model with constant coefficient,
2.2 SIS model with coefficient as a function of time t
2.3 SIS model with constant number of carriers
2.4 SIS model when the carriers is a function of time t, SIR model, Epidemics with vaccination

Unit 3 Single-species population models– Age structured:

3.1 Continuous-time continuous-Age-Scale population models
3.2 Lotka's model for population growth
3.3 Discrete-Time Discrete Age-Scale population model, Bernardelli, Lewis and Leslie (BLL) model
3.4 Density Dependence model, Two-sec models, Continuous-time Discrete-Age population model

Unit 4 Single-species population models – non-age structured:

4.1 Exponential Growth model, its formulation, solution and interpretation
4.2 Effects of immigration and Emigration on population
4.3 Logistic Growth model, its formulation
4.4 Solution and interpretation.

Sem
VII

Transform Theory

OPTIONAL

Marks : 70 + 30

Objectives

- To Understand the concept of Laplace Transform, Fourier Transform & Fourier Series.
- To Develop the skills of calculation various transforms and obtaining Fourier Series.
- To acquire the Knowledge of Integral Transform.
- To Apply the knowledge of Integral Transform for any real time problem.

Learning Outcomes

This course will enable students to:

- Find Laplace transform of an elementary function.
- Evaluate Inverse Laplace transform using convolution theorem.
- Find the Fourier series of the periodic function
- Evaluate Fourier Cosine and Sine transform.

Unit 1 Laplace Transform

1.1 Definition of Laplace transform, Elementary properties of Laplace transform, Linearity Property
1.2 Transforms of derivatives and integrals, Unit step function
1.3 Shifting theorem
1.4 Laplace transform of periodic function

Unit 2 Inverse Laplace Transform

2.1 Definition and properties of inverse Laplace transform
2.2 Direc's delta function, Differentiation and integration of inverse Laplace transform
2.3 Convolution and integral equations, Partial fraction, Shifting theorem of inverse Laplace transform
2.4 Application of Laplace transform to solve differential equations

Unit 3 Fourier series

3.1 Basic concepts: Definition, Dirichlet condition
3.2 Fourier series of 2π periodic function
3.3 Even and odd function, Fourier series of an even and odd functions, Fourier series of discontinuous function
3.4 Half range Fourier Cosine and Sine series

Unit 4 Fourier Transform

4.1 Basic concepts: Definition
4.2 Examples and properties
4.3 Shifting theorem
4.4 Convolution theorem

PHYSICS

Sem **VII**

Mathematical Physics

Core Compulsory

Marks : 70 + 30

Objectives

- To have concept of matrix and differential equations in solving physical problems.
- To have knowledge of different special functions, Legendre, Hermite and Bessel.
- To provide the basic definition and applications of Beta, Gamma and harmonic functions to solve physical problems
- To train the students in the applications of Fourier series for solving certain special classes of physical problems.

Learning Outcomes

After learning this course, students will be able to:

- Inculcate necessary skills to solve problems of interest, seen and unseen, to physicists.
- Have a grasp in various mathematical techniques necessary for solving physical problems like matrices, differential equations, Special Functions and Fourier series.

UNIT 1

1.1 Matrices, Addition and Multiplication of Matrices: Types of Matrices, Transpose of a Matrix. Symmetric and Skew-Symmetric Matrices. Conjugate of a Matrix. Hermitian and Skew-Hermitian Matrices. Singular and Non-Singular matrices. Orthogonal and Unitary Matrices. Trace of a Matrix.

1.2 Eigen-values and Eigenvectors: Finding Eigen values and Eigen vectors of a Matrix, Diagonalization of Matrices, Properties of Eigen-values and Eigen Vectors of Orthogonal, Hermitian and Unitary Matrices, Cayley-Hamilton Theorem, Finding inverse of a matrix using Cayley-Hamilton Theorem, Solutions of ordinary second order differential equations and Coupled Linear Ordinary Differential Equations of first order, Functions of a Matrix.

UNIT 2

2.1 First Order Differential equations: Separation of variables, homogeneous, non-homogeneous, exact and inexact differential equations and Integrating Factor.

2.2 Second Order Differential equations: Equations with constant coefficients. Wronskian and general solution. Particular Integral with operator method, method of undetermined coefficients and variation method of parameters. Euler differential equation and simultaneous differential equations of First and Second order.

2.3 Partial Differential Equation: Solutions to partial differential equations using separation of variables, Laplace's Equation in problems of rectangular geometry, Solution of wave equation for vibrational modes of a stretched string, rectangular and circular membranes, Solution of 1D heat flow equation, Green Function method.

UNIT 3

3.1 Special Functions: Legendre, Bessel, Hermite and Laguerre Differential Equations, Properties of Legendre Polynomials, Rodrigues Formula, Generating Function, Orthogonality. Simple recurrence relations, Expansion of function in a series of Legendre Polynomials, Bessel Functions of the First Kind, Generating Function, simple recurrence relations, Zeros of Bessel Functions (Jo(x) and J1(x)) and Orthogonality.

3.2 Special Integrals: Beta and Gamma Functions and Relation between them. Expression of Integrals in terms of Gamma Functions, Dirac Delta Function, Henkel Function, and Neumann Function.

UNIT 4

4.1 Fourier series: Periodic functions, Orthogonality of sine and cosine functions, Dirichlet Conditions (Statement only), Expansion of periodic functions in a series of sine and cosine functions and determination of Fourier coefficients, Even and odd functions and their Fourier expansions. Application, Summing of Infinite Series, Parseval Identity and its application to summation of infinite series

Sem

VII

Solid State And Digital Electronics

Core Compulsory

Marks : 70 + 30

Objectives

- This paper aims to cover the basic digital solid state electronics.
- The concept of Boolean algebra is discussed in detail and arithmetic circuits are described.
- Students will learn concept of switch, multivibrator, and different solid-state electronic circuits.

Learning Outcomes

- Understand the concept of Solid State and Digital Electronics.
- To learn about Solid-State switching Circuit in details.
- Thyristor Devices: Characteristics of different configurations, biasing, stabilization and their applications.
- Differentiating the Analog and Digital circuits, the concepts of number systems like Binary, BCD, Octal and hexadecimal are developed to elaborate and focus on the digital systems.

UNIT 1

1.1 Solid-State Switching Circuit:
Switch- Types of Switch, Switching Transistor, Switching Action, Multivibrator, Types of Multivibrator, Construction and Working of Transistor

1.2 Multivibrators: Astable Multivibrator, Monostable Multivibrator, and Bistable Multivibrator respectively. Differentiating Circuit, R-C Differentiating & Integrating Circuit, Clipping and Clamping Circuits.

UNIT 2

2.1 Thyristor and their applications:
Introduction, Applications, Symbolic representation, Principle and operation of SCR, Two transistor analogy of SCR, Comparison between Thyristor and Transistor, Methods of triggering a thyristor, DIAC, TRIAC, Rectifier circuits using SCR, Solid State Switching Circuits using Thyristor, Choppers (in brief).

UNIT 3

3.1 Digital Electronics: Analog and Digital Signal, Introduction to Number Systems, Decimal to Binary and Binary to Decimal Conversion, Binary Coded Decimal Code,

3.2 Logic Gates: AND, OR and NOT Gates using Diode, NAND & NOR Gate , NAND and NOR Gate as a universal gate, Boolean Algebra and Theorems, De Morgan's Theorems, Simplification of Logic Circuit using Boolean Algebra.

UNIT 4

4.1 Digital logic Modules: Combinational and Sequential logic circuits. Multiplexer and Demultiplexer, Memory element,

4.2 Flip-flop: RS flip-flop, Clocked RS flip-flop, D flip-flop, JK flip-flop, Clocked and 555 Timers (in brief)

Sem

VII

Physics Practical VII

Core Compulsory

Marks : 70 + 30

Objectives

- To learn practically about MOSFET
- To study semiconductors in detail
- To study solar cells

Learning Outcomes

- After learning the course, students will be able to gain practical knowledge about solid state and digital electronics, which would also help them in further study and research.

LIST OF EXPERIMENTS

1. To study the drain characteristics of single Gate MOSFET
2. To study the drain characteristics of dual Gate MOSFET
3. Study of semiconductors (Band gap, Carrier, Mobility)
4. To study the use of MOSFET as an amplifier and to measure the gain in common source configuration
5. To study of flipflop
6. To study the logic gates.
7. Bistable multivibrator using Transistor
8. Astable multivibrator using Transistor
9. To study SCR, DIAC& TRIAC characteristics
10. To Study Analog to Digital (A to D) Converter
11. To Study Hartley oscillator network theorem

Sem
VII

Applied Crystallography And Biophysics

CORE OPTIONAL

Marks : 70 + 30

Objectives

- The main objective of this course is to teach the fundamentals of applied crystallography, and different techniques to grow the crystals of bio molecules and their characterization techniques.

Learning Outcomes

- After learning the course, students will be able to get the idea about the concept of applied physics for this purpose here, to learn about crystallography and bio physics in the context of reserach field also.

UNIT: 1

1.1 X Ray diffraction Method: Laue method, Rotation method, Oscillation method, Weissenberg method, Projection-Spherical, stereographic & gnomonic, Precession method, Debye Scherrer Powder method, Powder diffractometry, Measurement of integrated intensity- factors affecting the intensity of diffraction, Determination of lattice parameter.

UNIT: 2

2.1 Single crystal X-ray diffractometry: Intensity data collection from single crystal specimen, Normalized structure factor – Wilson plot, Primary & secondary extinction, systematic absences and determination of space group from intensity data. Violation of Friedel`s law,

2.2 Fourier method in structure determination: estimation of relative phases. Refinement of molecular structure and interpretation of the results.

UNIT: 3

3.1 Protein – Amino acids: Primary structure and secondary structure of proteins, tertiary structure, quaternary structure. Organization of nucleic acid - Primary, secondary, tertiary structure of DNA, Structure of RNA, Sequencing of nucleic acids, antigens and antibodies. Crystallization of protein – few general methods of crystallization – vapor diffusion and micro techniques.

3.2 Biological applications: Biological applications of delocalization in molecules, radiation damage in biological molecules, ESR studies of Myoglobin and haemoglobin molecules, electronic properties of proteins, enzyme studies, carcinogenic activity, NMR applications: biochemistry, biophysics and in medicine.

UNIT: 4

4.1 Spectroscopic Techniques: Spectroscopic techniques used for studying biological molecules: Light scattering, small angle X-ray scattering, Mass Spectrometry : MALDI-TOF, Ultraviolet/visible spectroscopy, circular dichroism(CD) and optical rotatory dispersion(ORD), fluoroscence spectroscopy, Infrared spectroscopy, Raman spectroscopy.

Sem
VII

Astronomy And Astrophysics

CORE OPTIONAL

Marks : 70 + 30

Objectives

- The main objective of this course is to teach the fundamentals of Astronomy, earth, sun, moon and other planets of the solar system, Instruments used in space measurements.

Learning Outcomes

- After learning the course the student will be able to understand the solar system, sun and the activity on the surface of the sun, its effect on the earth's environment, observational instruments and techniques related to space and astrophysics.

UNIT 1

1.1 Astronomical Instruments: Birth, Life & Death of a Star, Energy generations in the stars, Light and its properties, The Earth's atmosphere and EM radiation, Optical telescopes, Radio telescopes, Hubble Telescope, Astronomical spectrograph, Photographic photometry,

1.2 Astronomical measurements: Stellar magnitude sequence, Absolute magnitude and distance modulus, the bolometric magnitude, Stellar parallax and units of stellar distances, Stellar positions, Stellar motions, The solar motion and the peculiar velocities of stars.

