



GOVIND GURU TRIBAL UNIVERSITY, BANSWARA

FACULTY OF EDUCATION

(Applicable w.e.f. Academic Year 2018-2019)

# SYLLABUS

Integrated Programme of

**B.Sc. B.Ed.**

**Study & Evaluation Scheme**

**NOTICE**

- 1. Change in syllabus/ordinance/rules/regulations/ and books may from time to time, be made by amendment or remaking and a candidate shall, accept in so far as the university determines otherwise comply with any change that applies to years he/she has not completed at time ofchange.**
- 2. All court cases shall be subject to the jurisdiction GGTU of Banswara headquarter Banswara only and not any otherplace.**

**FACULTY OF EDUCATION  
SYLLABUS AND SCHEME OF EXAMINATION  
ORDINANCES FOR B.Sc. B.Ed. PROGRAMME**

**1. Programme and Duration:**

Integrated Programme of Teacher Education titled 'Bachelor of Science and Bachelor of Education' (B.Sc. B.Ed.) degree programme. The programme will be of four-year duration organized on the year-end examination pattern. Each year will consist of a minimum 200 days of instruction excluding examination.

**2. Equivalence:**

The course contents related to various core courses offered in the Programme are equivalent to similar courses offered in the B.Sc. Programme recommended by University of Govind Guru Tribal University, Banswara. The course contents of the professional education component are equivalent to that of B.Ed. of GGTU, Banswara and are in accordance with the norms and regulations for the B.Sc. B.Ed. Programme prescribed by the NCTE (2014). This degree B.Sc. B.Ed. is thereby equivalent to B.Sc. and B.Ed. degrees of the GGTU, Banswara.

On successful completion of the programme, students are eligible for admission to Master Degree Programmes in respective subjects in the GGTU, Banswara and other Indian/Foreign Universities.

**3. Eligibility and Admission:**

Candidates who have passed Senior Secondary 10+2 examination or any other examination recognized as equivalent thereto by the GGTU, Banswara with at least 50% marks in the aggregate are eligible for admission to the course.

The reservation for SC/ST/OBC/PWD (Person with Disability) SBS and other category shall be as per the rules of the Central Government/State Government whichever is applicable.

There will be as per B.A./B.Sc. B.Ed. test for admission in this course in all the colleges of Rajasthan. Candidates who have passed Senior Secondary Examination (10+2) in any faculty from Board of Secondary Education, Rajasthan, Ajmer, or any other board as equivalent to there to by the GGTU, Banswara, with at least 50% marks in the aggregate are eligible to apply for admission to the course, however SC/ST/OBC/SBC as well as physically challenged and widow or divorce women candidate of Rajasthan having at least 45 marks in aggregate in the senior secondary examination will be eligible to apply for admission.

**4. Attendance:**

A candidate will be permitted to appear in the annual examination only if s/he has pursued a regular course of study and attended at least 75% of the classes for all the course work and practicum, 90% for school internship.

**5. Medium of Instruction**

The medium of instruction and examination is English and Hindi.

## 6. Course Structure:

### Objectives:

- To promote capabilities for inculcating national values and goals as mentioned in the constitution of India.
- To act as agents of modernization and social change.
- To promote social cohesion, international understanding and protection of human rights and right of the child.
- To acquire competencies and skills needed for teacher.
- To use competencies and skills needed for becoming an effective teacher.
- To become competent and committed teacher.
- To be sensitive about emerging issues such as environment, population general equality, legal literacy etc.
- To inculcate logical, rational thinking and scientific temper among the students.
- To develop critical awareness about the social issues & realities among the students.
- To use managerial organizational and information & technological skills.

### Learning outcomes:

1. Competence to teach effectively two school subjects at the Elementary & secondary levels.
2. Ability to translate objectives of secondary education in terms of specific Programmes and activities in relation to the curriculum.
3. Ability to understand children's needs, motives, growth pattern and the process of learning to stimulate learning and creative thinking to faster growth and development.
4. Ability to use-

5. Individualized instruction
6. Dynamic methods in large classes.
7. Ability to examine pupils' progress and effectiveness of their own teaching with proper evaluation techniques.
8. Equipment for diagnosing pupil progress and effectiveness of their own teachings with proper evaluation techniques.
9. Readiness to spot talented and gifted children and capacity to meet their needs.
10. Ability to organize various school programmes, activities for pupil.
11. Developing guidance point of view in educational, personal and vocational matters.
12. Ability to assess the all-round development of pupils and to maintain a cumulative record.
13. Developing certain practical skill such as:
  - a. Black board work
  - b. Preparing improvised apparatus
  - c. Preparing teaching aids and ICT.
14. Interest and competence in the development of the teaching profession and education. Readiness to participate in activities of professional organizations.

## **PROGRAMME STRUCTURE AND SCHEME OF EXAMINATION**

### **A. Generic Course:**

<b>Year</b>	<b>Papers</b>
I Year	General Hindi
II Year	General English
III Year	General Studies I
IV Year	General Studies II
IV Year	Environmental Studies

**B. Elective Course:**

Content of Science Subject- A student has to opt any one Group from the following:

Group 1 Physics, Chemistry and Mathematics (I,II & III)
Botany, Zoology and Chemistry (I,II & III)

**C. Professional Education Course:**

Year	Papers
I Year	Childhood and Growing Up
	Contemporary India and Education
II Year	Language Across the Curriculum
	Learning and Teaching
III Year	Knowledge and Curriculum
IV Year	Assessment for Learning
IV Year	Educational Management & Creating, inclusive school
IV Year	Gender, School and Society
IV Year	Understanding the Self
IV Year	Understanding ICT and Its Application
IV Year	Drama & Art

**D. Ability Enhancement Courses:**

Year	Papers
I Year	Guidance & Counseling in School
II Year	Yoga & Sports
II Year	Action Research

**E. Pedagogical courses: Pedagogy of a School subject II Year and III Year- A candidate shall be required to offer any two papers form the following-**

Pedagogy of General Science	Pedagogy of Physics
Pedagogy of Chemistry	Pedagogy of Biology
Pedagogy of Mathematics	

<b>B.Sc. B.Ed. Part I Examination - Total Marks : 1000</b>
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<b>B.Sc. B.Ed. Part II Examination - Total Marks : 1200</b>
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<b>B.Sc. B.Ed. Part III Examination - Total Marks : 1200</b>
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<b>B.Sc. B.Ed. Part IV Examination - Total Marks : 1100</b>
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<b>Total      4500</b>
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## B.Sc. B.Ed. Part I Examination

Course No.	Course Code	Name of Paper	Periods per Week	Periods per Year	Evaluation				
					Durati ion	External	Inter nal	Total	Min. for Pass
<b>Genetic Course*</b>									
GC 1		General Hindi	4	124	3	100	-	100	36
<b>Elective Course</b>									
EL 1		Physics (I)	3	93	3	40	10	50	18
		Physics (II)	3	93	3	40	10	50	18
		Physics (III)	3	93	3	40	10	50	18
		Physics Practical	4	124	5	-	50	50	18
EL 2		Chemistry I	3	93	3	40	10	50	18
		Chemistry II	3	93	3	40	10	50	18
		Chemistry III	3	93	3	40	10	50	18
		Chemistry Practical	4	124	5	-	50	50	18
EL 3		Zoology I	3	93	3	40	10	50	18
		Zoology II	3	93	3	40	10	50	18
		Zoology III	3	93	3	40	10	50	18
		Zoology Practical	4	124	5	-	50	50	18
EL 4		Botany I	3	93	3	40	10	50	18
		Botany II	3	93	3	40	10	50	18
		Botany III	3	93	3	40	10	50	18
		Botany Practical	4	124	5	-	50	50	18
EL 5		Mathematics I	4	124	3	60	10	70	25
		Mathematics II	4	124	3	55	10	65	23
		Mathematics III	4	124	3	55	10	65	23
<b>Professional Education Course</b>									
PEC 1		Childhood and Growing Up	4	124	3	80	20	100	36
PEC2		Contemporary India and Education	4	124	3	80	20	100	36
<b>Ability Enhancement Course</b>									
AEC 1		Guidance & Counseling in School	2	62	2	40	10	50	18
PCPI		Open Air Session/ SUPW Camp (Internal Practical) 5 days Open					50	50	18

		Air Session Shall be organize out of the college campus.							
				<b>Total</b>				<b>1000</b>	

**Total 1000**

### B.Sc. B.Ed. Part II Examination

Course No.	Course Code	Name of Paper	Periods per Week	Periods per Year	Evaluation				
					Duratio n	External	Inter nal	Total	Min. for Pass
<b>Genetic Course*</b>									
GC 2		General English	4	124	3	100	-	100	36
<b>Elective Course</b>									
EL 6		Physics (I)	3	93	3	40	10	50	18
		Physics (II)	3	93	3	40	10	50	18
		Physics (III)	3	93	3	40	10	50	18
		Physics Practical	4	124	5	-	50	50	18
EL 7		Chemistry I	3	93	3	40	10	50	18
		Chemistry II	3	93	3	40	10	50	18
		Chemistry III	3	93	3	40	10	50	18
		Chemistry Practical	4	124	5	-	50	50	18
EL 8		Zoology I	3	93	3	40	10	50	18
		Zoology II	3	93	3	40	10	50	18
		Zoology III	3	93	3	40	10	50	18
		Zoology Practical	4	124	5	-	50	50	18
EL 9		Botany I	3	93	3	40	10	50	18
		Botany II	3	93	3	40	10	50	18
		Botany III	3	93	3	40	10	50	18
		Botany Practical	4	124	5	-	50	50	18
EL 10		Mathematics I	4	124	3	60	10	70	25
		Mathematics II	4	124	3	55	10	65	23
		Mathematics III	4	124	3	55	10	65	23
<b>Professional Education Course</b>									
PEC 3		Language Across the Curriculum	4	124	3	80	20	100	36
PEC 4		Learning & Teaching	4	124	3	80	20	100	36
<b>Ability Enhancement Courseb(AEC)</b>									
AEC 3		Yoga & Sports	2	62	2	40	10	50	18
AEC 4		Action Research	2	62	2	40	10	50	18



Pedagogy Courses ( Candidate Shall be required to offer any two paper from the following for Part –I and other for Part – II)									
PC (Part-I)		Pedagogy of School Subject	4	124	3	80	20	100	36
PC 1		Pedagogy of General Science							
PC 2		Pedagogy of Physics							
PC 3		Pedagogy of Chemistry							
PC 4		Pedagogy of Biology							
PC 5		Pedagogy of Mathematics							
Teaching Enhancement Programme (TEP) (Internal Assessment)									
(TEP- I)		Pre- Practice Teaching (Internal Practical)	3 WEEKS				100	100	36
		1. Micro Teaching					20		
		2. Unit Plan & Blue Print					05		
		3. Observation of Demonstration lesson					05		
		4. Lesson Plan( Related one Pedagogy Subject) Seven Lesson in Which one Technology based lesson is compulsory					30		
		5. Simulated Teaching					20		
		6. Criticism (only one Pedagogy subject)					10		
		7. TLM workshop					05		
		8. Case Study & Project work					05		
								1200	

**Total 1200**

### B.Sc. B.Ed. Part III Examination

Course No.	Course Code	Name of Paper	Periods per Week	Periods per Year	Evaluation				
					Durati on	External	Inter nal	Total	Min. for Pass
<b>Genetic Course*</b>									
GC 3		General Studies I	4	124	3	100	-	100	36
<b>Elective Course</b>									
EL 11		Physics (I)	3	93	3	40	10	50	18
		Physics (II)	3	93	3	40	10	50	18

		Physics (III)	3	93	3	40	10	50	18
		Physics Practical	4	124	5	-	50	50	18
EL 12		Chemistry I	3	93	3	40	10	50	18
		Chemistry II	3	93	3	40	10	50	18
		Chemistry III	3	93	3	40	10	50	18
		Chemistry Practical	4	124	5	-	50	50	18
EL 13		Zoology I	3	93	3	40	10	50	18
		Zoology II	3	93	3	40	10	50	18
		Zoology III	3	93	3	40	10	50	18
		Zoology Practical	4	124	5	-	50	50	18
EL 14		Botany I	3	93	3	40	10	50	18
		Botany II	3	93	3	40	10	50	18
		Botany III	3	93	3	40	10	50	18
		Botany Practical	4	124	5	-	50	50	18
EL 15		Mathematics I	4	124	3	60	10	70	25
		Mathematics II	4	124	3	55	10	65	23
		Mathematics III	4	124	3	55	10	65	23
<b>Professional Education Course</b>									
PEC 5		Knowledge and Curriculum	4	124	3	80	20	100	36
<b>Pedagogy Courses ( Candidate Shall be required to offer any two paper from the following for Part –I and other for Part – II)</b>									
PC (Part –I)		Pedagogy of School Subject	4	124	3	80	20	100	36
PC 1		Pedagogy of General Science							
PC 2		Pedagogy of Physics							
PC 3		Pedagogy of Chemistry							
PC 4		Pedagogy of Biology							
PC 5		Pedagogy of Mathematics							
<b>Teaching Enhancement Programme (TEP) (Internal Assessment)</b>									
TEP II		Preporty lesson & Integrated lesson Activevity based (Second Pedagogy sub.) only five lesson per activites.					50	50	20
<b>School Attachment Programme (SIP)</b>									
SIP I		School Internship (Phase I, 4 Weeks) Internal Assessment Engaged with	4 WEE			Criticis m 10	150	150	60

		the field: Task and Assignment for Course -- & --. Including Criticism in both Pedagogy subjects. Criticism (Related Two Pedagogy Subject) 10% Technology based lesson is compulsory	K			marks each pedagogy subject			
SAP II		Final Lesson (External Assessment)				100		100	40
				<b>Total</b>				<b>1200</b>	

**Total 1200**

**Note- Third Year B.Sc. B.Ed.**

- a. Practice Lessons- Each student will give 20 Class- room lessons as far as possible equally distributed in the 2 methods but not less than 18 lessons per method. These lessons are to be given in the Secondary/higher secondary school.
- b. Technology Based Lessons- Student teacher will conduct at least two lessons using modern technology like audiovisual cassette, T.V. Program, Internet, Computerized Programme etc. Marks calculated out of 130 are to be given for the technology-based lessons. If because of some reasons it becomes impossible to conduct these lessons in the schools, they may be conducted as simulation lesson. Technology-based lessons may be recorded as videos in the internship programme by the student teacher personally.
- c. Lessons observation- Each students will observe 6 lessons in each methods of other students teacher and 2 lessons of actual teacher in the evenly distributed manner throughout the year.