UNIT 2

2.1 The Sun: Sun – a typical star, Photosphere limb darkening, Solar Granulation, Faculae, The Chromosphere, Solar corona, Prominences, The 11 year solar cycle, Solar magnetic fields, Theory of sunspots, Solar flares, Radio emissions from Sun, Solar wind, Solar neutrino puzzle

UNIT 3

3.1 Spectral Classification of Stars: Introduction, Boltzmann's formula, Saha's equation of thermal ionization, Harvard classification – HD catalogue, Luminosity effect on stellar spectra, Importance if ionization theory in Astrophysics, Spectroscopic parallax, The H-R diagram

3.2 Binary and multiple stars: Introduction, Visual binaries, Spectroscopic binaries, Eclipsing binaries, Multiple stars, Origin of binary stars, Stellar masses and mass luminosity relation, Mass transfer in close binary system

UNIT 4

4.1 Our Galaxy: Introduction, Rotation of the galaxy, Determination of rotational parameters in solar neighborhood. Radio observation of galaxy at 21 cm wave length, Rotation curve of the galaxy, Density distribution of gas and spiral structure, Radio and optical data. The general structure of our galaxy, the mass of our galaxy, Magnetic field in our galaxy, Cosmic rays, Continuous radio emission in our galaxy

CHEMISTRY

Sem
VII

Heterocyclic And Organometallic Chemistry

COMPULSORY

Marks : 70 + 30

Objectives

- To develop understanding and importance of heterocyclic compounds
- To get knowledge of preparations of Three and Four-membered heterocyclic
- compounds
- To carry out preparations of five & six-membered heterocyclic compounds
- To understand chemistry of Organometallic compounds and its applications

Learning Outcomes

Learners will be able to:

- Carry out Nomenclature of heterocyclic compounds
- Explain mechanism of preparation of various types of heterocyclic compounds
- Describe chemistry of heterocyclic compounds
- Demonstrate chemistry of Organometallic compounds and its applications in chemical world

UNIT 1 Three and Four membered heterocyclic compounds

1.1. Introduction, Classification and nomenclature of heterocyclic compounds
1.2. Preparation and chemical properties of aziridine
1.3. Formation and properties of oxirane
1.4. Methods for preparation and properties of azetidine
1.5. Preparation and properties of thietane

UNIT 2 Five and six membered heterocyclic compounds

2.1. Introduction
2.2. Classification and nomenclature
2.3. Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine
2.4. Methods of synthesis, chemical reactions with emphasis on mechanism of electrophilic Substitution
2.5. Mechanism of nucleophilic substitution reactions in pyridine. Comparison of basicity of pyridine, piperidine and pyrrole

UNIT 3 Fused Heterocyclic Compounds

3.1. Introduction to fused heterocyclic compounds
3.2. preparation and reactions of indole quinoline and isoquinoline with special reference to Fisher indole synthesis, skraup synthesis and Bischler – Napieralski synthesis
3.3. Mechanism of electrophilic substitution reactions of indole, quinoline and isoquinoline

UNIT 4 Organometallic compounds

4.1. Organomagnesium compounds
4.2. The Grignard reagent – formation, structure and chemical reactions and Applications
4.3. Organozinc compounds: formation and chemical reactions
4.4. Organolithium compounds: formation and chemical reactions

Sem
VII

Separation Techniques

COMPULSORY

Marks : 70 + 30

Objectives

- To know the history and introduction of chromatography
- To have knowledge of different types of chromatography
- To develop understanding of principles and instrumentation of HPLC and GC techniques
- To develop understating of theory and principles of ion exchange chromatography

Learning Outcomes

- Students can learn the basic analytical and technical skills to work effectively in the various fields of chemistry
- Students can define and calculate their mention factor, Rf, and describe how TLC and column chromatography can be used for separation and qualitative analysis
- Students will understand working principles of gas–solid and gas–liquid chromatography instruments and explains how analytical data can be obtained
- How to use gas chromatography–mass spectrometry to find the concentrations and identities of component mixture
- Account for the general features of chromatography systems

UNIT 1 General introduction, classification of chromatographic techniques

1.1. Paper Chromatography: Introduction, Principle, Migration parameters, Types of paper chromatography and experimental techniques, applications
1.2. Thin Layer Chromatography-Introduction, Rf value, Superiority of TLC over other chromatographic techniques, experimental details and applications
1.3. Column Chromatography- Principle, adsorbents used, preparation of column, adsorption, elution and applications

UNIT 2 High performance Liquid Chromatography

2.1. Introduction
2.2. Principle
2.3. Instrumentation
2.4. Mobile phase reservoir
2.5. Pumps
2.6. Columns
2.7. Detectors (UV-visible absorption and Electrochemical)
2.8. NPC Mode and RPC Mode and General applications

UNIT 3 Gas chromatography

3.1. Introduction
3.2. Types of Gas chromatography
3.3. Theory and principle
3.4. Instrumentation: Carrier gas system, Sample injection, Columns, Stationary phase
3.5. Detectors (Flame Ionization, Electron capture and Thermal conductivity)
3.6. General applications

UNIT 4 Ion exchange chromatography

4.1. Introduction
4.2. Principal
4.3. Types of ion exchange chromatography
4.4. Types of resins
4.5. Action of resins
4.6. Experimental techniques
4.7. Separation of metal ions
4.8. Separation of chloride and bromide ions
4.9. Removal of interfering radicals
4.10. Applications

Sem **VII**

Chemistry Practical-7

COMPULSORY

Marks : 70 + 30

Objectives

- Can get understanding and knowledge of steps in organic synthesis
- Can get understanding of various Unit operations in organic synthesis
- Get familiarize with fundamentals of chromatographic process
- Get idea about dyes and preparation of dyes

Learning Outcomes

Learners will be able to:

- Independently synthesize various organic compounds
- Apply their skill in isolation and characterization of Dyes and organic products
- Perform separation of amino acid mixtures through chromatography
- Deal with Inorganic substances qualitatively and quantitatively

Organic synthesis (Any Five)

1. Dibenzal acetone
2. Yaya yara
3. Benzotriazole
4. 2,3 Diphenyl quinoxalines
5. 6-methyl-4-oxo-1,2,3,4-tetrahydro-2-thiopyrimidine
6. Phthalimide
7. Diels alder reaction
8. Benzilic acid

Chromatographic separation (Any Five)

1. Separation and identification of DL-alanine and L-lysine amino acids by paper chromatography
2. Separation and identification of L-leucine and L-alanine amino acids by paper chromatography
3. Separation and identification of L-leucine and glycine amino acids by paper chromatography
4. Separation and identification of sugars (glucose, fructose and sucrose) by paper chromatography
5. Separation and identification of DL-alanine and L-lysine amino acids by thin layer chromatography (TLC)
6. Separation and identification of DL-alanine and L-leucine amino acids by thin layer chromatography (TLC)
7. Separation and identification of mixture of organic compounds
8. Separation of pigments from the extract of spinach leaves by thin layer chromatography (TLC)

Elective 1: Preparation of Dyes (Any Five)

1. Methyl orange
2. Orange-II
3. Methyl Red
4. 1-phenylazo-2 Naphthol
5. Chrysoidine
6. Diazoaminobenzene

Elective 2: Advanced Inorganic Chemistry-II (Any Five)

Argentometric Titrations

1. To determine the strength of a silver nitrate solution by Mohr's method
2. To determine the strength of silver nitrate solution by Volhard's Method

Complexometric Titrations

1. To estimate Calcium with EDTA
2. To estimate Magnesium with EDTA
3. To determine the total, permanent and temporary hardness of water by complexometric titrations

Iodometric Titration

1. To determine the strength of copper sulphate solution Iodometrically
2. To determine the strength of potassium dichromate solution
3. To determine the strength of potassium permanganate solution
4. To estimate percentage of available chlorine in bleaching powder

Sem
VII

Industrial Chemistry-I

Optional

Marks : 70 + 30

Objectives

- To know theory of colour and constitution of dye, classification and types of dye
- To get knowledge of Classification of fertilizers as well as study of raw materials for nitrogenous, Phosphate and potash fertilizers
- To get idea about fuels and explosives

Learning Outcomes

- Student will know theory of colour and constitution of dye, classification and types of dye.
- Learner get knowledge of Classification of fertilizers as well as study of raw materials for nitrogenous, Phosphate and potash fertilizers
- Student will get learn about synthesis and application of fuels and explosives

UNIT 1 : Synthetic dyes

1.1. Colour and constitution [electronic concept]
1.2. Classification of dyes
1.3. Acid Dyes
1.4. Basic dyes
1.5. Direct dyes
1.6. Mordant dyes
1.7. Vat dyes
1.8. Chemistry and synthesis of methyl orange, congo red, malachite green, crystal violet, phenolphthalein, fluorescein, alizarin and indigo dyes

UNIT 2: Fertilizers

2.1. Classification of fertilizers
2.2. Fertility of soil
2.3. pH value of soil
2.4. Natural Organic and Inorganic fertilizers
2.5. Artificial fertilizers
2.6. Study of raw materials for nitrogenous
2.7. Phosphate and potash fertilizers
2.8. Manufacture of calcium ammonium nitrate, urea and ammonium phosphate

UNIT 3 : Fuels

3.1. Introduction
3.2. Classification of fuels
3.3. Criterion of selection of fuels
3.4. Properties of fuels
3.5. Fossil fuels
3.6. solid fuels
3.7. Natural and Artificial solid fuels
3.8. Industrial solid fuels
3.9. Coal, Different kinds, its formation
3.10. Origin of coal, analysis of coal ultimate and proximate analysis

UNIT 4: Explosives

4.1. Introduction of explosives
4.2. Classification
4.3. Characteristics of Explosives
4.4. Synthesis and application of explosives such as Pentaerythritoltetranitrate (PETN), RDX, Nitrocellulose, Nitroglycerine, Dynamite, Gun Powder, TNT and Picric Acid

Sem VII

Advanced Inorganic Chemistry-II

Optional

Marks : 70 + 30

Objectives

- To get knowledge for organometallic compound in the context of inorganic chemistry
- To study thoroughly organometallic reactions and catalyst
- To understand concept and theory of Bioinorganic Chemistry
- To study the polymeric chemistry using inorganic material

Learning outcome

- The students will be able to understand the organometallic compounds and their bonding properties thoroughly
- The students will be able to understand reaction and preparations organometallic compounds with applications efficiently
- The students will be able to understand the role of essential elements in biological processes and their applications
- The students will be able to get idea about inorganic polymers and their structural properties with potential applications

UNIT 1 Organometallic Compounds

1.1. Definition
1.2. Types of organometallic compounds
1.3. Classification
1.4. EAN and nomenclature
1.5. Bonding: metal carbon bonding, metal carbon multiple bonding
1.6. Metal alkyl complexes of group 1, 2 and 13
1.7. Metal olefin complexes and nature of bonding in these complexes

UNIT 2 Organometallic reactions and catalyst

2.1. Preparation and reactions of ferrocene
2.2. Structure of ferrocene
2.3. Preparation and reaction of carbonyl compound of transition elements
2.4. Bonding in linear carbonyls
2.5. Structure of mono and poly nuclear carbonyls
2.6. Organometallic catalysts used in industrial cycles

UNIT 3 Bioinorganic Chemistry

3.1. Essential and trace elements in biological process
3.2. metalloporphyrrinn with special reference to haemoglobin and myoglobin.
3.3. Biological role of alkali and alkaline earth metals ion with reference to K^{+1}& Ca^{+2} and nitrogen fixation

UNIT 4 Inorganic Polymers

4.1. Silicones
4.2. Preparation and properties of silicones
4.3. Nomenclature
4.4. Preparation of silicone products
4.5. Elastomers and their types
4.6. Ring opening reactions of cyclosiloxanes
4.7. Polyphosphazenes

BOTANY

Sem
VII

Genetics And Evolution

Compulsory

Marks : 70 + 30

OBJECTIVE

- To enable students to comprehend the modern concepts and applied aspects of genetics and evolution, to create awareness regarding common hereditary diseases.

LEARNING OUTCOMES

After successfully completing this paper, students will be able to:

- Define the terminologies of Genetics and evolution
- Study of Mendelian Genetics
- Explain the Concept, Characters and Examples of multiple alleles.
- Study of evolution patterns
- Understand the heredity patterns

UNIT 1 CLASSICAL GENETICS

1.1 Gregor Johann Mendel and his contribution
1.2 Monohybrid crosses: Law of Dominance and Law of Segregation
1.3 Dihybrid crosses and Law of Independent assortment
1.4 Modified Mandelian Ratios:Lethal Genes; Co- dominance, Incomplete dominance
1.5 Complimentary and Supplementary genes

UNIT 2 HEREDITY

2.1 Cytoplasmic Inheritance: Shell Coiling in Snail, Kappa particles in Paramecium, leaf variegation in Mirabilis jalapa, Male sterility
2.2 Multiple Allelism
2.3 Chromosomal theory of Inheritance

UNIT 3 SEX DETERMINATION AND GENE EXPRESSION

3.1 Linkage and Crossing over
3.2 Theories of Sex determination
3.3 Physical and Chemical properties of Nucleic Acids
3.4 Central Dogma of Life : Replication, Transcription & Translation

UNIT 4 EVOLUTION

4.1 Origin of Life: Various Theories of Protobiogenesis
4.2 Oparin Haldane Hypothesis, Urey & Miller’s Experiment
4.3 Evolution Theories:Lamarckism, Darwinism, Mutation Theory, NeoDarwinism
4.4 Evidences for Evolution : Morphological, Physiological, Embryological and Paleontological Evidences

Sem
VII

Plant Ecology

Compulsory
Marks : 70 + 30

OBJECTIVE

- To equip students with knowledge of the theories of evolution, ecosystems, habitat and current environmental issues.