**B.A. B.Ed. Part IV Examination**

Course No.	Course Code	Name of Paper	Periods per Week	Periods per Year	Evaluation				
					Durat ion	External	Inter nal	Total	Min. for Pass
<b>Genetic Course*</b>									
GC 4		General Studies II	4	124	3	100	-	100	36
GC 5		Environmental Studies	4	124	3	100	-	100	36
<b>Professional Education Course</b>									
PEC 7		Educational Management & Crating an inclusive School	5	124	3	80	20	100	36

PEC 8		Gender, School and Society	5	124	3	80	20	100	36
PEC 9		Assessment of learning	5	124		80	20	100	36
PEC 10		Understanding the self	5	124		50	50	100	36
PEC 11		Understanding ICT and its Application in Education	5	124		50	50	100	36
PEC 12		Drama & Art	5	124			50	50	18
SIP IV		School Internship (Phase II, 16 Weeks) Internal Assessment Engagement with the field: Tasks and Assignment for Courses 1 & 9	16 Weeks				150	150	60
SIP V		Viva-Voce for School Internship subject				100		100	40
SIP VI		II Pedagogy Subject Final lesson				100		100	40
							<b>Total</b>	<b>1100</b>	

**Total 1100**

#### **F. Examination**

1. There shall be a University examination at the end of each year as per details of the scheme of examination.
2. A candidate shall be admitted to the next higher class only if s/he passes his/her Part I/ Part II / Part III Examination as per rules mentioned hereinafter.
3. In order to qualify for B.Sc. B.Ed. degree a candidate should obtain a minimum of 36% marks in theory and practical separately, wherever applicable in each subject in each year of the course and 40% marks in Pre Internship in III Year and also in Internship in Teaching in the Fourth Year.
4. Candidate shall not be permitted to change the core subjects in subsequent years of the course.
5. However, in the case of General Hindi/General English, and Environmental Education and Sustainable Development and Computer Fundamental, Internet & MS office, if a candidate fails in Part I s/he would get two more chances for clearing this paper either along with the supplementary examination in Part I or with the main examination in Part II. Non-appearance or absence from the examination of this paper will be counted as a chance.

6. A candidate who fails in more than two subjects but passes in practical s/he will be required to appear again in all the subjects (theory) except practical only as an ex-student.
7. A candidate will be given a maximum of three chances at the main examination and the corresponding supplementary examination in any year of the course. If s/he does not pass the examination even thereafter, s/he will not be eligible for readmission to any year of the programme.
8. If a candidate fails in the Pre-Intern -ship/Internship in Teaching or is unable to complete Pre-Internship/Internship in teaching but passes in all other subjects s/he will be required to repeat the complete Pre-Internship/ Internship in Teaching' in the next academic session along with regular candidates.
9. Division will be awarded to the successful candidates only after the Part IV examination and on the basis of cumulative total of marks obtained in all the four years of the course in all the subjects including Internship in Teaching but excluding the core subjects i.e., General Hindi/General English, and Environmental Education and Computer Application.

#### **G. Evaluation**

Evaluation of Theory Papers: Some theory papers will carry a weightage of 100 marks, out of which 80 marks will be for external University Examination and 20 marks will be for internal sessional work. Out of 20 mark, 10 marks will be for sessional and 10 marks will for mid-term test. In some of the papers carrying 80 marks, 70 marks will be for external and 10 marks will be internal sessional works. In some of the papers carrying a weightage of 50 marks, 40 marks will be for external University Examination and 10 marks will be for internal sessional work. Out of 10 mark, 5 marks will be for sessional and 5 marks will be for mid-term test.

1. Each question paper (80 Marks) will have three sections- Section A will contain 10 very short answer type questions and the candidate will be required to attempt the entire ten questions. Each question will carry two marks. Section B will contain 10 short answer type questions out of which a candidate is required to attempt any 5 questions (one question per unit to be attempted out of two questions per unit). Each question will carry 6 marks, Section C will have 5 question and a candidate will be required to attempt any three questions. There will be 10 marks for each question.
2. Each question paper (40 Marks) will have three sections- Section A will contain 4 very short answer type questions and the candidate will

be required to attempt all four questions. Each question will carry 2 marks. Section B will contain 3 short answer type questions out of which a candidate is required to attempt any 2. Each question will carry 6 marks, Section C will have 3 question with a choice of attempting any 2 questions. Essay type questions will carry 10 marks each.

3. Very short answer type questions would aim at testing of critical thinking, knowledge of concepts facts, definitions, laws, principles, generalization etc. and understanding of principles and concepts.
4. Short answer type questions would aim at testing knowledge, definitions, laws, generalization etc. and understanding of concepts.
5. Essay type questions ae to aim at testing the abilities of critical thinking and application of principles taught in theory.

## FIRST YEAR B.Sc. B.Ed.

COURSE	NOMENCLATURE
GC 1	General HINDI
EL - 1	Physics (I)
	Physics (II)
	Physics (III)
	Physics Practical
EL - 2	Chemistry I
	Chemistry II
	Chemistry III
	Chemistry Practical
EL - 3	Zoology I
	Zoology II
	Zoology III
	Zoology Practical
EL- 4	Botany I
	Botany II
	Botany III
	Botany Practical
EL- 5	Mathematics I
	Mathematics II
	Mathematics III
PEC- 1	Childhood and Growing Up
PEC- 2	Contemporary India and Education
AEC- 1	Guidance & Counselling in School
PCP:1	OPEN AIR SESSION

## Generic Course GC: 1

प्रथम वर्ष बी.एस.सी. बी.एड.

सामान्य हिन्दी

- नोट :
1. उक्त पाठ्यक्रम में 5 इकाई होंगी एवं प्रत्येक इकाई से 20 प्रश्न होंगे।
  2. प्रश्न पत्र में 100 प्रश्न होंगे, प्रत्येक प्रश्न 1 अंक का होगा, इस प्रकार प्रश्न पत्र 100 अंको का होगा।
  3. प्रश्न पत्र में प्रश्न वस्तुनिष्ठ प्रकार (Objective type) के होंगे।

### इकाई-1

1. हिन्दी भाषा का उद्भव एवं विकास
2. हिन्दी की उपभाषाओं का सामान्य परिचय
3. देवनागरी लिपि : नामकरण, गुण, दोष एवं सुधार का इतिहास
4. वर्ण विचार : स्वर, व्यंजन
5. शब्द विचार : तत्सम, तद्भव, देशज व विदेशी

### इकाई-2

1. विकारी शब्द : सामान्य परिचय एवं भेद।  
(संज्ञा, सर्वनाम, क्रिया, विशेषण)
2. अविकारी शब्द : क्रिया विशेषण, संबंधबोधक, समुच्चयबोध,  
विस्मयादिबोधक, निपात (भेद उदाहरण)
3. शब्द रचना एवं शब्द शुद्धीकरण : (सन्धि, समास, उपसर्ग, प्रत्यय)
4. वाक्य रचना एवं वाक्य शुद्धीकरण : शब्द क्रम, वाक्य भेद, उदाहरण।
5. शब्द ज्ञान - पर्यायवाची, विपरीतार्थी, शब्द-युग्म, वाक्यांश बोधक एक शब्द, समश्रुत भिन्नार्थक शब्द।

### इकाई-3

1. लोकोक्तियाँ, मुहावरे
2. कार्यालयी पत्र : स्वरूप, पत्र प्रकार (औपचारिक, अनुस्मारक, अर्द्ध



सरकारी, प्रेस विज्ञप्ति, कार्यालयी पत्र लेखन के चरण परिपत्र)।

3. अँग्रेजी के पारिभाषिक (तकनीकी) शब्दों के समानार्थक हिन्दी शब्द
4. अनुवाद : पदनाम, उपाधि एवं वाक्यांश।

#### इकाई-IV

1. कम्प्यूटर परिचय : विकास यात्रा, घटक, कार्य प्रणाली
2. भाषाई कम्प्यूटर : यूनीकोड पूर्व स्थिति, यूनीकोड वर्तमान स्थिति, आवश्यक औज़ार (वर्ड प्रोसेसिंग कांट प्रबंधन, विविध तकनीक)
3. हिन्दी विकीपीडिया का उपयोग, ब्लॉग-प्रकाशन, इण्टरनेट का उपयोग, ई-मेल।
4. कोश : प्रयोजन, प्रयोग विधि, प्रकार (सामान्य कोश, समांतर कोश, तकनीकी कोश)।
5. फिल्म समीक्षा एवं पुस्तक समीक्षा।

## **Elective Course**

### **COURSE CURRICULAM AND SYLLABUS OFFOUR YEAR INEGRATED COURSE**

#### **PHYSICS**

**Each theory paper in the annual examination shall have three sections.**

**Section A** shall contain one compulsory question of 5 marks having 10 parts. Two parts shall be set from each unit. The candidate is required to answer each part in about 20 words.

**Section B** shall contain five compulsory questions of 5 marks each with internal choice .One question with internal choice will be set from each unit .The answer may be given in approximately 250 words.

**Section C** shall contain four descriptive questions covering all units and candidate has to answer any two questions of ten marks each. The answer may be given in approximately 500 words. There can be two parts in a question from this section.

**In total the candidate has to answer eight questions in each theory paper.**

#### **FIRST YEAR B.Sc. B.Ed. INTEGRATED COURSE**

##### **PAPER-I**

##### **MECHANICS OF PARTICLES, RIGID BODIES AND CONTINUOUS MEDIA**

**Marks :50**

**External :40**

**Internal :10**

##### **UNIT - I**

Laws of motion, conservation of energy and momentum, transformation equations for rotating frame, centripetal and Coriolis accelerations, Coriolis force, Coriolis force due to earth's rotation – experimental demonstration by Foucault pendulum.

Motion under a central force, conservation of angular momentum, Kepler's laws.

##### **UNIT – II**

Fields and potential, gravitational field and potential due to spherical bodies, Gauss's and Poisson's equations, gravitational self energy.

Two body problem, reduced mass, scattering and scattering cross sections, illustrations, Rutherford scattering by hard spheres, centre of mass and laboratory reference frames, binary stars.

##### **UNIT – III**

System of particles, centre of mass, calculation of centre of mass of regular bodies, angular momentum, equations of motion, conservation theorems for energy, momentum and angular momentum, system of variable mass, elastic and inelastic collisions, rigid body, degrees of freedom, Euler's theorem.

#### UNIT – IV

Molecular rotations (as rigid bodies), moment of inertia, di and tri atomic molecules, intrinsic spin, precessional motion, motion of top, gyroscope. Elastic constants for an isotropic solid, their inter relation, torsion of a cylinder, bending of beam, applications to cantilever.

#### UNIT – V

Kinematics of moving fluid, equation of continuity, Euler's law for fluidity.

Viscous fluids, streamline and turbulent flow, flow through a capillary tube, Poiseuille's law, Reynold's number, Stoke's law, theory of rotation viscometer, effect of temperature and pressure on the viscosity of liquids.

#### **Text and Reference Books:**

1. E.M. Purcell, Editor, Berkeley Physics Course, Vol. 1, Mechanics, McGraw Hill.
2. R.P. Feynmann, R.B. Lighton, M. Sands, The Feynmann Lectures in Physics, Vol.I, B.I. Publications, Bombay, Delhi, Calcutta, Madras.

**PAPER-II**  
**OSCILLATIONS, WAVES AND ACOUSTICS**

**Marks :50**  
**External :40**  
**Internal :10**

**UNIT - I**

**Free oscillations of simple systems:** Equilibrium; concept of potential well, small oscillations approximation, solutions, linear and transverse oscillations of a mass between two springs, diatomic molecule, reduced mass concept.

**Damped and forced oscillations:** Damped oscillations; critical damping, Q of an oscillator. Forced oscillator with one degree of freedom; Transient and steady state oscillations, resonance energy absorption, low and high frequency responses.

**UNIT - II**

**Free oscillations of system with two degrees of freedom:** Two dimensional oscillator; normal modes, longitudinal and transverse oscillation of coupled masses, energy transfer between modes, coupled pendulum.

**Fourier analysis:** Fourier series and Fourier coefficients; simple examples (square wave, saw-tooth wave, half and full wave rectifier), use of exponential representation for harmonic oscillations, expression for Fourier coefficients. Non-periodic disturbance; representation by Fourier integral, Fourier transform. Case of a wave train of finite length, constancy of  $f \times f \cdot k$  (the uncertainty product).

**UNIT - III**

**Wave equation:** Waves in a one-dimensional chain of particles; classical wave equation; wave velocity, boundary conditions and normal modes, dispersion relations, dispersion waves, acoustic and optical modes.

**Waves in continuous media:** Speed of transverse waves on a uniform string, speed of longitudinal waves in a fluid, energy density and energy transmission in waves, typical measurements, dispersion in waves, group velocity and phase velocity, their measurements.

**Superposition of waves:** Linear homogenous equations and the superposition principle, interference in space and energy distribution; beats and combination tones.

**UNIT -IV**

**Ultrasonics:** Production, detection, and applications of ultrasonic waves

**Vibrations in bounded systems:** Normal modes of a bounded system; harmonics, the quality of sound, Chladni's figures, Vibration of a drum. Noise and Music; Limits of human audibility; intensity and loudness, bel and decibel. Music scale and musical instruments.

**UNIT - V**

**Reflection, refraction, and diffraction of sound:**

Acoustic impedance of a medium, percentage reflection, and refraction at a boundary, impedance matching for transducers. Diffraction of sound; principle of a sonar system, sound ranging.

**Applied acoustics:** Transducers and their characteristics, recording and reproduction of sound, measurement of frequency, velocity, waveform, and intensity. The acoustics of halls, reverberation period, Sabine's formula.

**Text and Reference Books:**

1. Waves and Oscillations, Berkley Physics Course Vol. III
2. Vibrations and waves, I.G. Main (Cambridge University Press)
3. The Physics of Vibrations and Waves, H.J. Pain, McMillan (1975).

**PAPER-III  
ELECTRICITY AND MAGNETISM**

**Marks :50**  
**External :40**  
**Internal :10**

**UNIT- I**

Electric Field: Coulombs law, unit of charge (SI and other systems of units). Conservation and quantization of charge. Field due to different charge distributions, monopole, dipole, quadrupoles, line charge, sheet charge. Torque on a dipole in uniform field and non-uniform fields, flux of an electric field. Gauss.s law - applications to deduce **E** fields, force per unit area on the surface of a charged conductor. Potential: Line integral of electric field and electrical potential. Field as the gradient of potential. Potential energy of a system of charges and its calculation in various configurations. Field equations for **E** in vacuum. Energy associated with **E** field. Differential form of Gauss.s law: Poisson.s equation, Laplace.s equation, boundary conditions and uniqueness theorems. Electric field around conductors: induced charges, field and potential inside a conductor, field near the surface of a conductor, method of images.

**UNIT - II**

Electric fields in matter: atomic and molecular dipoles, induced dipoles, polarizability tensor, electronic and molecular contributions. Electrical field caused by polarized matter, **E** and **D** fields, permittivity, dielectric constant. Capacitor filled with dielectric, field equations in presence of dielectric. The field of a polarized sphere, dielectric sphere in a uniform field. Energy in dielectric systems. Polarizability and susceptibility, frequency dependence of polarizability, Clausius-Mossotti equation. Magnetic field: Magnetic field **B** seen through Lorentz force on a moving charge, unit for B field, magnetic dipoles in atoms and molecules, gyromagnetic ratio. Magnetic field due to currents: Biot and Savart.s law. Field equations in magnetostatics, Ampere.s law. Fields due to a straight wire, magnetic dipole, circular current and solenoid. Magnetic fields in matter. Magnetizing current, magnetization vector, **H** and **B** fields, magnetic permeability, susceptibility. Comparison of magnetostatics and electrostatics.

**UNIT - III**

Electrical current: current density and current; nonsteady currents and continuity equations. Electrical conductivity, resistivity, conductance and their temperature dependence. Thermo electric current and dark current, non-ohmic circuitry, thermistor. Varying current. Rise and decay of currents in LR and CR circuits, time constant, integrating and differentiating circuits, electrical shielding. Study of a discrete LC transmission line.

**UNIT - IV**

Alternating currents: Skin effect for resistance at high frequencies, complex impedance, reactance, impedances of LCR series and parallel circuits, resonance, Q factor, power dissipation and power factor. AC bridges: Anderson.s, deSauty.s and Owens bridges, Self and mutual inductance. Measurement of mutual inductance by Carry Foster Method, Coupled circuits and Transformers.

**UNIT - V**

Ballistic Galvanometer (moving coil type), its distinction from beat type. B.G. differential equation and its solution under different conditions of damping. Critical damping, over damping. Logarithmic

decrements, charge sensitivity, current sensitivity, determination of B using search coil and B.G. Determination of high resistance using B.G. Factors for sensitivity. B.G. constant. Measurement of mutual inductance by Carey Foster's bridge by B.G. Measurement of small resistance by Kelvin's double bridge.

**Text and Reference Books:**

1. E.M. Purcell, Ed. Berkeley Physics Course, Vol. 1, Electricity and Magnetism McGraw Hill.
2. D. Halliday and R. Resnick, Physics, vol. 2, Wiley Eastern, New Delhi.
3. D.J. Griffiths, Introduction to Electrodynamics, Prentice Hall of India.
4. Reitz and Milford, Electricity and Magnetism, Addison Wesley.
5. A.S. Mahajan and A.A. Rangawala, Electricity and Magnetism, Tata McGraw Hill.
6. A.M. Portis Electromagnetic Fields
7. S.S. Atwood, Electricity and Magnetism, Dover publication.
8. A.F. Kip, Fundamentals of Electricity and Magnetism, International Student Edition, McGraw Hill and Kogakusha, 1969

## PHYSICS PRACTICALS

**Note :** Students are expected to perform sixteen experiments in all taking the eight experiments from each section. One experiment from section A and one from section B will be set in the examination paper. The distribution of marks in the practical examination will be as follows:

(i) Two experiments	30 Marks
For each experiment, distribution of marks will be as follows:	
Figure :	2
Formula/Theory :	2
Observation :	7
Calculation and Result :	3
Precautions :	1
(ii) Viva voce	10
(iii) Records	10
<b>Total</b>	<b>50 Marks</b>

### LIST OF EXPERIMENTS

#### Section-A

1. Determination of elastic constants  $Y$ ,  $f'$ ,  $f''$  and  $K$  by Searle's method.
2. Determination of thermal conductivity „ $K$ . of a bad conductor by Lee's method.
3. Determination of  $J$  by Callender and Barne's method.
4. Study of temperature variation of surface tension by Jaegers method.
5. Study of free fall of a body: use of a digital timer to get time and velocity at different depth and analysis.
6. Study of collision in two dimension
7. Kater's pendulum, precise setting, analysis and determination of value of acceleration due to gravity „ $g$ . at a place.
8. Study of damping of a bar pendulum under various kinds of damping mechanisms.
9. To determine coefficient of damping  $k$ , relaxation time  $T$  and quality factor of a damped SHM using a Simple pendulum.
10. Study of dependence of period of oscillations of a spring or rubber band on mass and spring constant.
11. To determine the velocity of sound in air at room temperature with Kundt's tube.
12. Using scattering to deduce the nature of potential hump or well (two dimensional)
- 13 Study of laws of parallel and perpendicular axes for estimation of moment of inertia.
14. Computer simulation of equations of motion for a system of particles.
15. Computer simulation of molecular rotations, as rigid bodies.
16. Study of motion of a top and a gyroscope.
17. Study of torsion of a wire; dependence on radius, length, torque and material (static method)
18. To determine the modulus of rigidity of the material of a wire by statistical method using Bortan's Apparatus
19. To determine the value of modulus of rigidity of the material of a given wire by dynamical method using Maxwell's needle
20. Study of flow of liquids through capillaries: laminar and turbulent flow stages, capillaries
21. To determine the coefficient of viscosity of water by Poiseville's method
22. Studying the fall of solids through a liquid.

23. To determine the coefficient of viscosity of a liquid (glycerine or castor oil) by Stoke.s method
24. Study of air flow through a capillary : U- tube with a long capillary fitted on one arm, mercury level Differencepushing air.
25. To determine Poisson.s ratio of rubber

#### **SECTION -B**

1. Calibration of Carey Fosters bridge wire and determination of the specific resistance of the material of the given wire.
2. Measurement of thermo e.m.f.
3. To study growth and decay of current in R.C. circuit and determine the time constant.
4. To determine impedance of L-R circuit and find phase relation ship in current and voltage.
5. To determine the constants of a ballistic galvanometer. Current and charge sensitivity, time period, log decrement andgalvanometer resistance.
6. To determine intensity of magnetic field using search coil and ballistic galvanometer.
7. To determine high resistance by method of leakage. Measure leakage resistance of a condenser.
8. To determine low resistance by Kelvin.s double bridge.
9. Determination of dielectric constant of a given liquid.
10. To determine induStance of a coil using Anderson.s method.
11. Desauty.s bridge method for comparison of two capacitors.
12. To determine mutual inductance by Carry Foster.s Method
13. Study of the impedance of a capacitor of varying frequencies to measure C.
14. Response curve for LCR circuits series resonance.
15. Study of a discrete LC transmission line.
16. 16. Response curve for LCR circuit parallel resonance
17. Measurements of electric charge and related quantities using an electrometer.
18. Study of potential distribution in a given geometrical configuration.
19. Mapping of electric fields for specified configurations.
20. Study of magnetic field using a vibration magnetometer.
21. Study of the rise and decay of current in a RL circuits.
22. Characteristics of a choke.
- 23 Study of the impedance of an inductor at varying frequencies to measure R and L



# FIRST YEAR B.Sc. B.Ed. CHEMISTRY

## PAPER I INORGANIC CHEMISTRY

Marks :50  
External :40  
Internal :10

### UNIT - I

**Covalent Bond:** Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions. Valence Shell Electron

Pair Repulsion (VSEPR) theory, regular and deviation from regular geometry, MO theory, homonuclear and heteronuclear (CO, NO, HF and HCl) diatomic molecules, multi center bonding in electron deficient

molecules, bond strength and bond energy, percentage ionic character from dipole moment and electronegativity difference.

**Ionic Solids :** Ionic structures, radius ratio effect and coordination number, limitation of radius ratio rule, lattice defects, semiconductors, lattice energy and Born Haber cycle, hydration energy and solubility of ionic solids, polarizing power and polarizing of ions. Fajan's rule, Metallic bond - free electron, valence bond and band theories.

**Weak Interactions:** Hydrogen bonding, Van der Waals forces.

### UNIT - II

**s-Block Elements :** Comparative study, diagonal relationships, salient features of hydrides, solvation and complexation tendencies including their function in bio-systems, an introduction to metal alkyls and aryls.

**Chemistry of Noble Gases :** History of discovery, separation of inert gases, chemical properties of the noble gases, chemistry of xenon, structure and bonding in xenon compounds.

### UNIT - III

**Group 13 :** General properties, oxides, hydroxide, halides and hydrides of boron, diborane and higher

boranes, borohydrides, borazine, oxyacids of boron, borax and borax bead test.

**Group 14 :** General properties, inert pair effect, halides, oxides, silicates, silicones, graphitic compounds, carbides, cyanides and carbonyls, brief idea of fullerenes.

**Group 15 :** General properties, hydrides, azides, halides, oxides and oxyacids of phosphorous, nitrogen fixation, fertilizers.

### UNIT - IV

**Group 16 :** General properties, polymorphism, hydrides, halides, oxides and oxyacids of sulphur, thiosulphuric acid and salts, thionic acids and their salts, tetrasulphur tetranitride.

**Group 17 :** General properties hydrogen halides, oxides and oxyacids of halogens, interhalogen compounds polyhalides, basic properties of halogens.

#### UNIT - V

**Non-Aqueous Solvents :** Physical properties of a solvent, types of solvents and their general characteristics, Differentiating and leveling solvents, reactions in non-aqueous solvents with special reference to liquid  $\text{NH}_3$  and liquid  $\text{SO}_2$ .

**Acids and Bases :** Arrhenius, Bronsted - Lowry, Lax - Flood, solvent system and Lewis concepts of acid and bases, Usanovitch definition.

#### BOOKS RECOMMENDED

1. Concise Inorganic Chemistry : J.D. Lee
2. General Inorganic Chemistry : J.A. Duffy, Longman (2nd Ed.)
3. Principles of Inorganic Chemistry : B.R. Pun and L.R. Sharma.
4. Basic Inorganic Chemistry : F.A. Cotton and G. Wilkinson, Wiley Eastern.
5. Molecular Geometry : R.J. Gillespie, Van Nostrand Reinhold.
6. Inorganic Chemistry (Hindi ed.) : Suresh Ameta, A. Sharma and M. Mehta, Himanshu Publication.

## PAPER II

### ORGANIC CHEMISTRY

Marks :50  
External :40  
Internal :10

#### UNIT - I

**Structure and Bonding** : Localized and delocalized chemical bond, Van der Waals interaction, charge transfer complexes, resonance, hyperconjugation, aromaticity electrometric, inductive and field effects, hydrogen bonding.

**Mechanism of Organic Reactions** : Curved arrow notation, drawing electron movements with arrows, half-headed and double-headed arrows, types of organic reactions, energy considerations.

**Reactive Intermediates** : Carbocations, carbanions, free radicals, carbenes, arynes and nitrenes, their formation and stabilities.

Methods of determination of reaction mechanism (product analysis, intermediates, isotope effects, kinetic and stereochemical studies).

#### UNIT- II

**Stereochemistry of Organic Compounds** : Concept of isomerism, types of isomerism.

**Optical Isomerism** : Elements of symmetry, molecular chirality, enantiomers, stereogenic centre, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centers, diastereomers, threo and erythro diastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization.

Relative and absolute configuration. sequence rules. D and L, R and S systems of nomenclature. Geometric isomerism- determination of configuration of geometric isomers. E and Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds.

Conformational isomerism- conformational analysis of ethane and n-butane; conformations of cyclohexane, axial and equatorial bonds, conformation of mono substituted cyclohexane derivatives. Newman projection and Sawhorse formulae, Fischer and Flying Wedge formulae.

Difference between configuration and conformation.

#### UNIT - III

**Alkanes** : General methods of formation, physical & chemical properties. Mechanism of free radical substitution in alkanes with reference to halogenation, orientation, reactivity and selectivity.

**Cycloalkanes** : Nomenclature, methods of formation, chemical reactions, Baeyer's strain theory and its

limitation, ring strain in small rings (cyclopropane and cyclobutane), theory of strainless rings, the case of

cyclopropane ring: banana bond.

**Alkenes, Dienes and Alkynes** : Brief introduction of alkenes, their formation with reference to mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, regioselectivity in alcohol dehydration The Saytzeff rule, Hofmann elimination, physical properties and relative stabilities of alkenes.

**Chemical Reactions of Alkenes** : mechanisms involved in hydrogenation, electrophilic and free radical additions, Markownikoff's rule, hydroboration-oxidation, Oxymercuration-reduction, epoxidation, ozonolysis, hydration, hydroxylation and oxidation with  $\text{KMnO}_4$  polymerization of alkenes, substitution at the allylic and vinylic positions of alkenes, industrial applications of ethylene and propene.

**Nomenclature and Classification of Dienes** : Isolated, conjugated and cumulated dienes, structure of fallenes and butadiene, methods of formation, polymerization, chemical reactions- 1,2 and 1,4- additions, Diels - Alder reaction.

**Alkynes** : Acidity of alkynes, mechanism of electrophilic and nucleophilic addition reactions, hydroboration, metal-ammonia reductions, oxidation and polymerization.

#### UNIT - IV

**Arenes and Aromaticity** : Nomenclature of benzene derivatives, the aryl group, aromatic nucleus and

side chain, structure of benzene, molecular formula and Kekule structure, stability and carbon - carbon bond lengths of benzene, resonance structure, and M.O. picture.

**Aromaticity** : The Huckel rule, aromatic ions. Aromatic electrophilic substitution: General pattern of the mechanism, role of s and p complexes. Mechanism of nitration, halogenation, sulphonation, mercuration and

Friedel-Craft reaction. Energy profile diagrams. Activating and deactivating substituents, orientation and ortho-para ratio. Side chain reactions of benzene derivatives, Birch reduction, Methods of formation and chemical reactions of alkylbenzenes. alkynylbenzene and biphenyl.

#### UNIT - V

**Alkyl and Aryl Halides** : Nomenclature and classes of alkyl halides, methods of formation, chemical

reactions, mechanism of nucleophilic substitution reactions of alkyl halides,  $\text{SN}^2$  and  $\text{SN}^1$  reactions with energy profile diagrams, factors affecting  $\text{SN}^2$  and  $\text{SN}^1$  reactions.

Haloform reaction, Freons :

Methods of formation of aryl halides, nuclear and side chain reactions, the addition - elimination and elimination - addition reaction, mechanisms of nucleophilic aromatic substitution reactions.

Relative reactivities of alkyl halides v/S allyl, vinyl and aryl halides, synthesis and uses of DDT and BHC.

#### BOOKS RECOMMENDED

1. A Text Book of Organic Chemistry : K.S. Tiwari, S.N. Mehrotra and N.K. Vishnoi.
2. Modern Principles of Organic Chemistry : M.K. Jain and S.C. Sharma
3. A Text Book of Organic Chemistry : (Vol. I and II), O.P. Agarwal.
4. A Text Book of Organic Chemistry : B.S. Bahl and Arun Bahl.
5. A Text Book of Organic Chemistry : P.L. Soni.

6. Organic Chemistry : (Vol. I, II and III), S.M. Mukherji, S.P. Singh and R.P. Kapoor, Wiley Eastern Ltd., (New Age International).
7. Organic Chemistry, Morrison and Boyd, Prentice Hall.
8. Organic Chemistry (Hindi Ed.) : Suresh Ameta, P.B. Punjabi and B.K. Sharma, Himanshu Pub.

## PAPER III PHYSICAL CHEMISTRY

**Marks :50**  
**External :40**  
**Internal :10**

### UNIT - I

**Mathematical Concepts** : - Logarithmic relations, curve sketching, linear graphs and calculation of slopes, differentiation of function like  $kx$ ,  $ex$ ,  $xn$ ,  $\sin x$ ,  $\log x$ , maxima and minima, partial differentiation and reciprocity relations, integration of some useful/relevant functions, permutations and combinations, factorials, probability.

**Computers** : General introduction to computers, different components of a computer, hardware and software, input-output devices, binary numbers and arithmetic, introduction to computer languages, programming operating systems.

### UNIT- II

**Gaseous State** : Postulates of kinetic theory of gases, deviation from ideal behavior, Van- der Waals equation of state.