LEARNING OUTCOMES

After completion of this paper, students will be able to

- Understand core concepts of biotic and abiotic.
- Understand the Energy Flow
- Analysis the biodiversity pattern
- Evaluate energy sources of ecological system
- Understand and analyze Environmental issue

UNIT 1 ECOLOGICAL FACTORS

1.1 Population Ecology
- 1.1.1 Organism and its environment
- 1.1.2 Abiotic Factors
- 1.1.3 Biotic Factors
- 1.1.4 Adaptation in plants

1.2 Community
- 1.2.1 Habitat and niche
- 1.2.2 Characters: Analytical and synthetic

UNIT 2 ECOSYSTEM

2.1 Ecosystem structure and Function
2.2 Ecosystem types
2.3 Energy flow
2.4 Ecological Pyramids
2.5 Ecological Succession
2.6 Biogeochemical cycle
- 2.6.1 Carbon cycle
- 2.6.2 Nitrogen cycle

UNIT 3 ENVIRONMENTAL ISSUES

3.1 Radioactive waste
3.2 Ozone Depletion
3.3 Deforestation
3.4 Greenhouse effect
3.5 Acid Rain

UNIT 4 SOIL AND WATER

4.1 Soil
- 4.1.1 Classification of soil
- 4.1.2 Soil profile
- 4.1.3 Soil Formation

4.2 Water
4.2.1 Importance: States of water in the environment
4.2.2 Precipitation types (Rain, Fog, Snow, Hail, Dew)
4.2.3 Hydrological Cycle; Water in soil; Water table

Sem VII

Practicals In Plant Science 7

Compulsory

Marks : 70 + 30

Objectives

- To provide comprehensive knowledge to the students regarding modern concepts and applied aspects of genetics and evolution through problem solving approach and create awareness related to several common hereditary diseases.
- To impart detailed understanding of various ecological concepts pertaining to ecosystems, soil properties and community characteristics through practical and demonstration.
- To enable students to understand basics of horticulture and advanced propagation techniques of horticultural crop.
- To equip students to understand the biomes, types of ecosystems and instruments used in environmental monitoring.

Learning Outcomes

After successfully completing paper, students will be able to:

- Explain concept of Mandelian Genetics and solve examples related to incomplete dominance, multiple alleles and epistasis
- Study various patterns of evolution and heredity
- Understand core concepts of abiotic and biotic factors of ecosystem
- Evaluate ecological pyramids and energy flow in ecosystem
- Explain special practices in horticulture and their economic importance
- Describe different methods of plant propagation
- Classify vegetables, fruits, ornamental plants, spices and flowers
- Study fruits and Vegetables production technology
- Apply the techniques of making dry flowers and their preservation
- Understand core concepts and methods of ecological and physical sciences and their application in environmental problem-solving
- Learn the key concepts of environmental monitoring involving water quality assessment using analytical instruments

List of Experiments

GENETICS AND EVOLUTION

- Genetics problems related to law of Dominance.
- Genetic problems related to law of segregation.
- Genetic problems related to law of Independent Assortment.
- Genetic problems of Incomplete Dominance
- Genetic problems of Co-dominance.
- Genetic problems of Multiple alleles.
- Genetic Problems of Epistasis.

PLANT ECOLOGY

1. To determine the minimum size of quadrat by Species curve method.
2. To determine the minimum number of quadrat to be laid down in the field under the study.
3. To study vegetation using Quadrat and also find frequency, Density and Abundance
4. To study the vegetation using chart quadrat method.
5. To determine soil moisture, content porosity & bulk density of soil collected from different location.
6. To determine the water holding capacity of soil collected from different location.
7. Determination of the alkalinity from a given water sample.
8. Demonstration practical of Ecological Pyramid
9. Demonstration practical of Energy flow
10. Demonstration practical of Ecosystem

HORTICULTURE

1. Phenology of any two of each: fruit, vegetables and flowering crops
2. Study of garden tools and implements- Sprayer, Duster, Pruning knife, Sprinkler, Micro-irrigation system,
3. Study of garden containers and filling of pots and pits and plantation any one plants of each fruit, vegetable and flowering crops
4. Study of cutting, layering, budding and grafting
5. Study of technique of training and pruning
6. Methods of harvesting of cut flowers and their preservation methods
7. Methods of making dry flowers
8. Visit to any one Nursery unit, Commercial Orchards, fruit market, floriculture Industry and submission of report in Practical Examination

ENVIRONMENT BIOLOGY

1. To study types of Biomes.
2. To study structure and types of ecosystem
3. To study population dynamics
4. To study impact of various pollution on seed germination
5. To study the types of waste and waste management
6. To study working and principle of pH meter
7. To study working and principle of EC meter
8. To study working and principle of BOD incubator
9. To study working and DO meter
10. To study working and Colorimeter
11. To study working and Atomic Absorption Spectroscopy (AAS)
12. To study the waste generation at IITE and develop a plan for its management.
13. Visit to zero waste institution and prepare a report.

Sem VII

Horticulture

Optional

Marks : 70 + 30

OBJECTIVE

- To enable students to understand basics of horticulture and advanced propagation techniques of horticultural crop.

LEARNING OUTCOMES

After completion of this paper, students will be able to

- Define branches and scope & economic importance of horticulture.
- Explain Special Practices in Horticulture.
- Describe methods of Plant Propagation.
- Classify Vegetables, Fruits, Ornamental plants, Spices and Flowers.
- Study fruits and Vegetables Production Technology.
- Apply the techniques of making dry flowers and their preservation.

UNIT 1 FUNDAMENTALS OF HORTICULTURE

1.1 Definition
1.2 Branches
1.3 Importance and scope
1.4 Classification of Horticultural Crops
1.5 Special horticultural practices

UNIT 2 SOIL AND WATER CONSIDERATIONS

2.1 Formation of soil
2.2 Classification, physical and chemical properties
2.3 Soil media, nutrients and manuring
2.4 Symptoms of excesses and deficiencies of nutrients
2.5 Plant growth regulators

UNIT 3 PLANT PROPAGATION AND PLANT PROTECTION

3.1 Propagation by specialized structures
3.2 Nursery based propagation: Cutting, Layering, Grafting and Budding
3.3 Role of Biotechnology

UNIT 4 PRODUCTION, PACKAGING AND MARKETING

4.1 Post-harvest management
    4.1.2 Production and Value Addition (Jams, Jelly, Tomato Catch-up etc.)
    4.1.3 Packaging, Marketing
4.2 Greenhouse cultivation
4.3 Floriculture
4.4 Root and tuber crops
4.5 Vegetable production, Organic gardening
4.6 Containers and packaging techniques

Sem
VII

Environmental Biology

Optional

Marks : 70 + 30

OBJECTIVE

- To enable students to understand the biosphere, major environmental threats and instruments used in environmental monitoring.

LEARNING OUTCOMES

After completion of this paper, students will be able to

- Understand core concepts and methods from ecological and physical sciences and their application in environmental problem-solving.
- Appreciate that one can apply systems concepts and methodologies to analyze and understand interactions between social and environmental processes.'
- Understand the global environment threats and will start thinking in the direction to resolve them
- Know the key concept of waste and its management

UNIT 1 THE BIOSPHERE

1.1 Biomes: Introduction about the types of Biomes, Characteristic features of Biomes
1.2 Ecosystems: Types and Structure
1.3 Biodiversity
1.4 Evolution and extinction

UNIT 2 ENVIRONMENTAL THREATS

2.1 Global Climate change
2.2 Population dynamics
2.3 Pest and pest control
2.4 Pollution

UNIT 3 WASTE MANAGEMENT

3.1 Types of waste
  3.1.1 Urban
  3.1.2 Industrial
  3.1.3 Biomedical
  3.1.4 e-waste.
3.2 Waste Management

UNIT 4 INSTRUMENTS USED IN ENVIRONMENTAL MONITORING

4.1 Working principle and applications of following sampling instruments:
  4.1.1 pH meter
  4.1.2 EC meter
  4.1.3 BOD incubator
  4.1.4 DO meter
  4.1.5 Colorimeter
  4.1.6 Atomic Absorption Spectroscopy (AAS)

Semester VIII

Semester – VIII								
			Total Papers	Credit	Hours	Internal	External	Total
Education	Education	Theory	1	3	45	30	70	100
	Education (EPC)	Practical	1	1	30	15	35	50
	Block Teaching and Internship	Practical	1	8	240	200	100	300
B.Sc (Science)	Principal	Theory/Practical	4 (3+1)	12	225	120	280	400
		Total	**9**	**24**	**540**	**365**	**485**	**850**

Sr. No.	Subject	Title of the paper	T/P	Nature	Credit	Hours	Internal	External	Total
1	Education	Gender, School and Society	Theory	Compulsory	3	45	30	70	100
2	Education	Optional Paper (Any One) 1. Educational Statistics 2. Guidance and Counselling 3. Value Education	Practical	Optional	1	30	15	35	50
3	Education	Block Teaching and Internship	Practical	Compulsory	8	240	200	100	300
4	Mathematics	Complex Analysis-II	Theory	Compulsory	3	45	30	70	100
5	Mathematics	Theory of Equations	Theory	Compulsory	3	45	30	70	100
6	Mathematics	Practical: Complex Analysis-II & Theory of Equations	Practical	Compulsory	3	90	30	70	100
7	Mathematics	Linear Programming	Theory	Optional	3	45	30	70	100
8	Mathematics	Dynamics and Statics	Theory	Optional	3	45	30	70	100
9	Physics	Quantum Mechanics	Theory	Compulsory	3	45	30	70	100
10	Physics	Atomic and Molecular Spectroscopy	Theory	Compulsory	3	45	30	70	100
11	Physics	Physics Practical VIII	Practical	Compulsory	3	90	30	70	100
12	Physics	Numerical Techniques	Theory	Optional	3	45	30	70	100
13	Physics	Non-conventional Energy Resources	Theory	Optional	3	45	30	70	100
14	Chemistry	Spectroscopy	Theory	Compulsory	3	45	30	70	100
15	Chemistry	Green Chemistry	Theory	Compulsory	3	45	30	70	100
16	Chemistry	Chemistry Practical-8	Practical	Compulsory	3	90	30	70	100
17	Chemistry	Industrial Chemistry-II	Theory	Optional	3	45	30	70	100
18	Chemistry	Advanced Physical Chemistry	Theory	Optional	3	45	30	70	100
19	Botany	Molecular Biology	Theory	Compulsory	3	45	30	70	100
20	Botany	Plant Tissue Culture	Theory	Compulsory	3	45	30	70	100
21	Botany	Practicals in Plant Science VIII	Practical	Compulsory	3	90	30	70	100
22	Botany	Ethnobotany and Herbalism	Theory	Optional	3	45	30	70	100
23	Botany	Plant Breeding	Theory	Optional	3	45	30	70	100
24	Zoology	Animal Biotechnology	Theory	Compulsory	3	45	30	70	100
25	Zoology	Animal Behaviour	Theory	Compulsory	3	45	30	70	100
26	Zoology	Practicals in Zoology -8	Practical	Compulsory	3	90	30	70	100
27	Zoology	Embryology	Theory	Optional	3	45	30	70	100
28	Zoology	Analytical Techniques	Theory	Optional	3	45	30	70	100

Any one subjects of Science (Mathematics, Physics, Chemistry and Botany) will have to be opted by the student.

EDUCATION

Sem
VIII

CoS 2 : Gender, School and Society

Compulsory

Marks : 35 + 15

Objectives

To enable the prospective teachers

- to acquire awareness regarding issues related to gender prevailing in school
- to gain understanding regarding psychological and sociological perspective regarding gender
- to find solution to reduce issue related to gender bias in Society
- to design strategies to bring gender equality in the school

Unit 1 Gender: Concepts and Emergence

1.1 Concept of Gender, Sex
1.2 Concept of Patriarchy, Feminism, Menism
1.3 Emergence of gender specific roles: sociological and psychological perspectives
1.4 Influence of family, caste, religion, culture, region, media on gender identity

Unit 2 Gender: Representations & Issues

2.1 Gender stereotype in India: Concept, Prevention-role of teacher, parent and school
2.2 Representation of Gender in text-books, school activities, student teacher interactions and Society
2.3 Gender bias: health and nutrition, education and workplace
2.4 Gender equality and equity given in Indian Constitution

Unit 3 Gender: Policies, Provisions

3.1 Gender equality provision in RTE-2009
3.2 Government initiatives for gender equality and equity
3.3 Gender and Law: Dowry, Prenatal sex determination, Domestic Violence
3.4 Role of International Organizations in Promoting Gender Equality

Unit 4 Gender Safety and Children

4.1 Gender Safety in Schools: Concept and safety measures
4.2 Child Sexual Abuse: Preventing and Dealing (POCSO Act)
4.3 Gender Safety across curriculum: Representation in text, adolescent health, relationships and emotional well being
4.4 Cyber Bullying : Concept and prevention

Sem
VIII

EPC 4 O1 : Educational Statistics

Optional
Marks : 35 + 15

Objectives

To enable the prospective teachers

- to acquaint the student teachers with the basic scientific concepts and practices in the educational statistics
- to enable the student to tabulate and find out some standard meaning from the raw scores by using statistical procedures
- to develop skills and competencies in the student teachers for the use of the statistical techniques in the field
- to enable the student teacher to interpret the result of educational statistics

Section A

1. Write a report on data collected of your class result by finding the mean, median and mode of scores on any one subject.
2. Write a report on data collected of your class result by finding the mean deviation, standard deviation and quartile deviation of scores on any one subject.
3. Do the analysis of achievement in different subjects.
4. Find the correlation between the scores of two subjects in the class and prepare a report.
5. Finding the central tendencies and measures of dispersion of result with the help of MS-Excel and write a report.
6. Do the trend analysis of five year result of standard XI of different subjects.
7. Graphical presentations of student's achievement in the different subject of your nearby school.