**Critical Phenomena** : PV isotherms of real gases, continuity of states, the isotherms of Van der Waals equation, relationship between critical constants and Van der Waals constants, the law of corresponding states, reduced equation of state.

**Molecular Velocities** : Root mean square, average and most probable velocities, qualitative discussion of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter, liquefaction of gases (based on Joule - Thomson effect).

**Liquid State** : Intermolecular forces, structure of liquid (a qualitative description).

**Liquid Crystals** : Difference between liquid crystal, solid and liquid, classification, structure of smectic, nematic and cholesteric phases, theory of liquid crystals and its applications, thermography and seven segments cell.

### UNIT - III

**Solid State** : Definition of space lattice, unit cell, Bravais lattices.

**Laws of crystallography** : (i) Law of constancy of interfacial angles (ii) Law of rationality of indices,

Weiss and Miller indices (iii) Law of symmetry, symmetry elements in crystals classification of crystals, X-ray diffraction by crystals derivation of Bragg equation, determination of crystal structure of NaCl, KCl and CsCl (Laue's method and powder method).

**Colloidal State** : Definition of colloids, classification of colloids. Solids in liquid (sols): Properties - kinetic, optical and electrical, stability of colloids, protective action, Hardy - Schuize law, gold number.

Liquids in Liquid (emulsions): Types of emulsions, preparation. emulsifier, Liquids in solid (gels)- classification, preparation and properties inhibition, general applications of colloids.

#### UNIT - IV

**Nuclear and Radiochemistry** : Elementary idea of nucleus, nuclear forces, packing fraction, mass defect and binding energy, nuclear fission and fusion reactions, calculation of Q - values of nuclear reactions, liquid drop and shell models of nucleus, theory of radioactivity, G.M. Counter, half life period, average life, radioactive disintegration, radioactive steady state, group displacement law, radioactive series, separation and identification of isotopes, application of radioactivity and radioactive tracers.

#### UNIT - V

**Atomic Structure** : Dual nature of electron, De Brogue equation, Davission and Germer experiment. Heisenberg uncertainty principle, Schrodinger wave equation, significance of  $\psi$  and  $\psi^2$ , probability distribution curves shapes of s, p and d - orbitals, Zeeman and Stark effects.

**Physical Properties and Molecular Structure** : Physical properties of liquids, vapour pressure, measurement of vapour pressure, heat of vaporization, Trouton's rule. Surface tension, measurement of surface tension.

Viscosity and its measurement, effect of temperature on the surface tension and viscosity, use of these properties in determination of chemical constitution.

#### BOOKS RECOMMENDED

1. Principles of Physical Chemistry: B.R. Puri and L.R. Sharma.
2. A Text Book of Physical Chemistry: A.S. Negi and S.C. Anand.
3. Physical Chemistry, Pt. I & II : C.M. Gupta, J.K. Saxena and M.C. Purohit.
4. Physical Chemistry (Hindi Ed.) : Suresh Ameta, R.C. Khandelwal, R. Ameta and J. Vardia, Himanshu Pub.
5. Computers and Applications to Chemistry, Ramesh Kumari, Narosa Publishing House Pvt. Ltd.

# CHEMISTRY PRACTICALS

## Distribution of Marks

	Exercises	Marks
1.	Semi-micro analysis of Inorganic mixture containing five radicals (excluding Na <sup>+</sup> and K <sup>+</sup> )	10
2.	(i) Detection of extra element (N, S and halogen) if any and functional groups in given sample organic compounds. (ii) Purification of the given organic compounds by crystallization (charcoal) sublimation and determination of its m.p.	7
	OR	
	Determination of mixed melting points using urea-cinnamic acid mixtures of given compositions.	7
3.	One Physical Chemistry Experiment	10
4.	Vice-voce	8
5.	Records	8
	<b>Total</b>	<b>50 marks</b>

## LIST OF EXPERIMENTS

1. **Semi-micro Analysis of Inorganic mixture:** The mixture shall contain **Five** radicals (at least two cations and two anions) soluble in water or in HCl. Two cations of the same group except IIA and IIB may be given. Not more than one interfering radical may be given. Interfering radical may not be given with typical anion combinations.

2. (i) Detection of extra elements (N, S, and halogen), one organic compound from the following functional groups be given for identification:

Carboxylic acids, Phenols, Alcohols, Carbohydrates, Aldehydes, Ketones, Nitro.

Compounds: Amino compounds, Anilides, Amides, Esters, Thiomide,

Hydrocarbons, Halogen containing compounds.

(ii) **Crystallization:**

Concept of induction of crystallization.

Phthalic acid from hot water (using fluted filter paper and stemless funnel)

Acetanilide from boiling water.

Naphthalene from ethanol

Benzoic acid from water

**Decolourization and crystallization using charcol:** Crystallization and decolourization of impure naphthalene (100 g of naphthalene mixed with 0.3 g of Congo Red using 1 g decolourizing carbon) from ethanol.

**Simple Sublimation:** Camphor, Naphthalene, Phthalic acid and Succinic acid.

**Criteria of purity:** Determination of M.P., B.P., Mixed M.P.

**3. Physical Chemistry Experiments :** Any one of the following experiments may be given in the examination.

**Ionic equilibria**

a) Measurement of pH of different solutions like aerated drinks, fruit juices, shampoos and soaps (use dilute solutions of soaps and shampoos to prevent damage to the glass electrode) using pH-meter.

b) Preparation of buffer solutions and measurement of the pH of buffer solutions and comparison of the values with theoretical values of following buffers.

(i) Sodium acetate-acetic acid

(ii) Ammonium chloride-ammonium hydroxide

**Colloids :** To prepare arsenious sulphide sol. and compare the precipitating power of mono-, bi- and trivalent anions.

**Viscosity and Surface Tension**

(i) To determine the percentage composition of a given mixture (non-interacting systems) by viscosity method.

(ii) To determine the percentage composition of a given binary mixture by surface tension method.

(iii) To determine the parachor value of  $-CH_2-$  group.

(iv) To determine the rheochor value of  $-CH_2-$  group.

**Transition Temperature**

(i) Determination of transition temperature of the given substance by thermometric/dilatometric method (e.g. :  $MnCl_2 \cdot 4H_2O$ ,  $SrBr_2 \cdot 2H_2O$ ).

**Thermochemistry**

(i) To determine the solubility of benzoic acid at different temperatures and to determine  $\Delta H$  of the dissolution process.

(ii) To determine the enthalpy of neutralisation of a weak acid/weak base versus strong base/strong acid and determine the enthalpy of ionisation of the weak acid/weak base.

(iii) To determine the enthalpy of solution of solid calcium chloride and calculate the lattice energy of calcium chloride from its enthalpy data using Born-Haber cycle.

**Virtual experiments (any two)**

(i) Purification of organic / inorganic compounds by crystallization / sublimation.

(ii) Preparation of biodiesel from vegetable oil.

(iii) Fractional distillation of crude oil / coal .

(iv) Conformational analysis of alkanes/ cycloalkanes.

(v) Any other virtual experiment related to the content of syllabus and availability of the experimental facilities.

**BOOKS RECOMMENDED**

1. Practical Chemistry - Giri, Bajpai and Pandey, S. Chand & Co. Ltd., New Delhi.

2. Laboratory Manual in Organic Chemistry, R.K. Bansal, Willey Eastern.

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

4. Experiments in Physical Chemistry - J.C. Ghose, Bharti Bhawan.

5. Experiments in General Chemistry, N.r. Rado and U.C. Agarwal, Eastern Press.

6. Practical Chemistry - Suresh Ameta and P.b. Punjabi, Himanshu Publication.



## **FIRST YEAR ZOOLOGY**

### **Pattern of question paper in the annual examination and distribution of marks:**

Each theory paper in the annual examination shall have three sections i.e. A,B, and C. In section A, total 10 questions will be set in the paper, selecting at least two from each unit. These questions are to be answered in a word or so. All questions are compulsory. Each question carries 0.5 mark, total 05 marks.

In section B, there shall be total 10 questions, selecting two questions from each unit, five questions to be answered by the student selecting at least one from each unit. Answer should be given in approximately 250 words. Each question carries 05 marks, total 25 marks.

In section C, 04 descriptive type questions will be set in the examination paper from five units of the syllabus of the paper, selecting not more than one question from a unit. Each question may have two sub divisions. Students are required to answer any two questions approximately in 500 words. Each question is of 10 marks, total 20 marks.

## **FIRST YEAR ZOOLOGY**

### **PAPER-I LIFE AND DIVERSITY OF ANIMALS-I (INVERTEBRATES)**

**Marks :50  
External :40  
Internal :10**

#### **UNIT- I**

- 1 General characters and classification of Protozoa and Porifera (up to classes) with examples.
- 2 Type study: Paramecium. Parasitic protozoans and their Pathogenesis
- 3 Type study-Sycon.
- 4 Canal system in sponges.

#### **UNIT-II**

- 5 General characters and classification of Coelenterata and Ctenophora
- 6 Type study-Obelia.
- 7 Corals and coral reefs - their formation, kinds and importance. Polymorphism in Coelenterates, Metagenesis.
- 8 Affinities of Ctenophora

### UNIT-III

- 9 General characters and classification of Platyhelminthes (upto classes) and Aschelminthes(upto phyla)
- 10 Type study –Fasciola , Taenia
- 11 Concept of pseudocoelom
- 12 General characters and classification of Nematoda (upto classes)
- 13 Type study: Ascaris
- 14 Endoparasites in relation to human diseases, parasitic adaptations of trematodes, cestodes, and nematodes.

### UNIT-IV

- 15 General characters and classification of Annelida and Arthropoda (up to classes) with examples.
- 16 Concept of metamerism, segmentation and coelom
- 17 Type study-Pheretima, Periplaneta.
- 18 Economic importance of arthropods

### UNIT-V

- 19 General characters and classification of and Mollusca and Echinidermata (up to classes)with examples.
- 20 Type Study –Pila *and* Asterias
- 21 Concept of Torsion and its importance
- 22 Echinoderm larvae.

## **ZOOLOGY**

### **PAPER II CELL BIOLOGY**

**Marks :50  
External :40  
Internal :10**

#### **UNIT -I**

- 1 Cell theory and its modern interpretation
- 2 Structure, function and general characteristics various types of cells
- 3 Prokaryotic and eukaryotic cells.

#### **UNIT -II**

- 4 Various models and hypothesis in understanding the structure of plasmamembrane (Overton, Danielli and Davison, Robertsons and Fluid mosaic model)
- 5 Functions of plasma membrane and membrane transport
- 6 Cell cytoskeleton-Microtubule, Microfilament and Intermediate Filament.
- 7 Structure and function Cilia, flagella, Centriole and basal bodies.
- 8 Brief idea of cell cycle (General description of mitosis and meiosis).

#### **UNIT -III**

- 9 Structure and function of nucleus and nucleolus.
- 10 Nucleic acids: Watson and Crick model of DNA, chemical nature of DNA and replication of DNA.
- 11 Chemical nature and structure of various types of RNAs and basic concept of transcription

#### **UNIT -IV**

- 12 Structure and function of Ribosome
- 13 Structure and function of Endoplasmic Reticulum (Rough and Smooth)
- 14 Basic concept of Protein Synthesis.

#### **UNIT -V**

- 15 Structure and function of Golgi. Concept of GERL system.
- 16 Structure and function of Mitochondria and Peroxisomes.
- 17 Structure, function and polymorphism of Lysosomes.

**ZOOLOGY**  
**PAPER- III**  
**DEVELOPMENTAL BIOLOGY**

**Marks :50**  
**External :40**  
**Internal :10**

**UNIT -I**

- 1 Aims and scope of developmental biology. Brief historical review and concepts of Embryology.
- 2 Neuroendocrine regulation of reproductive organs in brief.
- 3 Gametogenesis: Spermatogenesis and structure of sperm, oogenesis and structure of ovum, types of ova.

**UNIT -II**

- 4 Fertilization: Main events of fertilization, acrosome reaction, polyspermy preventing mechanisms.
- 5 Errors in fertilization and significance of fertilization. Parthenogenesis (In brief)
- 6 *In vitro* fertilization and test tube baby.
- 7 Embryo transplant.

**UNIT -III**

- 8 Cleavage: planes, patterns & types of cleavage.
- 9 Blastulation: Types of blastulae.
- 10 Gastrulation: fate maps, morphogenetic movements and their significance in gastrulation. Mechanism and main characteristic of gastrulation.

**UNIT -IV**

- 11 Elementary knowledge of fate of three germ layers.
- 12 Primary organizer and embryonic induction, concept of competence.
- 13 Determination, differentiation; Main characteristics of growth and regeneration.
- 14 Regeneration.

**UNIT -V**

- 15 Extra embryonic membranes: Development and functions.
- 16 Placentation: Definition, types, classification on the basis of morphology and histology. Functions of placenta.

## ZOOLOGY: PRACTICAL

S.No.	Exercise	
1	Major dissection	10
2	Cell Biology/ Developmental Biology exercise	05
3	Mounting/ Slide preparation	04
4	Spots(10)	15
5	Viva-voce	8
6	Record	8
	<b>Total :-</b>	<b>50</b>

Major Dissection marks will be given only if virtual dissection is available otherwise marks may be given according to availability of dissection alternate.

### 1. General survey of invertebrates (museum specimens):

The student is required to know classification, habit and habitat, economic importance etc.

- A Protozoa : *Entamoeba, Polystomella, Monocystis, Euglena, Noctiluca, Trypanosoma, Nyctotherus, Paramecium, Vorticella,*
- B Porifera : *Scypha, Hyalonema, Euplectella, Spongilla, Euspongia.*
- C. Coelenterata : *Physalia, Aurelia, Alcyonium, Corallium, Gorgonia, Pennatula, Madrepora, Metridium*
- D Platyhelminthes and Aschelminthes : *Dugesia, Fasciola, Taenia, Schistosoma, Dracunculus, Ascaris (male and female), Wucheraria, Enterobius*
- E Annelida and : *Nereis Heteronereis, Aphrodite, Arenicola, Chaetopterus Hirudinaria.*
- F Onychophora : *Peripatus.*
- G Arthropoda : *Limulus, Aranea, Palamnaeus, Lepas, Balanus, Apus, Sacculina, Eupagurus, Carcinus, Lepisma, Pediculus, Bombyx, Apis, Cimex, Julus, Scolopendra, Ixodes.*
- H Mollusca : *Mytilus, Chiton, Terebrantula, Turbinella, Loricifer, Limax, Doris, Aplysia, Dentalium, Nautilus, Sepia, Octopus, Loligo, Pecten, Solen, Pinctada.*
- I Echinodermata : *Asterias, Pentaceros, Antedon, Ophiothrix, Holothuria.*
- J Hemichordata : *Balanoglossus, Saccoglossus.*

### II. Study of the permanent slides, sections passing through different regions of animals and developmental stages.

- 1 Protozoa : Blood smears showing malarial parasite. *Paramecium*: Binary fission, conjugation.
- 2 Porifera : T.S. and L.S. of *Sycon.*, spicules, spongin fibres and gemmules
- 3 Coelenterata : *Obelia* (colony and medusa), planula, scyphistoma andephyra larvae of *Aurelia*, T.S. of mesentery of *Metridium*

4 Platyhelminthes : Miracidium, sporocyst, redia and cercaria larvae of *Fasciola*, scolex of *Taenia*, W.M. of mature and gravid proglottids of *Taenia*, hexacanth and cysticercus larvae of *Taenia*.

5 Aschelminthes : T.S. of *Ascaris*. (male and female)

6 Annelida : T.S. of *Nereis* through different regions, parapodia of *Nereis* and *Heteronereis*. Trochophore larva.

7 Arthropoda : V.S. of compound eye, nauplius, zoea, megalopa larvae and *Mysis*

8 Mollusca : T.S. of gill lamella and T.S. of shell of *Lamellidens*, glochidium larva.

9 Echinodermata : T.S. of arm, tube feet and pedicellaria, bipinnaria larva of starfish, echinopluteus larva.

10 Hemichordata : *Torneria* larva.

### III Dissections: Various systems of preserved animals/Virtual dissection

Virtual dissection of Digestive, Blood Vascular, Excretory, Reproductive system of Frog Rat/Rabbit (if facility of virtual is made available by University)

1. *Pheretima* : General anatomy, digestive, nervous, excretory and reproductive systems.

2. *Palaemon* : Appendages, general anatomy, digestive system and nervous system.

3. *Cockroach* : Mouth parts, Alimentary canal and Reproductive system (only after permission from institutional animal ethical committee otherwise virtual)

**IV Mountings: Permanent preparation of the following:** 1 Protozoa : *Euglena*, *Paramecium*, rectal ciliates, *Polystomella*.

2 Porifera : Sponge spicules, spongin fibres and gemmules.

3 Coelenterata : *Obelia* (colony and medusa)

4 Platyhelminthes : Proglottid of *Taenia*.

5 Annelida : Parapodia of *Nereis* and *Heteronereis*, ovary, septal nephridia and setae (*in situ*) of earthworm.

6 Arthropoda : Statocyst and hastate plate of prawn, salivary glands and tracheae of cockroach, W.M. of *Cyclops*, *Daphnia*, mouthparts of any 4 insects *Culex*, *Anopheles* male and female, housefly, cockroach and honey bee.

7 Mollusca : Gill lamella, glochidium larva, osphradium and radula of *Pila*.

### Cell Biology

1. Prepared slides of mitochondria, Golgi bodies, centrosome, different stages of mitosis.

2. Buccal smear preparation for localization of mitochondria and Golgi complex using vital stains.

3. Preparation of Mitosis.

4. Squash preparation of polytene chromosomes.

### Developmental Biology: Slides and specimen

1 W.M of eggs, early cleavage stage, T.S. of blastula and gastrula of frog.

2 Study of chick embryo: 18 hours, 24 hours, 36 hours, 48 hours and 72 hours.

3 T.S. of ovary and testis.

4 Sperm smear to study the structure of sperm.

5 Foetus with placenta.

- The teacher concerned will provide e-materials to practical in the form of video ordemonstrations or written materials including dissections.

### **REFERENCE BOOKS (LATEST EDITIONS):**

#### **LIFE AND DIVERSITY OF ANIMALS (INVERTEBRATES)**

- 1 Hickman C.P.Jr., F.M. Hickman and L.S. Roberts, Integrated Principles of Zoology, Mosby College Publication. St. Louis.
- 2 Ayyar, E.K. and T.N. Ananthakrishnan, Manual of Zoology, Vol.1 (Invertebrata), Parts I and II. S. Viswanathan (Printers and Publishers) Pct. Ltd., Madras.
- 3 Jordan, E.L. and P.S. Verma, Invertebrate Zoology, S.Chand & Co. Ltd., RamNagar, New Delhi. (English and Hindi Editions).
- 4 Parker and Haswell, Text Book of Zoology, Vol.1, (Invertebrata), A.Z.T.B.S. Publishers and Distributors, New Delhi- 110051
- 5 Ismail, S.A., Vermicology: The Biology of Earthworms, Orient Longman, India.
- 6 Kotpal, R.L. Agarwal and Khetrapal: Modern Text Book of Zoology: Invertebrates, Rastogi Publications, Meerut. (English and Hindi Editions)
- 7 Storer, T.I. and Usinger, K.L.: General Zoology, Tata McGraw- Hill Publishing Co., New Delhi.
- 8 Simpson, G.G.: Principles of Taxonomy, Oxford and IBH Publisher Co. New Delhi.

#### **CELL AND DEVELOPMENTAL BIOLOGY :**

- 9 Alberts, Bray, Lewis, Raff, Roberts and Watson, Molecular Biology of the Cell (Garland).
- 10 Balinsky, An Introduction to Embryology (CBS College Publishers)
- 11 Grant: Biology of Developing systems (Holt, Reihart and Winston).
- 12 Gilbert: Developmental Biology (Sinauer)
- 13 Alberts, B., et al., Molecular Biology of the Cell (Garland)
- 14 Lodish, H., et al., Molecular Cell Biology (Freeman).

#### **PRACTICAL :**

- 15 Verma, P.S., A manual of practical Zoology S.Chand and Co. Ltd., Ram Nagar, New Delhi (English and Hindi Editions).
- 16 Lal, S.S.: Practical Zoology, Invertebrates, Rastogi Publication, Meerut (English and Hindi Editions).

**BOTANY**  
**PAPER-I**  
**ALGAE, LICHENS AND BRYOPHYTES**

**Marks :50**  
**External :40**  
**Internal :10**

**Unit-1**

General characters, thallus organisation, pigments and reserve food material in algae. Electron microscopic structure of *Chlamydomonas* and the Cyanophycean cell. Fritsch's Classification and modern trends in classification. Morphology, reproduction and evolutionary relationships in the following: Cyanophyta : *Oscillatoria*, *Nostoc*. Chlorophyta : *Chlamydomonas*, *Volvox*, *Hydrodictyon* and *Cladophora*.

**Unit-2**

General characters of Xanthophyta, its relationship with Chlorophyta, Morphology and reproduction in Xanthophyta : *Vaucheria*; Chlorophyta : *Coleochaete* and *Oedogonium*; Charophyta : *Chara*. General account of Bacillariophyceae.

**Unit-3**

Morphology & reproduction in Phaeophyta: *Ectocarpus*; Rhodophyta: *Polysiphonia*. Economic importance of algae. Lichens: Important features, structure, habitat, importance as colonisers and indicators of environment. Vegetative multiplication and life cycle of *Parmelia* and *Usnea*.

**Unit-4**

General characters and classification of Bryophytes. The evolutionary trends in thallus structure and sporogonium. Morphology and life history of *Riccia*, *Marchantia*, *Pellia*, *Porella* and *Anthoceros*.

**Unit-5**

Morphology, life history and relationships of *Sphagnum* and *Polytrichum*. Economic importance of Bryophytes.

**Note:**

The paper setter is required to set questions of 3 types contained in 3 Sections (**Section A**- 10 questions,

**Section B**- 10 questions and **Section C**- 4 questions) from the 5 units of each paper. There will be 10 questions in **Section A** which will be asked from all the 5 units, i.e., 2 questions from each unit. These questions have to be answered in one word or a few words only. Each question will be of half mark. All the questions in **Section A** are compulsory. In **Section B**, 10 questions will



be set from the 5 units, i.e., 2 questions from each unit. Students are required to attempt at least 1 question from each unit. Each question will carry 5 marks. The answers of each question should be given in about 250 words. In **Section C** there will be 4 descriptive type questions set from all the 5 units, not more than 1 question from each unit. These questions may also have subdivisions. The students are required to answer 2 questions, each in approximately 500 words. Each question will carry 10 marks.

In short, pattern of question paper and distribution of marks for UG classes will be as under :

**Section A:** 10 questions, 2 questions from each unit, short answer, all questions compulsory.

Total marks: **05**

**Section B:** 10 questions, 2 question from each unit, 5 question to be attempted, at least 1 from each unit, answer approximately in 250 words.

Total marks: **25**

**Section C:** 04 questions (question may have subdivision), not more than 1 question from each unit, descriptive type, answer in about 500 words, 2 questions to be attempted.

Total marks: **20**

**PAPER-II**  
**MYCOLOGY, MICROBIOLOGY AND PLANT PATHOLOGY**

**Marks :50**  
**External :40**  
**Internal :10**

**Unit-1**

Characteristics and broad classification of fungi. Structure and life history of *Albugo*, *Penicillium*, *Phyllactinia* and *Morchella*. Elementary knowledge of Mycorrhizae and their symbiotic significance.

**Unit-2**

Structure and life history of *Puccinia*, *Ustilago*, *Agaricus* and *Alternaria*. Economic importance of fungi : food, industries, medicine and biological controls.

**Unit-3**

Characteristics, classification, structure and reproduction of bacteria. Isolation and pure culture of bacteria, Gram's staining. Salient features of Micro-biology of water, soil and food.

**Unit-4**

Characteristics, structure and economic importance of Mycoplasma. Viruses: Nature, structure, transmission and multiplication of plant viruses.

**Unit-5**

Principles of plant pathology. Methods of disease control. Important symptoms of plant diseases of the following : Green ear disease of Bajra. Loose smut of Wheat, Black Rust of Wheat, Citrus canker. Little leaf of *Solanum melongena* (Brinjal). Yellow vein mosaic of Bhindi, Tikka disease of ground nut.

**Note :**

The paper setter is required to set questions of 3 types contained in 3 Sections (**Section A**- 10 questions,

**Section B**- 10 questions and **Section C**- 4 questions) from the 5 units of each paper. There will be 10 questions in **Section A** which will be asked from all the 5 units, i.e., 2 questions from each unit. These questions have to be answered in one word or a few words only. Each question will be of half mark . All the questions in **Section A** are compulsory. In **Section B**, 10 questions will be set from the 5 units, i.e., 2 questions from each unit. Students are required to attempt at least 1 question from each unit. Each question will carry 5 marks . The answers of each question should

be given in about 250 words. In **Section C** there will be 4 descriptive type questions set from all the 5 units, not more than 1 question from each unit. These questions may also have sub-divisions. The students are required to answer 2 questions, each in approximately 500 words. Each question will carry 10 marks.

In short, pattern of question paper and distribution of marks for UG classes will be as under :

**Section A** : 10 questions, 2 questions from each unit, short answer, all questions compulsory. Total marks : **05**

**Section B** : 10 questions, 2 question from each unit, 5 question to be attempted, at least 1 from each unit, answer approximately in 250 words. Total marks : **25**

**Section C**: 04 questions (question may have sub-division), not more than 1 question from each unit, descriptive type, answer in about 500 words, 2 questions to be attempted. Total Marks : 20

**PAPER-III**  
**PALAEOBOTANY, PTERIDOPHYTES AND GYMNOSPERMS**

**Marks :50**  
**External :40**  
**Internal :10**

**Unit-1**

Characteristics and broad classification of pterido-phyta. Stellar system in pteridophytes. Geological TimeScale. Types of fossils, process of fossilization. Applied aspects of Palaeobotany. Structure of *Rhynia* and *Williamsonia*.

**Unit-2**

Occurrence, structure and life history of *Psilotum*, *Lycopodium* and *Equisetum*.

**Unit-3**

Occurrence, structure and life history of *Selaginella* and *Marsilea*. Homospory, heterospory and origin of seed habit.

**Unit-4**

General characters, economic importance and broad classification of Gymnosperms, occurrence, structure of life history of *Cycas*.

**Unit-5**

Occurrence, structure and life history of *Pinus* and *Ephedra*.

**Note :**

The paper setter is required to set questions of 3 types contained in 3 Sections (**Section A**- 10 questions, **Section B**- 10 questions and **Section C**- 4 questions) from the 5 units of each paper. There will be 10 questions in **Section A** which will be asked from all the 5 units, i.e., 2 questions from each unit. These questions have to be answered in one word or a few words only. Each question will be of half mark . All the questions in **Section A** are compulsory. In **Section B**, 10 questions will be set from the 5 units, i.e., 2 questions from each unit. Students are required to attempt at least 1 question from each unit. Each question will carry 5 marks . The answers of each question should be given in about 250 words. In **Section C** there will be 4 descriptive type questions set from all the 5 units, not more than 1 question from each unit. These questions may also have sub-divisions. The students are required to answer 2 questions, each in approximately 500 words. Each question will carry 10 marks .

In short, pattern of question paper and distribution of marks for UG classes will be as under :

**Section A** : 10 questions, 2 questions from each unit, short answer, all questions compulsory.  
Total marks :05

**Section B** : 10 questions, 2 question from each unit, 5 question to be attempted, at least 1 from each unit, answer approximately in 250 words. Total marks : **25**

**Section C** : 04 questions (question may have sub-division), not more than 1 question from each unit, descriptive type, answer in about 500 words, 2 questions to be attempted. Total marks : **20**

## PRACTICALS

The practical exercises have been divided into following two groups based on the theory papers as detailed below:

Group-I Algae, Fungi, Lichens, Microbiology and Plant Pathology.

Group-II Bryophytes, Pteridophytes, Gymnosperms and Palaeobotany.

### GROUP I

Microscopic preparations and study of following algal materials: *Nostoc*, *Oscillatoria*, *Chlamydomonas*,

*Volvox*, *Coleochaete*, *Hydrodictyon*, *Cladophora*, *Oedogonium*, *Vaucheria*, *Chara*, *Ectocarpus* and *Polysiphonia*.

Study of different types of Lichen specimens.

Microscopic preparation and study of following fungal materials : *Albugo*, *Phyllactinia*, *Morchella*, *Penicillium*, *Ustilago*, *Agaricus*, *Puccinia* and *Alternaria*.

Study of some locally available materials showing plant diseases caused by Viruses, Mycoplasma, Bacteria and Fungi in field/ laboratory. Yellow vein mosaic of Bhindi, Little leaf of *Solanum melongena* (Brinjal), Citrus canker, Green ear disease of bajra, Rust and Smut of wheat and White rust of crucifers.

### GROUP II

Study of external and internal morphology and micro-scopic preparations of following Bryophytes : *Riccia*, *Marchantia*, *Plagiochasma*, *Pellia*, *Anthoceros*, *Sphagnum* and *Polytrichum*.

Microscopic examination of fossil slide specimens/ photographs: *Rhynia* and *Williamsonia*.

Temporary, double stained microscopic preparations and study of stem/ rhizome, anatomy of following pteri-dophytes: *Psilotum*, *Lycopodium*, *Selaginella*, *Equisetum* and *Marsilea*. Study of temporary, single stained micro-scopic preparation of the following : Cone of *Lyco-podium*, *Selaginella* and *Equisetum*. Petiole, Root and Sporocarp of *Marsilea* ; Rhizophore and root of *Selagi-nella*.

Temporary, double stained microscopic preparations of T.S., T.L.S. and R.L.S. of stem of *Pinus* and *Ephedra* and T.S. Leaflet and Rachis of *Cycas* and needle of *Pinus*, T.S. of normal and coralloid roots of *Cycas*. Microscopic preparations of male cone of *Pinus* and male and female cones of *Ephedra*. Study of male cone and megasporophyll of *Cycas*.