Section B

1. Graphical presentations of student's achievement in the different standard of your nearby school.
2. Prepare Graphical presentations of students achievement in the different subject of your nearby school with the help of excel.
3. Graphical presentations of student's achievement in the different standard of your nearby school with the help of excel.
4. Convert a achievement scores of one standard students in any subject in percentile and percentile rank and prepare a report.
5. Prepare a frequency distribution of a score in one subject and prepare its report.
6. Do the trend analysis of attendance of B.Ed. students.
7. Compare the judgment of different judges of the activities done at college level.

Mode of Transaction: Workshops of one day to describe the idea and the activity.
Activities to be conducted (any one from section A and B respectively)

Note: Trainees will select one activity from each section for submission BUT for better exposure minimum three activities from each unit will be carried out at institutional level.

Sem

VIII

EPC 4 O2 :
Guidance and Counselling

Optional

Marks : 35 + 15

Objectives

To enable the prospective teachers

- to understand functions of various counseling centers
- to conduct case study on Divyang children and NGO or Academic organization
- to prepare report on implementation of RTE
- to conduct an interview of counsellor to find out guidance and counselling activities at the school
- to administer IQ, Aptitude and Personality test

Section A

1 Discussion on concept and need of Guidance and Counselling

2 Visit to any guidance and counselling centre (Vocational, Personal guidance centre) and prepare report based on its activities

3 A case study of Divyang child by interviewing care taker, parents and special educator

4 A case study of any NGO, Academic organization such as special school for divyang children with reference to their activities

5 Report on implementation of RTE-2009 with reference to provision of 25% seats for economically weaker and disadvantaged children in the schools.

6. Interviewing and preparing report to find out guidance and counselling activities at the school by interviewing associated personnel (counsellor, school principal, teachers, parents and students).
7. Movie/ documentary review with reference to guidance and counselling
8. Designing and implementing vocational guidance programme for school students
9. DisCuSsion on the case study of counseling presented in the textbook of English (SL) of standard-11
10. Identify the issues related to guidance and perform role playing.

Section B

1. Administering Intelligence test and based on it guiding students and preparing report
2. Administering study habits inventory and based on it guiding students and preparing report
3. Administering Personality test and based on it guiding students and preparing report
4. Administering Aptitude Test and based on it guiding students and preparing report
5. Administering interest inventory and based on it guiding students and preparing report
6. A study of group dynamics with the help of Sociometry and prepare report
7. Designing and implementing remedial strategies for slow learners/ gifted learners.
8. Preparing student profile by administering psychological tests at school level

Mode of Transaction: Workshops of one day to describe the idea and the activity.
Activities to be conducted (any one from section A and B respectively)

Note: **Trainees will select one activity from each section for submission BUT for better exposure minimum three activities from each unit will be carried out at institutional level.**

Sem
VIII

EPC 4 O3 : Value Education

Optional

Marks : 35 + 15

Objectives

To enable the prospective teachers

- to understand the concept of various value and analyse it
- to review and reflect on the events involving value judgement
- to prepare report of their reflections

Section A

- In order to move from “me” to “we”, what changes would you like to bring in your college environment?
- Prepare presentation/paper on any one topic with your reflection: The factors for lacking of values in today‘s world is:
  - Wealth Without Work
  - Pleasure Without Conscience
  - Knowledge Without Character
  - Commerce Without Ethics
  - Science Without Humanity
  - Politics Without Principles
- Watch the following youtube videos https://www.youtube.com/watch?v=gIYJePEnvUY and https://www.youtube.com/watch?v=OVAokeqQuFM and analyse it.
- Watch the following youtube video https://www.youtube.com/watch?v=IfdjubjdMtc and analyse it.
- Watch movie: “Madam Geeta Rani” and reflect your view if you were there in place of Geeta Rani.
- Write a script of a Drama to inculcate any one value among this student

Section B

- Watch any one patriotic movie any analyse identify the values and if you are a director, how you have projected this theme in this movie.
- Read article 51A of Indian constitution and analyse your behavior with reference to these fundamental duties.
- Read the chapter 6: ‘Equitable and Inclusive Education: Learning for All’ of NEP 2020 and make an action plan to implement it as a teacher.
- Read the textbook of Social Science of any standard from 6 to 8 and make a list of the values reflected from it.
- Visit any orphan/old age house and reflect your thoughts that came after this visit.
- For example think “Because of the corona disease, you are hospitalized for a short time. What cautions will you take for society? Reflect your views and make a list of values that are governing your decisions.

Mode of Transaction: Workshops of one day to describe the idea and the activity.
Activities to be conducted (any one from section A and B respectively)

Note: Trainees will select one activity from each section for submission BUT for better exposure minimum three activities from each unit will be carried out at institutional level.

Sem

VIII

SI 4 : Block Teaching and Internship

Compulsory

Marks : 200+100

Objectives

To enable the prospective teachers

- To develop ability to handle school activities independently
- To develop the proficiency in imparting lessons
- To develop the proficiency in preparing blueprint
- To develop the ability to administer psychological test
- To develop the ability to reflect on their daily routine in schools

<table>
<tr><th>Type of Activity</th><th rowspan="2">Credit</th><th rowspan="2">Hrs.</th><th colspan="2">Lessons</th><th>Total</th><th colspan="3">Marks</th></tr>
<tr><th>Block Teaching</th><td>M1</td><td>M2</td><td></td><td>Int.</td><td>Ext.</td><td>Total</td></tr>
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<tr><td>Test</td><td>1</td><td>1</td></tr>
<tr><td>Observation</td><td>5</td><td>5</td></tr>
<tr><td></td><td colspan="3">Test Result Analysis and Remedial Lesson Planning (1+1)</td><td>10</td><td></td><td>10</td></tr>
<tr><td colspan="9"></td></tr>
<tr><th>Type of Activity</th><th>Credit</th><th>Hrs.</th><th colspan="3">Activity</th><th colspan="3">Marks</th></tr>
<tr><th>Internship</th><td></td><td></td><td colspan="3"></td><td>Int.</td><td>Ext.</td><td>Total</td></tr>
<tr><td rowspan="2">Internship</td><td rowspan="6">4</td><td rowspan="6">120</td><td colspan="3">Internship Lessons and activities assigned by school. Submission of Internship report with reflective Journal+ Observation of lessons of School teachers and peers</td><td>20</td><td></td><td>20</td></tr>
<tr><td colspan="3">Blue Print in each method of 50 marks</td><td>30</td><td></td><td>30</td></tr>
<tr><td rowspan="3">Submissions</td><td colspan="3">Science Practical/ / Map Reading/ Literary Activity/ Math Puzzle/ Budget Analysis /any other related activity to the subject</td><td>10</td><td></td><td>10</td></tr>
<tr><td colspan="3">Psychological Test</td><td>20</td><td></td><td>20</td></tr>
<tr><td colspan="3">Institutional Visit</td><td>10</td><td></td><td>10</td></tr>
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<tr><td>Annual Lesson</td><td>-</td><td>-</td><td>1</td><td>1</td><td>2</td><td>-</td><td>100</td><td>100</td></tr>
</table>

MATHEMATICS

Sem

VIII

Complex Analysis-II

COMPULSORY

Marks : 70 + 30

Objectives

- To understand the concepts of contour integral
- To develop the skill of finding residues and poles of complex function.
- To acquire the knowledge of different types of singularities of complex function
- To apply the knowledge of complex analysis for any real time problem.

Learning Outcomes

This course will enable students to:

- Find contour integral of the function.
- Evaluate derivative of an analytic function.
- Find the residue using Cauchy Residue theorem.
- Evaluate zeros of analytic function.

Unit 1 Integral 1

1.1 Derivatives of Functions w(t), Definite Integrations of w(t)
1.2 Contours and Contour Integrals
1.3 Upper bounds for moduli of contour integrals, Antiderivatives
1.4 Cauchy-Goursat Theorem

Unit 2 Integral 2

2.1 Simply and Multiply Connected domains, Cauchy Integral Formula Derivatives of
2.2 Analytic Functions
2.3 Liouville's Theorem and The Fundamental Theorem of Algebra
2.4 Maximum Modulus Principle

Unit 3 Power Series

3.1 Convergence of Sequences and Series
3.2 Taylor Series, Maclaurin's series
3.3 Residues, Cauchy's Residue Theorem
3.4 Singularities and Types of Singularities

Unit 4 Poles

4.1 Zeros of Analytic Functions
4.2 Zeros and Poles
4.3 Residues at Poles
4.4 Examples of Complex Integration using Residue

Sem
VIII

Theory Of Equations

COMPULSORY
Marks : 70 + 30

Objectives

- To understand concepts of Numerical and Algebraic Equations.
- To develop the skills of identifying different types equations.
- To acquire knowledge of number of positive and negative roots of polynomials.
- To apply the knowledge finding the solutions of cubic and biquadratic polynomial.

Learning Outcomes

This course will enable students to:

- Find solution of numerical and algebraic equation.
- Evaluate roots of an equation.
- Find transformation of an equation.
- Know Transformation of the biquadratic into the reciprocal form.

Unit 1 Numerical and Algebraic Equation

1.1 Definitions, Numerical and Algebraic Equations, Polynomials,
1.2 Theorem relating to polynomials when the variable receive the large value,
1.3 Theorem relating to polynomials when the variable receive the small value, change of form of a polynomial corresponding to an increase or diminution of the variable. Derived function, Continuity of a rational function,
1.4 Form of the quotient and remainder when a polynomial is divided by a binomial, Tabulation of function, Graphic representation of a polynomial, Maximum and Minimum values of polynomials, Quadratic Equations and Quadratic inequality.

Unit 2 Roots of equations

2.1 Theorems related to the real roots of equations,
2.2 Existence of a root in the general equation, Imaginary roots, Theorem determining the number of roots of an equation, equal roots, Imaginary roots enter in equation in pairs,
2.3 Descarte's rule of signs for positive roots, Descarte's rule of signs for negative roots, Use of Descarte's rule in proving the existence of imaginary roots, Theorem relating to the substitution of two given numbers for the variable, Examples, Relation between the roots and coefficients, Theorem, Application of the theorem,
2.4 Depression of an equation when a relation exists between two of its roots, The cube roots of Unity, Symmetric function of roots, Examples, Theorem relating to symmetric functions, Examples

Unit 3 Transformation of equation

3.1 Transformation of equations, Roots with signed changed, Roots multiplied by a given quantity,
3.2 Reciprocal roots and reciprocal equations, To increase or diminish the roots by a given quantity, Removal of terms,
3.3 The cubic, Biquadratic, Homogeneous Transformation, Transformation by symmetric functions, Formation of the equation whose roots are any powers of the roots of the proposed equation, Transformation in general, equations of a squared differences a

cubic, Criterion of the nature of the roots of cubic, Equation of differences in general, Reciprocal equation,

3.4 Binomial equations, Propositions embracing their leading general properties, The special roots of the equation x^n-1=0, Solution of Binomial equations by circular functions, Examples.

Unit 4 Application of algebraic and numerical equation

4.1 On the algebraic solution of equations, The algebraic solutions of the cubic equation, Application to numerical equations,

4.2 Expression of the cubic as the difference of two cubes, Solution of the cubic by symmetric function of the roots, Examples, Homographic relation between two roots of a cubic, First solution by radicals of the biquadratic,

4.3 Euler’s assumption, Examples, Second solution by radicals of the biquadratic, Resolution of the quartic into its quadratic factors, Ferrari’s solution, Resolution of the quartic into its quadratic factors, Descarte’s solution,

4.4 Transformation of the biquadratic into the reciprocal form, Solution of the biquadratic by symmetric function of the roots, equation of the soared differences of a biquadratic, Criterion of the nature of the roots of a biquadratic, examples.

Sem

VIII

Practical: Complex Analysis- II & Theory Of Equations

COMPULSORY

Marks : 70 + 30

Objectives

- To understand concepts of numerical and algebraic equations.
- To develop the skills of identifying different types of equations.
- To acquire the knowledge of different types of singularities of complex function
- To apply the knowledge of complex analysis for any real time problem.