## MARKING SCHEME

There shall be a practical examination of five hours duration and the distribution of marks shall be as follows:

S.No	TOPIC	MARKS
1.	A double stained section of plant part either of Pteridophyte or	

Gymnosperm glycerine mount	10
2. Minor preparation of Pteridophyte or Gymnosperm (not covered in Q.1)	05
3. Preparation and mounting of the part of :	10
a) A Bryophyte	
b) A Fungus	
c) An Alga	
d) Bacteria	
4. Spots : Seven	10
a) One from each group (Algae, Lichen, Bryophytes, Fungi, Fossil, Pteridophytes, Gymnosperms).	
b) One microbiological experiment for comments.	
5. Viva-Voce	10
6. Practical records	05
	TOTAL

### BOOKS SUGGESTED

Alexopoulos, C.J.: Introductory Mycology, John Wiley and Sons, N.Y. 1978.

Bendre, A. and Kumar, A.: A Test Book of Practical Botany, Rastogi Publication, Meerut.

Ghemawat, M.S., Kapoor, J.N. and Narayan, H.A.: A Text Book of Algae, Ramesh Book Depot, Jaipur, 1976.

Gupta, M.N.: A Class Book of Gymnosperms, 1978.

Parihar, N.S.: An Introduction to Embryophyta, Vol. I, Pteridophyta, Vol. II, Central Book Depot, Allahabad, 1969.

Sharma, P.D.: Fungi, Rastogi Publications, Meerut, 1989.

Sharma, P.D.: Microbiology and Plant Pathology, Rastogi and Co. Meerut, 1989.

Vashishtha, B.R.: Botany for Degree Students (Algae, Fungi, Bryophyta and Gymnosperms), S. Chand and Co., New Delhi, 1976.

Singhvi, V., Pandey, P.C. and Jain, D.K.: A Text Book of Botany, Rastogi and Co., Meerut.

# MATHEMATICS

## PAPER-I ALGEBRA

Marks :70  
External :60  
Internal :10

### UNIT-I

Symmetric, Skew Symmetric, Hermitian and skew Hermitian matrices. Linear independence of row and column matrices. Row rank, column rank and rank of a matrix. Equivalence of column and row ranks.

Eigen values, Eigen vectors and characteristic equation of a matrix. Cayley-Hamilton theorem and its use in finding inverse of a matrix. Theorems and examples of consistency of a system of linear equations.

### UNIT- II

Relation between the roots and coefficients of general polynomial equation in one variable. Transformation of equations. Descartes's Rule of signs, solution of Cubic equations (Cardan method). Biquadratic equations. Horner's Method, Ferrari's Method.

### UNIT-III

Groups and their defining theorems. Various examples, order of an element and related theorems, Permutation Groups, even and odd permutations, cyclic groups, subgroups, union, intersection of two and finite subgroups and various examples, product of two subgroups.

### UNIT -IV

Left and right cosets and their properties, Lagrange's theorem, index of a subgroup. Normal subgroups their examples and elementary basic theorems, Quotient group. Simple group, centre of group, Normalizer of an element and that of a subgroup, Conjugacy relation, class equation for finite groups.

### UNIT-V

Group homomorphism and isomorphism with elementary basic properties, Cayley's theorem for finite groups, fundamental theorem of homomorphism in groups. The three isomorphism theorems of groups. Automorphisms and inner automorphisms.

#### References:

1. I. N. Herstein : Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975.
2. R. S. Agrawal : A Textbook on Modern Algebra.

3. K. B. Datta : Matrix and Linear Algebra Prentice Hall of India Pvt. Ltd., New Delhi, 2000.
4. H. S. Hall and S.R. Knight : Higher Algebra, H.M. Publications, 1994.
5. Bansal, Bhargava, Agrawal: Amurt Beej Ganita.
6. Chandrika Prasad : Text book on Algebra and Theory of Equations, Pothishala Pvt. Ltd, Allahabad.
7. Gokhroo, Saini : Elements of Abstract Algebra
8. Sharma, Purohit : Elements of Abstract Algebra

## **MATHEMATICS**

### **PAPER-II CALCULUS**

**Marks :65**  
**External :55**  
**Internal :10**

#### **UNIT-I**

Polar coordinates and derivatives of arc, polar subtangent and subnormal, pedal-equation, Roll's Theorem, Mean Value Theorems, Taylor's Theorem, their proofs, verifications and applications.

#### **UNIT -II**

Asymptotes, curvature, Test of concavity and convexity. Points of inflexion. Multiple points. Tracing of curves in Cartesian and polar coordinates.

#### **UNIT – III**

Beta Gamma functions and their properties. Quadrature, Rectification.

#### **UNIT - IV**

Degree and order of a differential equation. Equations of first order and first degree, Equations in which the variables are separable, Homogeneous equations. Linear equations and equations reducible to the linear form. Exact differential equations.

#### **UNIT - V**

First order and higher degree equations solvable for  $x, y, p$ . Clairaut's form and singular solutions. Geometrical meaning of a differential equation. Linear differential equations with constant coefficients. Homogeneous linear ordinary differential equations and the equations reducible in homogeneous form.

#### **References:**

1. Gorakh Prasad : A Text book on differential calculus (Pothi shala)
2. Gorakh Prasad : A Text book on Integral calculus and Differential Equations (Pothi shala).
3. E. A. Codignton : An introduction to ordinary Differential Equations Prentice Hall of India, 1961.
4. P.K. Jain and S. K. Kaushik: An Introduction to Real Analysis, S. Chand & Co., New Delhi-11, 2000.



5. Bansal, Bhargava : Avakalan Ganita-II
6. Bansal, Bhargava : Samakalan Ganita-II
7. Gokhroo, Saini : Uchch Avakalan Ganita.
8. Gokhroo, Saini : Uchch Samakalan Ganita.
9. Bansal, Bhargava & Agrawal: Avkal Samikaran I .
10. Gokhroo, Saini, Kumbhat: Avkal Samikaran.

## MATHEMATICS

### PAPER –III GEOMETRY

**Marks :65**  
**External :55**  
**Internal :10**

#### UNIT -I

General equation of second degree, nature of conic, eccentricity and foci of conic, Tracing of different conics. Ellipse : Tangent, normal, Chord of contact of the tangents, pole and polar, eccentric angle, auxiliary circle, director circle, equation of chord in term of middle point, pair of tangents, conjugate lines, diameter and conjugate diameters and their properties.

#### UNIT - II

Hyperbola: Parametric coordinates, tangent, normal, chord of contact of tangents, pole and polar etc. asymptotes, conjugate hyperbola, conjugate diameters, rectangular hyperbola, equation of hyperbola referred to its asymptotes. Polar Equations: Polar equation of conic, polar equations of tangent, perpendicular lines and normal, director circle of the conic.

#### UNIT-III

Plane and straight line: Equation to represent two planes and angle between them, projection on a plane area of a triangle and volume of tetrahedron. Equations of line intersecting two lines, skew lines, shortest distance between two lines, intersection of three planes and three lines.

#### UNIT- IV

Sphere: General Equation, Tangent Plane, Pole and Polar, Intersection of two spheres, Radical plane, Radical line, Radical centre, Co-axial spheres, Limiting points.  
Cone: Enveloping cone, Tangent plane, Reciprocal cone, Three mutually perpendicular generators, Right circular cone. Cylinder: Right circular cylinder, Enveloping cylinder

#### UNIT-V

General equation of second degree in three dimensions. Intersection of a line and a conicoid. Tangent lines and Tangent plane. Condition of tangency, plane section with a given centre. Diametral plane. Principal planes, principal directions and plane sections.

#### **References:**

1. Gorakh Prasad and H.C.Gupta: A Text book of coordinate Geometry (Pothishala)
2. S.L.Loney : The Elements of coordinate Geometry; Mack-Millan and Company, London.

3. R.J.T. Bell : Elementary Treatise on coordinate Geometry of Three Dimensions.
4. P.K. Jain and Khalil Ahmed: A Textbook of Analytical Geometry of Three Dimensions, Wiley Eastern Ltd., 1999.
5. N.Saran and R.S.Gupta : Analytical Geometry of Three Dimensions.(Pothhishala)
6. Bansal, Bhargava : Dwivim Nirdeshank Jyamiti
7. Gokhroo, Saini : Dwivim Nirdeshank Jyamiti
8. Gokhroo, Saini : Trivim Nirdeshank Jyamiti
9. Bansal, Bhargava : Trivim Nirdeshank Jyamiti.
10. Golas, Tandon, Bhargava : Analytical solid Geometry.

## **PROFESSINOL COURSE**

### **PEC- I -CHILDHOOD AND GROWING UP**

**Marks :100**  
**External :80**  
**Internal :20**

#### **OBJECTIVES:**

1. Understand the Developmental characteristic of Childhood and adolescence.
2. Learn the theories of development.
3. Understand Educational provision of children at different stages of development.
4. Understand the concepts and components of personality.
5. Know the techniques of personality assessment.
6. Understand nature and characteristics of intelligence.
7. Analyse the implications of understanding human development for teachers.
8. Situate child development in a socio-cultural context.

#### **Unit-I**

#### **Introduction to Concept and Process of Childhood Development:**

- Meaning of childhood development, Principles of development.
- Study of Life span-Prenatal, early childhood, middle childhood, adolescence & adulthood and stage specific characteristics.
- Meaning of cognition and its role in learning.
- Facilitating Holistic development for self and society
- Procedure for studying Children- Observation, Interview and Case Study.

#### **Unit-II**

## **Theories of Childhood Development and their Significance:**

- Erik Erikson's Psychosocial Theory.
- Piaget's Cognitive Theory.
- Arnold Gesell's Maturation Theory,
- Urie Bronfenbrenner's Ecological Theory.
- Vygotsky's Socio-cultural Theory
- Noam Chomsky's Processing Theory

### **Unit-III**

#### **Childhood and Adolescence:**

- Defining Childhood and Adolescence as a distinct stage.
- Adolescence special feature and challenges
- Characteristics and developmental task of Childhood and Adolescence
- Socialization of Childhood and Adolescence in different culture.
- Role of media in the life of adolescents with special reference to use of internet (Social networking sites, E-mails, Browsing),
- Personality Concept, Types and Components of Personality.
- Psychoanalytic theory of Personality by Freud.
- Factors Affecting Personality development.

### **Unit-IV**

#### **Family School and Community:**

- The Family: Meaning, function of the family, family as a social system, different styles of child rearing, Socioeconomic and Ethnic variation in Child Rearing, Cultural Influences of Family.
- School- Meaning and Function of School, School transition in childhood and adolescence, helping adolescence in school adjustment. Teacher student interaction, peer relation and its importance, Cultural value of peer groups.
- Community- Meaning and Function of Community, case study of a community- linked programme at local/national/international level.
- Intelligence, Nature and Characteristics
- Theories of Intelligence
  - a) J.P. Guilford Structure of Intellect

- b) Howard Garden's theory of Multiple Intelligence
- c) Daniel Goleman's Model of Emotional Intelligence
- Measurement of Intelligence, Types of Intelligence Test- Verbal, non-verbal and Performance Tests.

### **Unit-V**

#### **Issues and Concern in Childhood and Adolescence:**

- Children with difficult circumstances and Understanding of them- Juvenile delinquency, maladjustment, depression in adolescence.
- Marginalized Children-Child labour, Overweight/ Underweight children, Children growing up in poverty, HIV affected children, Orphans.
- Approaches to intervention and therapy for well-being- Preventive and Primitive Approach, Individual counseling and family therapy.

#### **Practicum: (Any two from the following)**

1. Administration, Scoring, interpretation and Reporting of one Mental Ability Test and one Personality Test. Any one from the following.
2. Observe children during their playtime in your practicing school (or nearby school) for a week; observe their play activities, relationships, Communication with their peers. On the basis of that prepare a report about understanding childhood.
3. Prepare a case study of a girl child from a minority community or a dalit household or a tribal community.
4. Observe and interact with ten adolescent children living in different contexts (rural areas, urban slum, dalit household, tribal community, urban area and working/street people) and compare their characteristics and problems.

#### **Books Recommended:**

1. Anastasi, A. & Urbina, S. (1997). Psychological testing (Seventh Edition). Indian Reprint, Delhi Pearson Education.
2. Atwata, E. (1998), Adolescence. New Jersey: Prentice Hall.
3. Berk, L.E. (2004) Child Development (6<sup>th</sup> edition) Allyn & Bacon. Boston.
4. Berk, L.E. (2000) Child Development (8<sup>th</sup> edition) PHI learning Pvt. Ltd. New Delhi.
5. Bhargav, V. (2005) Adoption in India: Policies and Experiences. New Delhi: Sage Publications
6. व्यास हिरष्चन्द्र एवं शर्मा— अधिगम और विकास के मनोसामाजिक आधार, राजस्थान हिन्दी ग्रंथ अकादमी, जयपुर-4

7. पाठक, पी.डी. (2007), शिक्षा मनोविज्ञान, विनोद पुस्तक मंदिर, आगरा।
8. गुप्ता, एस.पी., गुप्ता, अलका (2007) उच्चतर शिक्षा मनोविज्ञान, शारदा पुस्तक भवन, इलाहाबाद।
9. मंगल, एस.के.,(2008) शिक्षा मनोविज्ञान, प्रिंटिस हॉल ऑफ इण्डिया प्राइवेट लिमिटेड, नई दिल्ली।

## **PEC 2 - CONTEMPORARY INDIA & EDUCATION**

**Marks :100**  
**External :80**  
**Internal :20**

### **Objectives the Course enables the Student teacher to :**

1. Understand different perspectives of Education.
2. Analysis the concept of Education & its related terms.
3. Reflect on the educational ideas & systems of various thinkers & develop the ability to theorize education practice.
4. Collect evidence for the influence of socio-cultural aspects on education.
5. Analysis the role of education on Society by gathering various evidences & Illustrations'
6. To develop an understanding of the trends issues and challenges faced by contemporary education in India.

### **Course & Content**

#### **Unit- I**

#### **Salient Features of Ancient Indian Education & Concept**

1. Education : Meaning , types & nature , and functions of education, Informal, Formal & Non-formal education.
2. Vedic, Buddhist, Islamic & Development during British period (a) Adams Report (b) woods dispatch.
3. Post Independence area :- University Education commission (1948) , National Policy – 1986, NCF 2005, NCFTE 2009.

#### **Unit - II**

#### **Education thoughts & Practices :-**

Critical reflection on the educational thoughts of Indian & western thinkers & on their relevance to the present education system.

Indian :- Mahatma Gandhi, Swami Vivekananda, Gijju Bhai & Dr. Radhakrishnan , R. N.Tagore.

Western :- John Dewey, Rousseau, Montessori, Frobel.

### **Unit -III**

#### **Education & Socio Cultural Context :-**

-Education as an instrument of Social Change ; Influence of Educational on Society & Family.

- Socialization, Education & Culture & Social Control

-Secularism and Education ,Education for National Integration, Human rights & Education.