Learning Outcomes

- Obtain Taylor and Laurent series of a complex function
- Evaluate integral using Cauchy Residue theorem
- Find the solution of the cubic equation
- Apply Ferrari's method for numerical solution of the equation

List of Practical's (Problems)

1. Contour Integrals and examples, Upper Bounds for Moduli of Contour Integrals
2. Verifying Cauchy–Goursat Theorem, Cauchy Integral Formula
3. Examples of Taylor and Laurent series
4. Problems based on Cauchy's Residue Theorem
5. Definite Integrals Involving Sines and Cosines
6. Descarte's rule of signs for positive roots
7. Example of a symmetric function of roots.
8. Algebraic solution of the cubic equation
9. Application of a Ferrari's method
10. Solution of the biquadratic by symmetric function of the roots

Sem
VIII

Linear Programming

OPTIONAL

Marks : 70 + 30

Objectives

- To understand the concept of Convex set & Linear Programming problem.
- To develop the skills of Mathematical formulation of Linear Programming Problems.
- To acquire the Knowledge of methods to solve LPP.
- To Apply the knowledge of LPP for any real time problem.

Learning Outcomes

This course will enable students to:

- Know the concept of convex set.
- Evaluate the LPP using Simplex, Big-M method.
- Find solution of Assignment problem using various method.
- Find solution of transportation problem using various methods.

Unit 1 Convex Set and LPP

1.1 Convex Set, Extreme points of a convex set, Convex combination
1.2 Examples of convex sets, theorems on convex sets,
1.3 Introduction to LPP, Formulation of LPP Problems
1.4 Solution of LPP using Graphical method

Unit 2 Solution of LPP

2.1 Solution of LPP using Simplex method
2.2 Big M method,
2.3 Two-phase method

Unit 3 Duality and Dual Simplex method

3.1 Introduction, Definition of the dual problem, General rule of converting primal into its dual,
3.2 How to interpret the solution of the dual from its primal and vice versa,
3.3 Comparison of the solution of the primal and its dual,
3.4 Dual simplex Method.

Unit 4 Transportation and Assignment Problems

4.1 Introduction, Mathematical formulation of Transportation problem, Methods of finding initial basic feasible solution : North West Corner Method (N-W Corner Method),
4.2 Row Minima Method, Column Minima method, Matrix Minima Method (Least Cost Entry Method), Vogel's Approximation method (VAM),
4.3 Modified distribution (MODI) method for finding optimum solution of Transportation Problem, Unbalanced TP, Degenerate TP, Introduction of Assignment Problems,
4.4 Hungarian Method for solving Assignment Problem.

Sem
VIII

Dynamics And Statics

OPTIONAL

Marks : 70 + 30

Objectives

- To understand the concept of particles and forces.
- To develop the skills of understanding equilibrium of rigid body.
- To acquire the Knowledge of kinematics and kinetics.
- To apply the knowledge of conservation laws.

Learning Outcomes

This course will enable students to:

- Know the Newton's law.
- Know equilibrium of rigid body.
- Know concepts of Kinematics and Kinetics.
- Know work and energy theorems.

Unit 1 Particles and Forces

1.1 Newton's laws
1.2 Force
1.3 Moments and couples
1.4 Line of actions

Unit 2 Equilibrium

2.1 Resultants
2.2 Static equilibrium
2.3 Equilibrium of rigid body
2.4 A static equilibrium

Unit 3 Kinematics and kinetics

3.1 Rectilinear particle motions
3.2 Constant acceleration
3.3 Projectile motion
3.4 Angular velocity and acceleration

Unit 4 Energy and work

4.1 Kinetic and potential energy
4.2 Forces and Work
4.3 The Work-Energy Theorem, Energy and Momentum, Power,
4.4 Conservation laws, Momentum

PHYSICS

Sem **VIII**

Quantum Mechanics

CORE COMPULSORY

Marks : 70 + 30

Objectives

- Introduction to Quantum Mechanics and its importance.
- Study of Schrodinger Equation, which makes the basis of entire wave mechanics.
- Teach the students how the Quantum mechanics was formulated.
- To solve some basic problems using the approach of Quantum Mechanics.

Learning Outcomes

- The student will develop the skill to study further problems in quantum mechanics.
- It will help the student to learn the basic approach, which is applied in Solid-state physics and Nuclear Physics.

UNIT 1

1.1 Formulation of the Schrödinger Equation: Brief Introduction to Space quantization. Brief introduction of De Broglie's Hypothesis, Concept of wave packet and uncertainty principle, The Schrödinger Equation, A free particle in one dimension, Generalization to three dimensions, the operator correspondence and the Schrödinger equation for a particle subject to forces

1.2 Physical Interpretation and Condition on ψ: Normalization and probability interpretation, Non-normalizable wave function and box-normalization, Conservation of probability, Expectation value and Ehrenfest's theorem, Admissibility conditions on the wave function, Related Numericals.

UNIT 2

2.1 Stationary States: The time independent Schrödinger wave equation. A particle in a square well potential, Bound state in a square well potential ($E< 0$). Admissible solutions of wave equation, the energy eigenvalues – discrete spectrum.

2.2 The energy eigen functions: parity, Penetration into classically forbidden regions, Square well: Non-localized states ($E>0$), The square potential barrier: Quantum mechanical tunneling, Reflection at potential barriers and wells, One Dimensional Delta Function Well.

UNIT 3

3.1 General Formalism of Wave Mechanics

The fundamental postulates of wave mechanics, the adjoint of an operator and self adjointness, The eigenvalue problem: Degeneracy, Eigenvalues and eigen functions of self adjoint operators, The Dirac delta function, Observables: Completeness and normalization of eigen functions, Closure, Physical interpretation of eigenvalues, eigen functions and expansion coefficients, Momentum eigen functions: wave functions in momentum space. The uncertainty principle, States with minimum value for uncertainty product, commuting observables; removal of degeneracy,

3.2 Evolution of system with time: constants of the motion, Non Interacting and Interacting Systems

UNIT 4

4.1 Exactly Soluble Eigenvalue Problems: The Simple Harmonic Oscillator: The Schrödinger equation and energy eigenvalues, The energy eigen functions, Series solution; Asymptotic behaviour, Orthonormality, Properties of stationary states.

4.2 Angular Momentum and Parity: The angular momentum operators, The eigenvalue equation for L^2; Separation of variables, Admissibility conditions on solutions; eigenvalues, The eigenfunctions: Spherical harmonics, Physical interpretation, Parity

4.3 Three Dimensional Square Well Potential: Solution in Interior and Exterior Region

4.4 The Hydrogen Atom: Solution of the radial equation and energy levels, Stationary State Wave function.

Sem
VIII

Atomic And Molecular Spectroscopy

CORE COMPULSORY

Marks : 70 + 30

Objectives

- To provide a quantum mechanical understanding of atomic and molecular processes through spectroscopy and the applications to understand the structure of different types of matter.
- To enable the students to study the macroscopically observable physical phenomena through the microscopic constituents of atoms and molecules and their interactions.
- To enable the students to understand various applications of spectroscopic techniques.

Learning Outcomes

- At the end of the course, the students will be able to:
- Understand and be able to apply atomic and molecular spectroscopy.
- Understand the motions of atoms and molecules within a macroscopic substance.
- Understand infrared and Raman Spectra through Classical and quantum theory and their potential applications

UNIT 1

1.1 Atomic Spectra: Spectrum of Hydrogen atom and spectral series, Observation of Hydrogen spectrum, Failure of electromagnetic theory of radiation. Bohr's theory and spectrum of Hydrogen atom, Franck-Hertz Experiment, Short coming of Bohr's theory, Larmor's theorem, Stern-Gerlach Experiment, Fine structure of Hydrogen lines,

1.2 Alkali Spectra: Different series in Alkali spectra: main features, Ritz combination principle, explanation of salient features of Alkali spectra, Related Numerical

UNIT 2

2.1 X –Ray Spectra: Production of X Rays, Origin of X Radiations according to Electromagnetic Theory, Continuous X Ray Spectrum, Characteristic Emission Spectrum, Characteristic Absorption Spectrum, Comparison of Optical and X Ray spectra, Moseley's Law, Auger Effect.

UNIT 3

3.1 Pure Rotational Spectra: Salient features of Rotational spectra, Molecular requirement for rotation spectra, experimental arrangement, Molecule as a rigid rotator, explanation of rotational spectra (without the process of solving Schrodinger equation to get energy formula), the non-rigid rotator, Isotope effect on rotational spectrum.

3.2 Vibrational - Rotational Spectra: salient features of vibrational - Rotational spectra, Molecule as a harmonic oscillator, Molecule as anharmonic oscillator, Vibrational frequency and force constant for anharmonic oscillator, Fine structure of Infrared bands: Molecule as vibrating rotator, Diatomic molecule as symmetric top, Thermal distribution of vibrational and rotational levels.

UNIT 4

4.1 Raman Spectra: Nature of the Raman spectra, experimental arrangement for Raman spectra, Classical theory of Raman effect, Quantum theory of Raman effect, Raman spectra and Molecular structure, Infrared spectra versus Raman spectra, Laser as intense source.

Sem
VIII

Physics Practical VIII

CORE COMPULSORY

Marks : 70 + 30

Objectives

- To enable the students to handle different spectrometers.
- To make the students understand different atomic spectroscopic phenomenon.
- To make the students understand different phenomenon related with molecular spectroscopy.

Learning Outcomes

- After learning the course, students will be able to have practical understanding of different atomic and molecular spectroscopic phenomenon.

LIST OF EXPERIMENTS

1. To determine wavelength using Edser Butler plate.
2. To determine the birefringence of MICA using Babinet compensator
3. To determine the absorption lines in a rotational spectrum of Iodine vapours and calculate (i) Electronic Energy Gap, (ii) Vibrational Energies.
4. To determine the wavelength by Fresenl's Biprism.
5. To determine Cauchy's constant A and B using given formula and to find the wavelength of unknown line of a mercury spectrum. To determine Cauchy's constant A and B graphically and to find the wavelength of unknown line of a mercury spectrum.
6. To determine the wavelength using Michelson interferometer.
7. To determine refractive index by total internal reflection using Gauss eye piece.
8. To determine the wavelength of given source using Fabry Perot Etalon
9. Numerical methods using Excel.
10. To study the resistance temperature characteristics of Thermistor & Determine energy band gap of semiconductor material by Thermistor.
11. To study the Photoconductivity of CdS photo-resistor at constant irradiance and constant voltage

Sem
VIII

Numerical Techniques

Core Optional
Marks : 70 + 30

Objectives

- Introduction to Numerical Methods for Calculation.
- Study of Numerical techniques to Solve transcendental equations.
- Numerically compute Integration and Differentiation.
- To solve differential equation numerically.

Learning Outcomes

- The student will develop the skill to solve mathematical problems numerically.
- It will help the student to learn the basic numerical techniques widely used to solve problems in physics.

UNIT 1

1.1 Introduction to C programming: General Topics: Keywords, Identifiers, Constants, Variables, Data Types, Operators, Expressions, Precedence and Associativity of operators, Type conversions, I/O operations, Branching: if, simple if, if-else, nesting of if-else, else if ladder, switch, conditional operator, Looping: while, do while, for, continue and break, goto.

1.2 Solution of linear Equations: Solving Transcendental equations by Bisection, False Position (Regula-Falsi), Newton-Raphson method (with graphical analogy) and Ramanujans method. Advantage and disadvantage of these methods, propagation of errors in each of these methods, Gauss elimination, necessity of pivoting and Gauss-Jordan elimination. Modification of Gauss Method to compute inverse.

UNIT 2

2.1 Interpolation: Errors in Polynomial Interpolation, Finite Differences: Forward Difference, backward Difference. Newton's formula for Interpolation. Polynomial interpolation by Lagrange's method (along with examples of 3 or 4-point interpolation formula). Divided Differences and their properties, Newton's general Interpolation formula. Estimation of errors in these methods,

2.2 Curve Fitting: Least square curve fitting: Fitting of Straight line, Multiple Linear least squares

UNIT 3

3.1 Numerical integration: Numerical integration General Formula, trapezoidal, Simpson's rule (both 1/3 and 3/8) and Romberg integration. Error estimation in the mentioned formulas. Gaussian quadrature.

3.2 Numerical Differentiation: Differentiation using Newton's forward and backward difference formulas. Error in Numerical Differentiation.

UNIT 4

4.1 Solution of differential equations: Method to solve first order linear differential equations: Taylor Series Method. Euler's method and its limitations with a discussion on its accuracy. Modified Euler's method. 2nd and 4th order R-K Method. Error Estimation in these methods.

Sem
VIII

Non-Conventional Energy Resources

Core Optional

Marks : 70 + 30

Objectives

- To know the use of solar energy as a source of non-conventional energy.
- To know the use of wind energy as a source of non-conventional energy.
- To know the use of geothermal energy as a source of non-conventional energy.
- To know the use of ocean energy or tidal energy as a source of non-conventional energy.

Learning Outcomes

- After learning the course, students will be able to know about different sources of non-conventional energy which would be helpful in any future research work and helpful in any industry work

UNIT 1

1.1 Solar Energy: Introduction and application of solar energy, Essential subsystem in a solar energy plants. Solar energy routes and their prospects Units of solar power and solar energy, Merits and limitations of solar energy conversion and utilization, Solar constant, Power density for various wavelength of sunlight, Clarity index, Solar insolation, Tilt angle of the fixed flat plate collector, Solar calculations, Local apparent time

1.2 Solar thermal collectors: Parabolic through collectors, Paraboloidal dish collectors, Fresnel lens point focus collector and heliostate with central receiver, Heat transfer fluid, Thermal energy storage, Solar distributed collector thermal power plants, Solar boiler/ steam generator with large reflector and a central receiver, Solar pond, Solar thermo-electric converter, Merits and limitations of solar PV system, Prospects of solar PV system.

UNIT 2

2.1 Geothermal Energy : Introduction to the Geothermal energy Applications, Geothermal energy resources, Non-uniform geothermal gradients, hydrogeothermal resources, Geopressure geothermal resources, Hot dry geothermal resources, Geothermal fluids for electrical power plants, Principles of photoelectrochemical solar cell

UNIT 3

3.1 Wind Energy: Introduction to wind energy, Application of wind energy and historical back ground, Merits and limitations of wind energy conversions, Nature of wind and origin of wind, Wind energy quantum and variables in wind energy conversion systems, Wind power density, Power in a wind stream

3.2 Wind Turbines: Wind turbine efficiency, Power of a wind turbine for given incoming wind velocity, Forces on the blades of a propeller. Wind velocities and height from ground and site selection, Examples of wind farm site, Mean wind velocity, and wind velocity duration curve, Energy pattern factor and wind power duration characteristics, Introduction to wind turbine generator and terms and definitions, Types and characteristics of wind turbine generators, Horizontal axis propeller type wind turbine generator, Three blade HAWT.

UNIT 4

4.1 Ocean Energy: Introduction to energy from oceans, Ocean energy resources, Advantages and limitations of ocean energy conversion technologies, Introduction to the ocean wave energy conversion, Ocean waves and parameters of a progressive wave, Equation of a progressive and energy and power ocean waves, Summary of equations, Motion of water particles in the wave and wave data collection.

4.2 Tidal Energy: Introduction to the tidal energy conversion-tidal currents-tidal energy conversion, Tidal power – average theoretical power per tide-ocean tidal energy schemes-terms and definitions, Single basin tidal schemes – double basin schemes and multi-basin schemes.

CHEMISTRY

Sem **VIII**

Spectroscopy

COMPULSORY

Marks : 70 + 30

Objectives

To Develop understanding of spectroscopy

- Can define various terms and understand concept of absorption
- To Calculate the lambda max values for given structures
- Can Explain the basic principles of IR spectroscopy
- To understand theory, Instrumentation and applications of NMR spectroscopy

Learning Outcomes

Learners will be able to:

- Explain fundamentals of absorption spectroscopy
- Explain and Demonstrate lambda max values for given structures
- Describe concept of IR spectroscopy and its use
- Illustrate theory, Instrumentation and applications of NMR spectroscopy
- Interpret IR and NMR spectra

UNIT 1 Basics of spectroscopy

1.1. Electromagnetic radiation
1.2. Electromagnetic spectra
1.3. Energy levels in molecule
1.4. Classification of spectroscopic techniques
1.5. Rotational, Vibrational and Electronic transitions
1.6. Photoelectric effect
1.7. Born-oppenheimer approximation
1.8. Absorption and emission spectra
1.9. Instrumentation and various Components

UNIT 2 Ultra violet spectroscopy

2.1. Beer –Lambert law, molar absorptivity
2.2. Presentation and analysis of UV spectra
2.3. Types of electronic transitions
2.4. Effect of conjugation
2.5. Concept of chromophore and auxochrome
2.6. Bathochromic, hypsochromic hyperchromic and hypochromic shifts
2.7. UV spectra of conjugated dienes and dienones
2.8. Woodward - Fieser rules
2.9. Calculation of max. of simple conjugated dienes and α, β -unsaturated ketones
2.10. Applications of UV spectroscopy in structure elucidation of simple organic compounds

UNIT 3 Infrared spectroscopy

3.1. Molecular vibrations
3.2. Conditions for IR absorptions
3.3. Hooke's law
3.4. Calculation of vibrational frequency
3.5. Selection rules

3.6. Stretching and Bending vibrations
3.7. Concept of overtones and Fermi resonance
3.8. Measurement of IR spectrum, fingerprint region
3.9. Instrumentation
3.10. Sampling Techniques
3.11. Characteristic absorption of various functional groups such as alkanes, alkenes, alkynes, aromatics, alcohols, ethers, phenols, amines aldehydes, ketones etc
3.12. Applications of IR spectroscopy

UNIT 4 Nuclear Magnetic Resonance spectroscopy

4.1. Principle of nuclear magnetic resonance
4.2. Number of signals
4.3. Peak areas equivalent and non-equivalent protons
4.4. Positions of signals
4.5. Chemical shift
4.6. Shielding and deshielding of protons
4.7. Proton counting
4.8. Splitting of signals & coupling constants
4.9. Magnetic equivalence of protons
4.10. Simple problems on PMR spectroscopy for structure determination of organic compounds

Sem
VIII

Green Chemistry

COMPULSORY

Marks : 70 + 30

Objectives

- To study Twelve principles of green chemistry
- Understanding the role renewable resources: green solvents and green catalysis
- Understanding of designing a green synthesis and synthetic methodology

Learning Outcomes

- Students can understand the historical and advance concept of green chemistry and its advantages
- They can know the impact of advanced green chemistry on the fields of medicine, pharmacy and its impact on the global economy
- They can understand the fundamental twelve principles of green chemistry
- They can identify the physical properties of different green organic molecules and application in medical science

UNIT 1 Basic Green Chemistry

1.1. Introduction
1.2. Goals of green chemistry
1.3. Green chemistry and synthetic chemistry
1.4. Basic concept of wasted generation, pollution
1.5. percentage yield
1.6. atom economy
1.7. Industrial ecology and industrial ecosystem
1.8. metabolic processes in industrial ecosystem
1.9. Life cycles in industrial ecosystem

UNIT 2 Twelve principles of green chemistry

2.1. Prevention
2.2. Atom economy
2.3. less hazardous chemical syntheses
2.4. Designing safer chemicals
2.5. Use of renewable feedstock
2.6. reduce derivatives
2.7. catalysis
2.8. Designing for degradation
2.9. Real-time analysis for pollution prevention
2.10. Inherently safer chemistry for accident prevention

UNIT 3 Use of renewable resources

3.1. Green Solvents
3.2. Role of solvent
3.3. Solvent free process
3.4. choice of water as a solvent, ionic liquids
3.5. Polyethylene glycol solvent and bio solvents
3.6. Green Catalyst

3.6.1. Introduction
3.6.2. Catalysis in organic synthesis
3.6.3. Types of catalysis
3.6.4. Phase transfer catalysis and biocatalysis

UNIT 4 Designing a green synthesis and synthetic methodology

4.1. Choice of starting materials
4.2. Reagents, microwave & ultrasonic assisted synthesis
4.3. Green synthesis: Polycarbonates, Ibuprofen, Adipic acid, Disodium Iminodiacetate, Carbonyl Pesticide and Methyl Methacrylate

Sem
VIII

Chemistry Practical-8

COMPULSORY

Marks : 70 + 30

Objectives

- Can get Knowledge and importance of spectroscopy in organic chemistry
- Get knowledge regarding recognition of bands in IR spectrum of organic compounds
- Can get understanding of various unit processes in organic synthesis
- To understand the concept and importance of green synthesis
- To get knowledge about determination of the energy of activation and Distribution Coefficient of various chemicals

Learning Outcomes

Learners will be able to:

- Systematically interpret IR spectrum of various organic compounds
- Identify organic compounds using IR Spectrum
- Synthesize organic compounds by various unit processes
- Carry out Green synthesis of organic compounds
- Carry out determination of the energy of activation and Distribution Coefficient of various chemicals
- IR spectra interpretation:
- Interpretation of IR Spectra of Alkane, Alkene, Alkyne, Aromatic hydrocarbon, Alcohol, Phenol, Aldehyde, acid and Amine

Preparation of organic molecules based on following chemical processes (Any Three)

1. Nitration
2. Bromination
3. Sulphonation
4. Reduction
5. Oxidation

Elective 1: Green synthesis (Any Three)

1. Preparation of acetanilide
2. Preparation of biodiesel from vegetable/ waste cooking oil
3. Benzoin condensation using Thiamine Hydrochloride as a catalyst (instead of cyanide)
4. Mechanochemical solvent free synthesis of azomethines
5. Photoreduction of benzophenone to benzopinacol in presence of sunlight
6. Conversion of trans azo benzene into cis azobenzene
7. 1,4 –Naphthaquinone photodimer

Elective 2: Advanced Physical Chemistry (Any Three)

1. Determine the energy of activation energy of the reaction between potassium persulphate and potassium iodide
2. Investigation the auto-catalytic reaction between potassium permanganate and oxalic acid
3. Determine rate constant of the reaction between potassium persulphate and potassium iodide having equal concentration of the reaction species
4. Distribution Coefficient of Iodine between two immiscible solvents (Water and CCl_4)
5. Conductometric titration of KCl with $AgNO_3$

Sem **VIII**

Industrial Chemistry-II

Optional

Marks : 70 + 30

Objectives

- To know the components of Pharmacokinetics & pharmacodynamics of the drugs
- To get the knowledge of Fats Oils and Detergents and chemistry of Fats Oils and Detergents
- To get thorough knowledge of Cement Industry and various steps of involved in production of cement

Learning Outcomes

- To know the components of Pharmacokinetics & pharmacodynamics of the drugs
- To get the knowledge of Fats Oils and Detergents and chemistry of Fats Oils and Detergents
- To get thorough knowledge of Cement Industry and various steps of involved in production of cement

UNIT 1 Pharmaceutical Chemistry

1.1. Pharmacokinetics & pharmacodynamics of the drugs
1.2. Synthesis & therapeutic importance of Antibiotics drugs
1.3. Sulpha drugs
1.4. Aspirin
1.5. Phenacetin and chloroquine

UNIT 2 Study of various types of pharmaceutical excipients

2.1. Glidants
2.2. Lubricants
2.3. Diluents
2.4. Binders
2.5. Coating agents
2.6. Antioxidants
2.7. Emulsifying agents
2.8. Suspending agents
2.9. Preservatives
2.10. Colouring agents
2.11. Flavouring agents
2.12. Sweetening agents

UNIT 3 Fats, Oils and Detergents

3.1. Natural fats edible and industrial oils of vegetable origin common fatty acids, glycerides, hydrogenation of unsaturated oils
3.2. Saponification value
3.3. Iodine value
3.4. Acid value
3.5. Soaps and synthetic detergents
3.6. Alkyl and aryl sulphonates

UNIT 4 Cement Industry

4.1. Classification of cement
4.2. study of raw material and their availability
4.3. Manufacture of Portland cement with construction and working of rotary kiln
4.4. Role of gypsum in cement
4.5. Setting, hardening and strength
4.6. Characteristics of cement compounds
4.7. ISI specification of Portland cement
4.8. Study of special cement like high alumina cement
4.9. Early high strength cement and white Portland cement
4.10. Decay of cement concrete and its protection

Sem

VIII

Advanced Physical Chemistry

Optional

Marks : 70 + 30

Objectives

- To know fundamentals of electrochemistry
- To learn specific and equivalent conductances. Measurement of equivalent conductance and variation of equivalent and specific conductance with dilution
- To develop understanding of various types of conductometric titrations
- To know about colloidal state, classification of colloids and applications of colloids

- **Learning Outcomes**

Learner Will be able To

- learn know fundamentals of electrochemistry
- learn specific and equivalent conductances. Measurement of equivalent conductance and variation of equivalent and specific conductance with dilution
- learn to develop understanding of various types of conductometric titrations
- learn about colloidal state, classification of colloids and applications of colloids

UNIT 1 Colligative Properties of Dilute Solutions

1.1. Colligative properties
1.2. Vapour pressure lowering
1.3. Determination of molar mass of solute
1.4. Measurement of vapour pressure lowering
1.5. Osmosis and osmotic pressure
1.6. Derivation of equation for calculating osmotic pressure
1.7. Determination of molar mass, Measurement of osmotic pressure
1.8. The boiling point elevation
1.9. Derivation of equation and measurement of boiling point elevation
1.10. The Freezing point depression
1.11. Derivation of equation for molar mass
1.12. Measurement of freezing point depression