### **Unit -IV**

#### **Teacher Education & Educational Institutions :-**

- Status , Aims & Objectives of Teacher Education in India .
- Role & Responsibilities of UGC, NCERTE, NCTE, IASE , SIERT, DIET.
- Secondary Education & Open University :- Kendriya Vidyalaya , Navodaya Vidyalaya ,
- CBSE, ICSE, RBSE, IGNU, Vardhaman Open University (Introduction ,Aims ,Adminstration,Work ,) Kasturba Gandhi Balika Vidhyalaya , Modal School

### **Unit - V**

#### **Issue & Challenges :-**

- Diversity , Inequality , Marginalization :- Meaning , Concept ,Levels with Special Reference to
- Individual , Region , Language , Cast , Gender .
- Eradication of Illiteracy , National Adult Education Program, Equality of Opportunities.
- Means & Measures taken For Equality in terms of Gender
- Population Explosions & Education

#### **PRACTICUM:-(any two)**

- Write & Presentations On Educational Thought s of Various Thinkers .
- Preparation of an Album or Posters on different Thought s of Great Thinkers.
- Analysis of aims of Education From ancient vedic times to Modern times.
- Picture Collection & detail report of Eradication of Illiteracy Program.
- Picture Collection & detail report of National Adult Education Program.
- Prepared album & Work of Central Educational Institutions.

- Collection of Examples / Evidences to Show the influence of education on social change & the socio culture influences on Education aims.
- Comparative study of NCF 2005 of NCERT on aims of Education.
- Reading s on Position paper on “ Aims of Education “ NCF 2005
- Comparative Study of Aims of Education of few Countries.
- Visit to Modal School & Kasturba Gandhi Balika Vidhyalay & study their Education management pattern & Submit the Report.
- Comparative study of CBSE , RBSE & ICSE.
- Comparative study & Picture Collection of open University IGNU & VMOU.

References:-

शिक्षा के दार्शनिक एवं समाजशास्त्रीय सिद्धान्त , विश्व ज्ञानकोष (Vol.2<sup>nd</sup>) एन.आर.स्वरूप. सक्सेना , आर.लाल. बुक डिपो , मेरठ  
 उभरते भारतीय समाज में शिक्षा , डी.डी. मेहता , टण्डन पब्लिकेशन लुधियाना  
 उभरते भारतीय समाज में शिक्षा , डॉ. के.सी.जैन एवं शैल जैन ,टण्डन पब्लिकेशन लुधियाना  
 शिक्षा के दार्शनिक एवं समाजशास्त्रीय सिद्धान्त , विश्व ज्ञानकोष (Vol.1)) एन.आर.स्वरूप. सक्सेना एवं शिखा चतुर्वेदी, आर.लाल. बुक डिपो , मेरठ  
 उदीयमान भारतीय समाज में शिक्षा, डी.एल.शर्मा ,आर.लाल. बुक डिपो , मेरठ  
 उदीयमान भारतीय समाज में शिक्षा, डॉ गुरसरनदास त्यागी , विनोद पुस्तक मन्दिर , आगरा

# **ABILITY ENHANCEMENT COURSE**

## **AEC- 1 Guidance & Counseling in School**

**Marks :100**  
**External :80**  
**Internal :20**

### **Unit – I**

#### **Meaning and Nature of Guidance –**

Guidance concept, aims, objective functions and principles, Need and procedure for (educational psychological and social) guidance.

Purpose and principles of organization of different guidance services.

Organization of guidance services at Secondary Level – Need and importance.

Group guidance – concept , Need significance and principles, organization of guidance programs in school.

### **Unit II:**

#### **Meaning and Nature of Counselling:**

Counselling: Meaning, and nature; Difference between Guidance & Counselling; Principles and approaches of counselling, Individual and Group Counselling; Skills in Counselling- Skills for Listening, Questioning, Responding, & Communicating, Listening Attentively to the concerns of the counselee, Negotiating Self Discovery, Decision Making, Problem Solving etc and values such as Patience, Empathy etc.; Methods and Process of Counselling Academic, Personal, Career and Behaviour problems of students with special needs, viz. socio-emotional problems of children with disabilities and deprived groups such as SC, ST and girls, need for Counselling; Professional Ethics and Code of Conduct; Qualities and Qualifications of an effective Counsellor

### **Unit – III**



## **Career Guidance and Counselling:**

Educational and Career Information in Guidance and Counselling: Meaning, Importance, collection, types, classification of occupational information; Dissemination of Occupational Information: Class talk, career talk, Group discussion, Preparation of Charts and Poster, Career Exhibition, Career conference; Guidance for gifted, slow learner, socio-economically disadvantaged children; Career development: Meaning and Importance; Teacher's role in Career planning, Vocational training and placement opportunities for CWSN. Broad outline with respect to the emerging courses and career options available in India; Guidelines for Establishment of Guidance Cell or Career Corners in Schools

### **Unit – IV**

#### **Tool and Techniques of Guidance**

Testing and Non testing techniques for studying and appraisal of students.

- a. Testing techniques intelligence/mental ability tests, aptitude tests, altitude scales, interest inventories and personality tests.
- b. Non testing techniques interview, observation and case study.
- c. Tools questionnaire, anecdotal records, cumulative record cards etc.

#### **Suggestive List of Activities:**

Group Guidance-Preparation of Class Talk and One Career Talk  
Visit to different Guidance Centre  
Design a checklist Questionnaire to collect information on students and classify them under educational, psychological or social problem.  
Preparation of Cumulative Record  
To prepare a Case study and Analysis of Case study  
Administration, Scoring & interpretation of at least two tests: One Mental Ability Test and One Aptitude Test  
Job Analysis of a Counsellor  
Preparation of list of problem behaviours based on observation. Detailed study of the Guidance and Counselling Services available in a given School  
Prepare a Chart and Poster for dissemination of Career Information  
Familiarise and write a report of any one of the Personality Tests used in Guidance and Counselling

#### **References :**

1. Aggarwal JC (2004) Education vocational guidance and counseling Delhi.

2. Asch, M (2000) Principles of guidance and counseling, New Delhi Sarup and Sons.
3. Bhatia K.K. (2002), Principles of Guidance and Counseling Ludhiana, Vinod.
4. 4. Bhatanagar R.P. Rani S. (2001) Guidance and Counseling in Education and psychology.
5. Chauhan S.S. (2008) Principles and techniques of guidance UP Vikas publishing house Pvt. Ltd.

## **PROFESSINOL COURSE PRACTICAL**

### **OPEN AIR SESSION / SUPW CAMP**

Every college will organize 5 days camp in the first year of B.Ed. Course. Participation in such camp will be compulsory for all students.

Performance of students will be evaluated internally. Objectives of the camp will be as follows:-

1. To develop understanding about local environment and Community for connecting classroom teaching with outside world.
2. To develop sensitivity towards self, society and environment.
3. To develop feeling of togetherness and working collaboratively.
4. To develop organizational skills and leadership abilities.
5. To develop skill of conducting surveys.
6. To develop an understanding about sustainable future.
7. To develop dignity of labour through community service.

Suggested activities for Open Air Session/SUPW Camp

1. Study of the local environment/ socio cultural issues through survey.
2. Community awareness performance –cleanliness campaigns, plantation, value education, etc.
3. Participation in Health and Spiritual activities like morning Assembly, Yoga, P.T., Meditation, Silence hour.
4. Participation in Aesthetic and recreational activities.
5. Documentation and organization of exhibition for local community.
6. Productive and creative craft activities.

Note : Student teachers will participate in the above mentioned activities in collaborative manner (to develop the feeling of working and living together)

Guideline for assessment Max Marks 50

S. No.	Activity	Marks
1.	Participation in preparation of Camp	5
2.	Presentation of report of survey/ creative work	20
3.	Participation in Community Awareness Programme	15
4.	Participation in organizational process/community living/cultural and aesthetic activities	10
	<b>SECOND YEAR B.Sc. B.Ed.</b>	50

COURSE	NOMENCLATURE
GC 2	General English
EL 6	Physics (I)
	Physics (II)
	Physics (III)
	Physics Practical
EL 7	Chemistry I
	Chemistry II
	Chemistry III
	Chemistry Practical
EL 8	Zoology I
	Zoology II
	Zoology III
	Zoology Practical
EL 9	Botany I
	Botany II
	Botany III
	Botany Practical
EL 10	Mathematics I
	Mathematics II
	Mathematics III
PEC 3	Language Across the Curriculum
PEC 4	Learning & Teaching
AEC 3	Yoga & Sports
AEC 4	Action Research
PC 1	Pedagogy of General Science
PC 2	Pedagogy of Physics
PC 3	Pedagogy of Chemistry

PC 4	Pedagogy of Biology
PC 5	Pedagogy of Mathematics
TEP 1	Pre- Practice Teaching (Internal Practical)
	1. Micro Teaching
	2. Unit Plan & Blue Print
	3. Observation of Demonstration lesson
	4. Lesson Plan( Related one Pedagogy Subject) Seven Lesson in Which one Technology based lesson is compulsory
	5. Simulated Teaching
	6. Criticism (only one Pedagogy subject)
	7. TLM workshop
8. Case Study & Project work	

## GENERIC COURSE

### GC-2GENERAL ENGLISH

**Duration : 3 Hours**

**Marks :100**  
**External :100**

#### **Objectives:**

An essentially language based course that aims at making students study English prose with a view to enlarge their comprehension of the language and develop all the four skills (R/W/L/S/). It also aims at giving them basic skills in grammar, widening their vocabulary and teaching them to write simple and correct English.

The question paper will consist of 100 multiple choice questions of 1 mark each (OMR Sheet system)

#### **1. Comprehension and Vocabulary [Total 50 Marks]**

##### **Texts:**

**(A)** The Many Worlds of Literature ed: Jasbir Jain: Macmillan India **30 Marks**  
(Questions based on content from the prescribed text)

**(B)** Learning How to Fly: Life Lessons for the Youth by A P J Kalam (RUPA PUB.) **20 Marks**  
(Questions based on content from the prescribed text)

#### **2. Basic Language Skills: Grammar and Usage [Total 50 Marks]**

<b>Parts of Speech</b> (Noun, Pronoun, Adjective, Verb, Adverb, Preposition, Conjunction, & Interjection)	<b>5 Marks</b>
Determiners	<b>3 Marks</b>
Voice (Active & Passive)	<b>2 Marks</b>
Reported Speech (Direct & Indirect)	<b>2 Marks</b>
Tenses	<b>5 Marks</b>
Modals	<b>4 Marks</b>
Phrasal Verbs	<b>4 Marks</b>
Synonyms & Antonyms	<b>4 Marks</b>
Translation (Hindi to English)	<b>5 Marks</b>
Types of Sentences (Assertive / Declarative, Interrogative, Imperative and Exclamatory)	<b>3 Marks</b>

### **3. Comprehension and Composition**

Letter (Formal & Informal)	<b>3 Marks</b>
Unseen Passage	<b>10 Marks</b>

(This should imply not only (a) an understanding of the passage in question but also (b) a grasp of general language skills and issues with reference to words and usage within the passage.)

#### Recommended Reading

1. Thomson & Martinet: A Practical English Grammar (OUP)
2. Wren & Martin : High School English Grammar and Composition(S.CHAND.PUB.)
3. Raymond Murphy: Essential Grammar in Use: A self Study reference and practice book for elementary students of English 4th Edition.(CUP)
4. J. C. Nesfield : English Grammar : Composition and Usage (Macmillan)

## PHYSICS

**Each theory paper in the annual examination shall have three sections.**

**Section A** shall contain one compulsory question of 5 marks having 10 parts. Two parts shall be set from each unit. The candidate is required to answer each part in about 20 words.

**Section B** shall contain five compulsory questions of 5 marks each with internal choice .One question with internal choice will be set from each unit .The answer may be given in approximately 250 words.

**Section C** shall contain four descriptive questions covering all units and candidate has to answer any two questions of ten marks each. The answer may be given in approximately 500 words. There can be two parts in a question from this section.

**In total the candidate has to answer eight questions in each theory paper.**

### PAPER-I

#### KINETIC THEORY, THERMODYNAMICS AND STATISTICAL PHYSICS

Marks :50

External :40

Internal :10

#### UNIT – I

**Ideal Gas:** Kinetic Model, Deduction of Boyle's law, Review of the kinetic model of an ideal gas, Interpretation of temperature, Brownian motion, Estimate of the Avogadro number, Equipartition of energy, specific heat of monatomic gas, extension to di and triatomic gases, Behaviour at low temperatures, Adiabatic expansion of an ideal gas. Application to atmospheric physics (derivation of barometric equation)

**Real Gas:** Van der Waals model; equation of state, nature of Van der Waals forces, comparison with experimental P-V curves. The critical constants, gas and vapour. Joule-Thomson expansion of an Ideal gas and Van der Waals gas; Constancy of  $U+pV$ , Joule coefficients, Estimates of J-T cooling, adiabatic expansion of an ideal gas.

**Liquification of gases :** Joule Expansion, Joule-Thomson and adiabatic cooling, Boyle temperature and inversion temperature, principles of regenerative cooling and cascade cooling, Liquification of hydrogen and helium, meaning of efficiency.

## UNIT - II

**Transport phenomena in gases:** Molecular collisions, mean free path and collision cross-sections, Estimates of molecular diameter and mean free path, Experimental determination of mean free path. Transport of mass, momentum and energy and interrelationship, dependence on temperature and pressure.

**Maxwellian distribution of speeds in gas:** Derivation of distribution of speeds and velocities, experimental verification, distinction between mean, rms and the most probable speed values. Doppler broadening of spectral lines.

## UNIT - III

**The laws of thermodynamics:** The Zeroth law, Various indicator diagrams, work done by and on the system, First law of thermodynamics, internal energy as a state function. Carnot cycle and its efficiency, Carnot theorem and the second law of thermodynamics, Different versions of the second law, Reversible and irreversible changes.

Practical cycles used in internal combustion engines. Entropy, principle of increase of entropy. Thermodynamic scale of temperature; its identity with the perfect gas scale. Impossibility of attaining absolute zero; third law of thermodynamics.

**Thermodynamic relationships:** Thermodynamic variables; extensive and intensive, Maxwell's general relationships; applications to J-T cooling and adiabatic cooling in a general system, Van der Waals gas, and the Clausius-Clapeyron heat equation.

**Thermodynamic Potentials:** Relation to the thermo-dynamic variables, Equilibrium of thermodynamic systems, Cooling due to adiabatic demagnetization.

## UNIT - IV

**Statistical basis of the thermodynamics:**

Probability and thermodynamic probability, principle of equal *a priori* probabilities, probability distribution and its narrowing with the increasing  $n$ , average properties, Accessible and inaccessible states, distribution of particles with a given total energy into a discrete set of energy states.

**Phase space representation:** The  $\mu$  space; its division into sheets of energy, phase cells of arbitrary size, onedimensional oscillator, free particles, the functions  $F(E)$  and  $W(E)$ , definition of probability.

**Black Body Radiation:** Spectral distribution of BB radiation; pure temperature dependence, Stefan-Boltzmann law, Wien's displacement law, Rayleigh-Jeans law and the ultraviolet catastrophe, Pressure of radiation, Planck's hypothesis, mean energy of an oscillator and the Planck's law, complete fit with the experiment. Interpretation of specific heats of gases at low temperature.

## UNIT-V

**The bridge of Statistical physics with thermo-dynamics:** Thermal equilibrium between two subsystems, beta parameter and its identity with  $(kT)^{-1}$ , probability and entropy, Boltzmann entropy relation, statistical interpretation of the second law of thermodynamics. Boltzmann canonical distribution law; rigorous form of equipartition of energy.