UNIT 2 Electrochemistry-I

2.1. Electric conduction in electrolytic solution
2.2. Specific and equivalent conductances
2.3. Measurement of equivalent conductance and variation of equivalent and specific conductance with dilution
2.4. Kohlrausch law
2.5. Arrhenius theory of electrolytic dissociation and its limitations
2.6. Weak and strong electrolytes
2.7. Ostwald dilution law and its application and limitations

UNIT 3 Electrochemistry-II

3.1. Debye-Huckel-Onsager equation for strong electrolytes (elementary treatment only)
3.2. Transport number and its determination by Hittorf method and moving boundary method
3.3. Degree of dissociation of weak acids and bases and determination of dissociation constant
3.4. Solubility product of sparingly soluble salts and its determination by conductometric titrations

UNIT 4 Colloidal State

4.1. Types of Colloidal system
4.2. Classifications of Colloids
4.3. Lyophobic and Lyophilic Sols
4.4. Size range
4.5. Preparation and Properties of colloids solution
4.6. Dialysis
4.7. Electro dialysis
4.8. Ultrafiltration
4.9. Ultra microscope
4.10. Electrical Properties
4.11. Charge on colloidal particles
4.12. Zeta potential
4.13. Coagulation of Colloidal solution
4.14. Flocculation values
4.15. Electrophoresis
4.16. Electro osmosis
4.17. Importance and Applications of Colloids

BOTANY

Sem
VIII

Molecular Biology

COMPULSORY

Marks : 70 + 30

OBJECTIVE

- Students will learn about macromolecules and the macromolecular mechanisms found in living things, such as the molecular nature of the gene and its mechanisms of gene replication, mutation, and expression

LEARNING OUTCOMES

After completion of this paper, students will be able to

- Define the science of molecular biology and related topics such as biotechnology Describe cell components and cell molecules
- Describe DNA and RNA structure and their properties
- Understand and explain genome organization in prokaryotes and eukaryotes Understand and describe DNA synthesis, their control mechanisms and DNA replication errors
- Understand and describe the processes of transcription and translation, their control mechanism and post-transcription modification

UNIT 1 NUCLEIC ACIDS AND REPLICATION

1.1 Nucleic Acid is the universal genetic material: Experiments of Griffith, Avery et al, Hershey & Chase and Heinz Fraenkel-Conrat

1.2 Organization of genetic material in eukaryotes

1.3 DNA Replication is a Semi Conservative Process: Experiment of Meselson & Stahl

1.4 Role of various enzymes in DNA replication

UNIT 2 BIOSYNTHESIS OF PROTEIN

2.1 Transcription

2.2 Post transcriptional modifications

2.3 Genetic code and Ribosome

2.4 Translation

2.5 Post translational modifications

UNIT 3 MUTATION

3.1 Fluctuation analysis

3.2 Mutation and Mutation rate

3.3 Phenotypic effects of mutation, Phenotypic and Phenomic lag

3.4 Types of mutation: Spontaneous mutations and Induced mutations

3.5 Reversion and Ames test

UNIT 4 GENETIC ENGINEERING

4.1 Overview of R DNA Technology

4.2 Restriction Endonucleases

4.3 Isolation of DNA

4.4 Vectors of Recombinant-DNA Technology:

4.4.1 pBR 322

4.4.2 pUC

4.4.3 Bacteriophages
4.4.4 Hybrid Vector : Cosmid
4.4.5 Artificial Chromosomes : BACs, YACs
4.4.6 Ti Plasmid

4.5 Insertion of DNA molecules into a vector
4.6 Transformation and Growth
4.7 Detection of Recombinant molecules – Colony Hybridization
4.8 Expression of foreign DNA

Sem
VIII

Plant Tissue Culture

COMPULSORY
Marks : 70 + 30

OBJECTIVES

- To enable students to understand the current scenario of the field of biotechnology and basic techniques involved in plant tissue culture. To understand students about regeneration of plants and genetic variation under artificial condition.

LEARNING OUTCOME

After successfully completing this Paper, students will be able to:

- Define biotechnology and plant tissue culture
- Describe Plant Tissue Culture techniques.
- Explain the concept and technique of Germplasm and Cryopreservation

UNIT 1 INTRODUCTION AND LABORATORY ORGANIZATION

1.1 Definition, Origin and History of plant tissue culture

1.2 Laboratory organization (washing area, transfer area, culture area, green house)

1.3 Instruments (autoclave, laminar air flow, pH meter, oven, distillation unit)

UNIT 2 TECHNIQUES IN PLANT TISSUE CULTURE

2.1 Sterilization techniques

- 2.1.1 Media sterilization
- 2.1.2 Glassware sterilization
- 2.1.3 Plant material sterilization
- 2.1.4 Culture room sterilization
- 2.1.5 Small instrument sterilization

2.2 Media composition and preparation

- 2.2.1 Roles of various plant growth regulators (PGRs)
- 2.2.2 Inoculation of the explants
- 2.2.3 Maintenance of culture

UNIT 3 TYPES OF CULTURES

3.1 Seed culture

3.2 Embryo culture

3.3 Callus culture

3.4 Organ culture

3.5 Cell culture

3.6 Protoplast culture

UNIT 4 APPLICATIONS OF PLANT TISSUE CULTURE

4.1 Applications of Plant Tissue Culture:

- 4.1.1 Micropropagation
- 4.1.2 Synthetic seeds
- 4.1.3 Androgenesis
- 4.1.4 Virus elimination
- 4.1.5 Haploids, embryo rescue and triploids
- 4.2 Germplasm – Conservation and Cryopreservation

Sem
VIII

Practicals In Plant Science 8

COMPULSORY

Marks : 70 + 30

Objectives

- To impart detailed knowledge of macromolecules and equip students with macromolecular mechanisms of replication, transcription and translation found in prokaryotes and eukaryotes along with explaining molecular nature of the gene through human karyotyping and genetic engineering techniques.
- To enable students to understand current scenario of the field of plant biotechnology and explain basic techniques and laboratory instruments involved in plant tissue culture along with providing understanding regarding regeneration of plants and occurrence of genetic variation under in vitro conditions.
- To make students aware about different plants and their practical uses gained through the traditional knowledge of a local culture and tribal people of India.
- To enable students to understand conventional and advanced techniques of plant breeding including hybridization, autopolyploidy, aneupolyploidy, pure line selection and back cross selection.

Learning Outcomes

- Describe the science of molecular biology and related topics of modern biotechnology
- Describe structure and properties of DNA, RNA and protein
- Explain genome organization in prokaryotes and eukaryotes
- Understand and describe DNA synthesis, their control mechanisms and DNA replication errors
- Understand and describe the processes of transcription and translation, their control mechanism and post-transcription modification
- Understand Plant Tissue Culture technique including pollen culture
- Explain stock preparation of plant tissue culture media
- Describe process of synthesis of artificial seed
- Explain concept of germplasm and cryopreservation
- Recognize traditional medicinal plants
- Recognize the importance and usage of traditional knowledge provided by tribes of India
- Propose new strategies to enhance growth of medicinal herbs considering the practical issues pertinent to India
- Recognize the biopiracy and protection of traditional knowledge with the help of law
- Introduce the student with branch of plant breeding for the survival of human being protected from starvation
- Study techniques of production of new superior crop verities
- Understand the modern strategies applied in genetics and plant breeding to sequence and analyze genomes
- Know about artificial hybridization and new variety development
- Get the detail knowledge about modern strategies applied in plant breeding for crop improvement involving mass selection, pure line selection and clonal selection

MOLECULAR BIOLOGY

1. To study laboratory safety guidelines
2. To extract DNA from different fruits
3. To study DNA replication in prokaryotes through chart and models.

4. To study Transcription in prokaryotes through chart and models.
5. To study Genetic code.
6. To study central dogma through DNA sequence
7. To analyze human karyotype for the study of different chromosomal aberrations.
8. To study different enzymes used in genetic engineering
9. To study different vectors used in genetic engineering
10. To study basic technique of genetic engineering through chart and models

PLANT TISSUE CULTURE

1. To study the lab instruments used for tissue culture.
2. Preparation of Artificial seed and their germination.
3. To study a protocol for Preparation of Stock Solution
4. To study a protocol Preparation of M.S. Media.
5. To study protocol of hardening in tissue culture using any cultured plant.
6. To study protocol of direct organogenesis using appropriate explants.
7. To study protocol of pollen culture.

ETHNOBOTANY AND HERBALISM

1. To study the rituals and background of Dabla tribes of India.
2. To study the rituals and background of Toda tribes of India.
3. To prepare questioner for ethnobotanical survey.
4. To study plants used as cosmetics.
5. To study tribal intoxicants.
6. To study Adhatoda vasica.
7. To study Asperagus racemosus.
8. To study Cissus quadrangularis.
9. To study Vitex negundo.
10. Case study of successful tribal practices to the market.

PLANT BREEDING

1. To study Fertilization and Life cycle of Angiosperm plants
2. To study Reproductive Morphology and Floral Biology of Crops
3. To study Self-incompatibility and Male Sterility
4. To study Hybridization techniques: Selfing, Emasculation and Crossing
5. To study Autopolyploidy in crop improvement
6. To study Allopolyploidy in crop improvement
7. To study Aneuploidy in crop improvement
8. To study Mass selection method
9. To study Pure line selection
10. To study Pedigree selection
11. To study Bulk selection
12. To study Back cross selection
13. Practice of hybridization techniques in a self-pollinated and cross pollinated plants (any available plant).
14. Polyploidy induction in Allium cepa by colchicine. (Demonstration only)
15. A visit to agricultural research centre for observation and record of inter variety, inter specified integration plants.

Sem VIII

Ethnobotany And Herbalism

Optional

Marks : 70 + 30

OBJECTIVES

- Students will learn different plants and their practical uses through the traditional knowledge of a local culture and people.

LEARNING OUTCOME

On completion of the paper, students are able to:

- Recognize the basic medicinal plants
- Know the importance and usage of plants by the tribes of India
- Propose new strategies to enhance growth of medicinal herbs considering the practical issues pertinent to India
- Understand the importance of traditional knowledge
- Recognize the biopiracy and protection of TK with the help of law

UNIT 1 ETHNOBOTANY

1.1 Introduction, concept, scope and objectives
1.2 Ethnobotany as an interdisciplinary science
1.3 Major and minor ethnic groups or Tribals of India, and their life styles
1.4 Plants Used by the Tribals
  1.4.1 Food plants
  1.4.2 Intoxicants and beverages
  1.4.3 Resins and oils and miscellaneous uses
  1.4.4 Sacred plants

UNIT 2 METHODS OF ETHNOBOTANICAL STUDIES

2.1 Selection of Study area
2.2 Field Requirements
2.3 Questionnaire Preparation
2.4 Voucher specimen
2.5 Information about plant usages by people
2.6 Value addition of Traditional Knowledge

UNIT 3 ROLE OF ETHNOBOTANY IN MODERN MEDICINE

3.1 Medico-ethnobotanical sources in India
3.2 Significance of the following plants in ethno botanical practices (along with their habitat and morphology)
  3.2.1 Azadiractha indica
  3.2.2 Ocimum sanctum
  3.3.3 Vitex negundo
3.3 Role of ethnobotany in modern medicine with special example
  3.3.1 Rauvolfia sepentina
  3.3.2 Withania somnifera
  3.3.3 Asparagus racemosus

UNIT 4 ETHNOBOTANY AND LEGAL ASPECTS

4.1 Ethnobotany as a tool to protect interests of ethnic groups
4.2 Sharing of wealth concept with few examples from India
4.3 Biopiracy
4.4 Intellectual Property Rights and Traditional Knowledge.

Sem
VIII

Plant Breeding

Optional

Marks : 70 + 30

OBJECTIVE

- To enable students to understand conventional and advanced techniques of plant breeding.

LEARNING OUTCOMES

On completion of the Paper, students are able to

- 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 verities.
- Understand the modern strategies applied in Genetics and Plant Breeding to sequence and analyze genomes
- Get the detail knowledge about modern strategies applied in Plant Breeding for crop improvement i.e. Mass selection, pure line Selection and Clonal selection.
- Know about exploitation of Heterosis, hybrid and variety development and their release through artificial hybridization.

UNIT 1 PLANT BREEDING

1.1 Introduction to plant breeding
1.2 Scope and importance
1.3 Objective of plant breeding
1.4 Breeding systems: modes of reproduction in crop plants.

UNIT 2 METHODS AND PRACTICES OF BREEDING

2.1 Introduction to selection methods
2.2 Types of selections
  2.2.1 Mass selection
  2.2.2 Pure line selection
  2.2.3 Pedigree selection
  2.2.4 Bulk selection
  2.2.5 Back cross selection

UNIT 3 HYBRIDIZATION

3.1 Objectives of Hybridization
3.2 History
3.3 Techniques of Hybridization
3.4 Significance of Hybridization.
3.5 Heterosis and Hybrid vigour

UNIT 4 POLYPLOIDY IN CROP IMPROVEMENT

4.1 Numerical changes in chromosomes - Euploidy and Aneuploidy

4.2 Monoploidy - Origin and production, morphology and uses

4.3 Polyploidy - Concept and characteristics of polyploidy

 4.3.1 Autopolyploidy - Origin and production, effects of auto polyploidy and uses

 4.3.2 Allopolyploidy - Concept, synthesized allopolyploidy (wheat and cotton)

4.4 Aneuploidy - Monosomy and nullisomy

 4.4.1Origin and cytology

 4.4.2 Trisomy in Datura

4.5 Evolutionary significance of polyploidy

Evaluation Pattern

<table>
<tr><th rowspan="2">Type of Paper</th><th colspan="3">Internal</th><th colspan="3">External</th><th rowspan="2">Total Marks</th></tr>
<tr><th>Particulars</th><th>Marks</th><th>Total Marks</th><th>Particulars</th><th>Marks</th><th>Total Marks</th></tr>
<tr><td rowspan="4">Theory</td><td>Assignment/ Seminar/ Project/ Workshop</td><td>5</td><td rowspan="4">30</td><td rowspan="4">Semester end Written Examination</td><td rowspan="4">70</td><td rowspan="4">70</td><td rowspan="4">100</td></tr>
<tr><td>Attendance</td><td>5</td></tr>
<tr><td>CCE</td><td>5</td></tr>
<tr><td>From Prelim Exam</td><td>15</td></tr>
<tr><td rowspan="3">Practical (EPC** & LPC**)</td><td rowspan="2">Performance Based Assessment: Section A</td><td rowspan="2">7.5</td><td rowspan="3">15</td><td>Submission on Section A</td><td>10</td><td rowspan="3">35</td><td rowspan="3">50</td></tr>
<tr><td>Submission on Section B</td><td>10</td></tr>
<tr><td>Performance Based Assessment: Section B</td><td>7.5</td><td>Viva voce</td><td>15</td></tr>
</table>

****EPC:** Art in Education, Reflective Reading, Environment Education, Yoga in Education, Educational Management, Educational Statistics, Guidance and Counseling, Value Education

****LPC:** Gujarati/Hindi/Classical Sanskrit and English

*****Preliminary Examination:** One Exam of 35/70 Marks to be taken on the pattern of Annual Exam. It is to be converted to 15 Marks. Converted from Preliminary Exam

CCE (Continuous Comprehensive Evaluation): Two CCE of 25 Marks each to be taken .
Average of two CCE to be converted to 5 Marks.
CCE I- Unit 1 & 2 , CCE 2- Unit 3 & 4

Format of Question Paper

General Instructions:

1. **All questions are compulsory, options are internal.**
2. **Digits marked at the end of questions shows total marks of that questions.**
3. **Answer briefly and to the point.**

For 70 Marks: (Time 3 Hours)

Question 1 Answer following questions as directed: (From Unit 1)	
(A): Answer any two out of three In 400 words	08 Marks
(B): Answer any two out of three In 250 words	06 Marks
Question 2 Answer following questions as directed: (From Unit 2)	
(A): Answer any two out of three In 400 words	08 Marks
(B): Answer any two out of three In 250 words	06 Marks
Question 3 Answer following questions as directed: (From Unit 3)	
(A): Answer any two out of three In 400 words	08 Marks
(B): Answer any two out of three In 250 words	06 Marks
Question 4 Answer following questions as directed: (From Unit 4)	
(A): Answer any two out of three In 400 words	08 Marks
(B): Answer any two out of three In 250 words	06 Marks
Question 5: Answer any 7 out of 10 questions: (From All four Units)	14 Marks

For 35 Marks:(Time 2 Hours)

Question 1 Answer following questions as directed: (From Unit 1 & 2)	
(A): Answer any two out of three In 400 words	08 Marks
(B): Answer any two out of three In 250 words	06 Marks
Question 2 Answer following questions as directed: (From Unit 3 & 4)	
(A): Answer any two out of three In 400 words	08 Marks
(B): Answer any two out of three In 250 words	06 Marks
Question 3: Answer any 7 out of 10 questions (From All four Units)	07 Marks

Instructions about Examination

1. ASSESEMNT

1.1 There shall be two components for assesment of learners

1. Continuous and Comprehensive Evaluation (Internal Assessment)
2. Semester End Examination (External Examination)

1.2 The assessment carries any of the following modes, as per the requirement of the Papers as notified by the University.

(a) Written
(b) Practical
(c) Oral/Viva-voce
(d) ICT based Tests
(e) Open Book Examinations
(f) Submission of Project/Report

1.3 The semester end examination shall be mandatory for every student to appear in every examination conducted by the University. The examination shall be held according to the scheduled notified by the University from time to time. Any of the students who fail to present himself/herself at the examination as per schedule at the place notified and those who appear at the examination and leave the examination hall voluntarily or boycott the examination for any of the reasons or whatsoever deemed as forfeiting his/her rights to appear at the said examination. The University shall not hold fresh examination for any or all subjects for such students under any circumstances.

1.4 Practical, Oral (Viva-voce) Examination

1. The practical examination shall be organised by the respective College as per the instructions of the University. Principal of the college concerrned shall submit the time table including the names of the paper setters/ examiners to the Controller of Examination, IITE 15 days in advance.
2. The practical examination shall be conducted in presence of Examinerrs appointed by the University and to assist external examiner there shall be one internal examiner duly appointed by the University.
3. In event of assessment is to be carried out by reviewing the submissions of candidate, the examination shall be carried out jointly by internal as well as external evaluators by the University.

1.5 The Principal/HOD of the respective College shall send a list of students eligible and not eligible for the End-Term Examinations. Only those students will be allowed to appear in the End-Term Theory and Practical Examinations, whose names appear in the list of eligible students. It is the sole responsibility of the Institute/college to check the eligibility of the students before sending the list and Examination Form to the University.

Since the B.Ed. Course is governed by the rules and regulations stipulated by the NCTE, the 80% of the presence is required in theory classes and 90% of the presence is required in Practice Teaching/field based practicum/School Internship for qualifing in semester end examination.

1.6 Only those candidates who have passed the internal assessment of the particular course shall be permitted to appear in the examination. In case, the result of internal assessment is submitted during the examination, the external examination appeared shall be void for the further process.

1.7 Hall tickets shall be issued to each student by the Examination Department prior to the commencement of the examinations. No student shall be permitted to enter the Examination Hall without the Hall Ticket. The Students will be permitted to appear only in those examinations indicated in her / his Hall ticket. It is further clarified that the issuance of a Hall ticket is not an acknowledgement by the University that the student has fulfilled all the requirements which would entitle him/her to appear for the examination, such as, minimum attendance in any such case University may restrict the student to appear for the examination.

1.8 The result of the last semester shall not be declared (kept withheld) unless and until the candidate clears all the courses/papers of a program.

2. MARK SHEET

The Mark sheet would contain the performance of the student in terms of grades and it should contain photographs of the student, hologram of the IITE, QR Code, Name of the Institute where student studied in student Certificates and mode of Study.

3. ASSESSMENT AND EVALUATION:

CCE (Continuous and Comprehensive Evaluation):

There will be continuous and comprehensive evaluation for the Course. The learners will be evaluated internally as well as externally. As the university has adopted CCE module for the evaluation, the pattern scheme for evaluation will be as under:

3.1 SCHEME OF EVALUATION

INTERNAL EVALUATION (30 % of Marks)

Internal evaluation will include assignment/project/seminar/practical/MCQ test/Quiz/VIVA/ written test. It is up to the department/ College to select any of these. The ratio of marks will be 1:1:1:3 for each. The detailed Marks statement shall be submitted to Examination Section on or before the last day of the respective semester. Plagiarism of any kind in assignment/project work/ seminar/ any submission etc. will be punishable by the concerned departments.

EXTERNAL EVALUATION (70 % of Marks)

External evaluation will be semester end examination, theoretically and/or practically as case may be, conducted by the university at the end of each semester.

3.2 ASSESSMENT

There are two categories for evaluation: The student is eligible for Total for that subject, if there are more than 40 % of marks in Internal and External Evaluation.

3.3 GRADING SYSTEM AS PER UGC 10 POINT SCALE SYSTEM.

Cumulative Grade Point Average (CGPA): It is a measure of overall cumulative performance of a student over all semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed up to two decimal places.

i.e. $CGPA = \Sigma(C_i \times S_i) / \Sigma C_i$

where S_i is the SGPA of the ith semester and C_i is the total number of credits in that semester.

Semester Grade Point Average (SGPA): It is a measure of performance of work done in a semester. It is ratio of total credit points secured by a student in various courses registered in a semester and the total course credits taken during that semester. It shall be expressed up to two decimal places.

i.e $SGPA (S_i) = \Sigma(C_i \times G_i) / \Sigma C_i$

where C_i is the number of credits of the ith course and G_i is the grade point scored by the Students.

Grade Point: It is a numerical weight allotted to each letter grade on a 10-point scale.

Letter Grade: It is an index of the performance of students in a said course. Grades are denoted by letters O+, O, A+, A, B+, B and F.

3.4 PROCEDURE OF AWARDING THE GRADES

Marks and Award of Grades:

The following TABLE gives the marks, numerically grades, letter grades and classification to indicate the performance of the candidate.

Grading Pattern Table

Conversion of Marks to Numerical Grade, Letter Grade & Course Performance

Sr. No.	% of Marks	Letter grade	Grade point	Remarks
1	90 and above	O+	10	Outstanding
2	80 to 89	O	9	Excellent
3	70 to 79	A+	8	Very Good
4	60 to 69	A	7	Good
5	50 to 59	B+	6	Above Average
6	40 to 49	B	5	Average
7	0 to 39	F	0	Fail

4. CONFERNMENT OF DEGREES

A student shall be awarded degree if he/she has registered himself/herself, undergone the course of studies, completed the project reports / dissertation specified in the curriculum of his/her programme and earned the minimum Credits required within the maximum period of Course Duration + 2 years

5. MERITORIOUS AWARDS

5.1 The Prizes and Medals, the award of which are instituted by the University shall be presented at the Convocation to the awardees, if they choose to remain present, immediately after the conferment of the degrees. In other cases the same will be delivered to them through the Principal of the concerned College.

5.2 Gold Medal(s) shall be awarded on the basis of Total Marks obtained by the student in all the semesters. Medal will only be awarded for the Courses in which minimum 5 Students are enrolled in last semester.

5.3 If two or more students have secured the same Marks, then the marks secured by the students in the external examination only shall be taken into consideration in awarding the Gold Medals.

5.4 If both students also secure the same external marks, then both the students should be awarded the Gold Medal

5.5 The Rank Holders on the basis of Marks shall be awarded the University Gold medal for being First. The Second and third Rank holders shall be given rank certificates by the university. The University shall also issue Certificates indicating the name of the Medal awarded to the students.

5.6 The University may also consider issuing other Certificates of Merit or overall conduct at any convocation organized by the University.

5.7 A student who has been fined or has been expelled from the Hostel / College/University for any act of indiscipline shall not be eligible for the award of gold medal(s). A student who has failed in any course and has cleared the course in a Repeat Examination shall not be eligible for award of Gold Medals.

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Dr. Kalpesh Sorathia	Head, Department Of Botany, Tolani College of Arts And Science, Kachchh University
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Dr. Leena Dave	I/C Principal, Government Arts And Science College, Dahej, Veer Narmad South Gujarat University,
Dr. Alka Vyas	Former Head, Department of Botany, School of Sciences, Gujarat University.
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Dr. Anjanaben Chaudhari	Principal, Snatak Adhyapan Mandir, Vedachi

યુનિવર્સિટી ગીત

રાષ્ટ્રની ઉજળી આવતીકાલના અમે છીએ ઘડવૈયા,
અંધકારની સામે અડીખમ પ્રકાશના લડવૈયા,

તૂટે તિમિર તણાં હર બંધન . . .
આઇ.આઇ.ટી.ઇ. તુજને વંદન . . .(૨)

ઘડવૈયાનું ઘડતર કરતું ઉત્તમ વિદ્યાધામ ,
પરંપરાને પ્રયોગ કેરું થાય ઉચિત સન્માન,

તુજને કોટિ કોટિ અભિનંદન . . .
આઇ.આઇ.ટી.ઇ. તુજને વંદન . . . (૨)

સંસ્કૃતિનું રક્ષણ, આધુનિકતાનું આહ્વાહન,
સુરાષ્ટ્રના નિર્માણને સાર્થક કરતું ઉત્તમ શિક્ષણ,

પ્રગટે જ્ઞાન તણાં જ્યાં સ્પંદન . . .
આઇ.આઇ.ટી.ઇ. તુજને વંદન . . .(૨)

॥ न हि ज्ञानेन सदृशं पवित्रमिह विद्यते ॥

Indian Institute of Teacher Education

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