**Transition to quantum statistics:**  $h$  as a natural constant and its implications, cases of particles in a box and simple harmonic oscillator, Setting phase-cell size as nature's constant

(Planck's constant  $h$ ); quantization of energy. Indistinguishability of particles and its consequences. Bose-Einstein and Fermi-Dirac conditions, applications to liquid helium, free electrons in a metal, and photons in blackbody chamber, Fermi level and Fermi energy.

**Text and Reference Books:**

1. B.B. Laud, "Introduction to Statistical Mechanics" (Macmillan 1981)
2. F. Reif, "Statistical Physics" (McGraw-Hill, 1988)
3. K. Huang, "Statistical Physics" (Wiley Eastern, 1988)

**PAPER-II  
OPTICS**

**Marks :50  
External :40  
Internal :10**

**UNIT-I**

**Format's Principle** : Principle of experiments path, the aplanatic points of a sphere and other applications.

**General theory of image formation** : Cardinal points of an system; general relationship; thick lenses and lens combinations, telephoto lenses.

**Aberration in images** : Chromatic aberration ; achromatic combination of lenses in contact and separated lenses.

Monochromatic aberrations and their reduction; spherical mirrors and schmidt corrector plates; oil immersion objective, meniscus lenses.

**Optical instruments** : Entrance and exit pupils, need for a multiple lens eye pieces. Common type eye pieces.

**UNIT – II**

**Interference of Light:** The principle of superposition ; two slit interference, coherence requirement for the sources, localized fringes in thin films, transition from fringes of equal thickness to those of equal inclination, Newton's rings, Michelson interferometer its uses for determination of wavelength, wavelength difference and standardization of meter. Intensity distribution in multiple beam interference, Fabry-Perot interferometer and etalon. Lummer Gehrke plate, Lloyds mirror.

**UNIT – III**

Diffraction of light Fresnel diffraction : Half period zones, circular aperture and obstacles; straight edge, explanation of rectilinear propagation, Zone plate with multiple foci

Fraunhofer diffraction : Diffraction at a slit, a circular aperture and a circular disc, resolution of images; Rayleigh criterion. Resolving power of a telescope and microscope, outline of phase contrast microscopy.

Diffraction grating : Diffraction at  $N$  parallel slits, plane diffraction grating, concave grating resolving power of grating and prisms.



## UNIT – IV

Polarization of light Double refraction and optical rotations : Double refraction in uniaxial crystals, explanation in terms of electromagnetic theory, Malus Law, Phase retardation plates, rotation of plane of polarization, origin of optical rotation in liquids and in crystals. Babinet Compensator, Polarimeters and their applications in measurement of specific rotation. Dispersion and Scattering : Theory of dispersion of light, absorption band and anomalous dispersion theory of Rayleigh Scattering.

## UNIT - V

### LASER

Laser System : Purity of spectral line; Coherence length and coherence time, spatial coherence of a source; Einstein's A and B coefficients; Coherence of induced emissions, conditions for laser action, existence of a metastable state, population inversion by pumping and cavity. He-Ne and Ruby Laser

Application of lasers : Spatial coherence and directionality, estimates of Laser and non linear optics : Polarization P including higher order terms in E and generation of harmonics. Momentum mismatch and choice of right crystal and direction for compensation.

### Recommended Books

1. Principle of Optics : B. K. Mathur (Third edition)
2. Text book of Optics : Subrahmanyam and Brijlal (S.Chand and Co.)
3. Optics : Jankins and White (McGraw Hill)
4. Text book of Optics : D. P. Khandelwal
5. Universities Optics Vol. I & II : Whittkar and Yarwood
6. Optics : Ajay Ghatak (Tata McGraw Hill)

## **PAPER-III ELECTRONICS**

**Marks :50  
External :40  
Internal :10**

### **UNIT-I**

Voltage and current sources, Open and Short Circuits, Kirchoff.s laws, Voltage and current divider rules, Mesh and node analysis, Principle of superposition, Thevenin.s and Norton.s theorem, Maximum Power transfer theorem.

#### **Semiconductor diodes:**

p-n junction diodes, I-V characteristics, diode as a rectifier, half wave, full wave and bridge rectifiers, clippers and clampers, Zener, varactor diode and their applications, Optoelectronic diodes: LED and Photo-diodes.

#### **Bipolar Junction Transistors (BJT) :**

Basic construction of pnp and npn transistors and their operation, Input and output characteristics of CB, CE and CC configurations, Biasing methods, active, saturation and cutoff regions, load line concepts, Graphical analysis of CE configuration and phase relationship.

#### **Field effect transistors:**

Basic constructions of JFET and MOSFET, Drain characteristics of JFET, biasing of JFET, operating regions, pinch-off voltage.

### **UNIT-II**

General amplifier characteristics, Two port analysis of a transistor, definition of h- parameters, current gain, voltage gain and power gain of an amplifier, Input and output resistances, Analysis of CB, CE and CC amplifiers for current gain, voltage gain, input and output impedances using h – parameters, Decibel power, Classifications of amplifiers, class A, B, AB and C amplifiers (graphical treatment only), RC coupled transistor amplifier, Gain frequency response, and high frequency limitations. Transformer coupled amplifier.

### **UNIT III**

#### **Feed back amplifiers:**

Basics of Negative feedback, Merits and demerits of negative feedback and its applications, Voltage series amplifier (Emitter follower) and Current series amplifier (CE amplifier with and without bypass capacitor).

**Oscillators:**

Positive feedback, Barkhausen criterion, Phase shift oscillator, Colpitts and Hartley oscillators, and Crystal oscillator.

**Operational Amplifiers:**

Characteristics of Operational amplifiers, circuit symbols, ideal and practical op-amp, Inverting and noninverting configurations, Applications of OP-AMP as an adder, subtractor, inverter, scale changer, phase shifter,

**UNIT-IV**

Binary, Octal, decimal and hexadecimal numbers and their inter conversions, 1's and 2's complements of binary numbers, addition and subtraction of binary numbers, OR, AND, NOT, NAND, NOR and XOR gates and their symbols and truth tables, Boolean algebra, DeMorgan's theorem, minterms and maxterms, sum of minterms and product of maxterms forms of Boolean functions, simplifications of Boolean function using Karnaugh's map (up to 4-variables)

**UNIT-V**

**Modulation:**

Basics of modulation, amplitude and frequency modulation, sidebands, Comparison between AM and FM, power of amplitude modulation and spectrum, AM and FM transmitters (Block diagram and principle of operation only).

**Demodulation:**

Demodulation of AM and FM waves, linear envelope detector, Hetrodyne and superhetrodyne receiver (Block diagram and principle of operation only)

**Cathode Ray Oscilloscope:**

Cathode ray tube-theory and construction, Cathode Ray Oscilloscope (Block diagram and operation), Application of CRO, wave form display, frequency, phase and amplitude determination, Lissajous figures.

**Recommended Books:**

1. Electronic Devices and Circuit theory by R. Boylestead and L. Nashelsky (Prentice Hall of India).
2. Foundations of Electronics by D. Chattopadhyaya, P.C. Rakshit, B. Saha and N.N. Purkait (New Age)
3. Electronic Devices by Allan Mottershed (Prentice Hall of India).
4. Digital fundamentals by Thomas L Floyd ( Unuited Book Stall, New Delhi).
5. Electronic fundamentals and applications by John D. Ryder (Prentice Hall of India).
6. Electricity and Magnetism by K.K. Tewari (S. Chand & Company Limited).

## PAPER-IV

### PHYSICS PRACTICAL

The distribution of marks in the practical examination will be as follows:

(i) Two experiments		48 Marks
For each experiment, distribution of marks will be as follows:		
Figure	:	3
Formula/Theory	:	3
Observation	:	10
Calculation and Result	:	6
Precautions	:	2
(ii) Viva voce		12
(iii) Records		15
	<b>Total</b>	<b>75 Marks</b>

**MAX. MARKS :75**

Students are expected to perform sixteen experiments in all taking eight from each section. One experiment from Section A and one from Section B shall be set in the examination paper.

### LIST OF EXPERIMENTS

#### Section-A

1. Determination of the size of the Lycopodium grains using Cornu's method.
2. Determination of wavelength of Mercury light using grating
3. Determination of resolving power of grating
4. Determination of dispersive power of the glass prism
5. Determination of wavelength of sodium light using Fresnel's biprism
6. Determination of wavelength of sodium light using Newton's rings
7. Determination of specific rotation of cane sugar solution using polarimeter.
8. Determination of wavelength of ultra sonic wave.
9. Determination of focal length of a high power microscope objective.
10. Measurement of absorption by a solution.
11. Study of aberrations of a thick lens.
12. Study of interference fringes in thin films of the following (not all)
  - (a) Thermal expansion of a crystal using interference fringes.
  - (b) Bending of a glass plate under load.

- (c) Bending of a rod under load.
- (d) Use of Newton's ring to determine the radii of curvature of surfaces.
- (e) Use of fringes in wedge film .
- 13. Resolving limit of the eye and of a telescope with a variable aperture.
- 14. Fresnel diffraction at a straight edge and a slit.
- 15. Fraunhofer diffraction at a single slit.
- 16. Resolving limits of grating and prism.
- 17. Study of polarization of the light by simple reflection.
- 18. Verification of Cauchy's relation using Prism and Grating.

### **Section-B**

1. To draw characteristic curves of Common emitter transistor and calculate its hybrid parameters.
2. To study gain and frequency response of a single stage Common emitter amplifier.
3. To determine varactor diode characteristics.
4. To draw characteristics of Zener diode and calculate voltage regulation factor.
5. To study ripple factor and internal resistance of a solid state power supply using LR, CR and Pi filter using aCRO
6. To find barrier height of a given solid state diode.
7. Use of p-n junction for the measurement of temperature.
8. Design and construction of phase shift oscillator.
9. Design, build and test of a logarithmic amplifier.
10. Study of a function generator using Operational Amplifier.
11. Study of NAND and NOR circuits (discrete and IC) XOR and De Morgans Theorem.
- 12 Study of multiplexers and demultiplexers.
- 13 Study of half adder and full adder circuit.
14. Study RS, D and JK flip - flops.
15. Study of Modulo- 3 , Modulo-5 and Modulo-7 binary counter circuits.
16. Study of characteristics of a thermistor.
17. Determination of solar constant or temperature of an oven through radiation measurement.
18. Resistance thermometry: temperature of a torch bulb filaments from R value, platinum resistance thermometry.

**CHEMISTRY**  
**PAPER I**  
**INORGANIC CHEMISTRY**

**Marks :50**  
**External :40**  
**Internal :10**

**UNIT - I**

**Chemistry of Elements of First Transition Series** : Characteristic properties of d-block elements (colour variable valency, magnetic and catalytic properties and ability to form complexes). Properties of the elements of the first transition series, their binary compounds and complexes illustrating relative stability of their oxidation states, coordination number and geometry.

**Chemistry of Elements of Second and Third Transition Series** : General characteristics, comparative treatment with their 3d-analogues in respect of ionic radii oxidation states, magnetic behaviour, spectral properties stereochemistry.

**UNIT - II**

**Oxidation and Reduction** : Use of redox potential data analysis of redox cycle, redox stability in water- Frost, Latimer and Pourbaix diagrams, principles involved in the extraction of the elements.

**Coordination Compounds** : Werner's coordination theory and its experimental verification, effective atomic number concept, nomenclature of coordination compounds, isomerism in coordination compounds valence bond theory of transition metal complexes, chelate and chelate effects.

**UNIT - III**

**Chemistry of Lanthanides** : Electronic structure, oxidation states and ionic radii, lanthanide contraction, complex formation, occurrence and isolation, lanthanide compounds.

**Chemistry of Actinides** : General feature and chemistry of actinides, chemistry of separation of Np, Pu and Am from U, similarities between the later actinides and the later lanthanides.

**UNIT - IV**

**Gravimetric Analysis** : Principles, solubility, formation and preparation of precipitation, colloidal properties, ageing and contamination of the precipitates, co-precipitation and post-precipitation.

**Simple Organic Reagents used in Inorganic Analysis** : 8-Hydroxyquinoline, Dimethylglyoxime,  $\alpha$ -nitroso-  $\alpha$ -naphthol, Anthranilic acid, Arsenic acid, Cupron and Cupferron.

#### UNIT - V

**Chromatography** : Basic principles, instrumentation and application of adsorption and partition chromatography, ion exchange separation.

**Errors in Quantitative Analysis** : Accuracy and precision, determinate, indeterminate and accidental errors, precision of a single measurement, precision of mean rejection of result, errors in a derived result methods of checking the accuracy of analysis, significant figures, computation values.

#### BOOKS RECOMMENDED

1. Text Book of Quantitative Inorganic Analysis : A.I. Vogel (Chapter I, II and XXIII).
2. Text Book of Quantitative Inorganic Analysis : I.M. Kolthoff and E.R. Sandell.
3. Concise Inorganic Chemistry : J.D. Lee.
4. General Inorganic Chemistry : J.A. Duffy.
5. Principle of Inorganic Chemistry : B.R. Puri and L.R. Sharma.
6. Basic Inorganic Chemistry : Cotton and Wilkinson and Gaus. Willey.
7. Inorganic Chemistry (Hindi ed.) : Suresh Ameta, A. Sharma and M. Metha, Himanshu Pub.

## PAPER II ORGANIC CHEMISTRY

Marks :50  
External :40  
Internal :10

### UNIT - I

#### **Alcohols and Epoxides :**

Unsaturated alcohols - Vinyl and Allyl alcohol.

Dihydric alcohol - Nomenclature, method of formation and chemical reactions of vicinal glycols.

Pinacol - Pinacolone rearrangement.

Trihydric alcohols - Formation and chemical reactions of glycerol.

Epoxides - Synthesis and reactions of epoxides, orientation of epoxide ring opening.

**Phenols** - Nomenclature, structure and bonding preparation of phenols, physical properties and acidic character, comparative acidic strength of alcohols and phenols, resonance stabilization of phenoxide ion.

Reactions of phenols - Electrophilic aromatic substitution, acylation and carboxylation, Mechanism of Fries rearrangement, Claisen rearrangement, Gatterman synthesis. Hauben=Hoesch reaction, Ledgerer Manasse reaction and Reimer-Tiemann reaction.

### UNIT - II

**Aldehydes and Ketones :** Synthesis, chemical and physical properties of aromatic aldehydes and ketones, mechanism of nucleophilic addition to carbonyl group with particular emphasis on Benzoin, Aldol, Perkin and Knoevenagel condensations, condensation with ammonia and its derivatives, Wittig reaction, Mannich reaction.

Use of acetals as protecting group, Oxidation of aldehydes, Baeyer, Villiger oxidation of ketones, Cannizzaro reaction, MPV, Clemmenson, Wolff-Kishner,  $\text{LiAlH}_4$  and  $\text{NaBH}_4$  reductions, Halogenation of enolizable ketones.

### UNIT- III

**Carboxylic Acids and their derivatives :** Nomenclature, structure and bonding, acidity of carboxylic acids, effects of substituents on acid strength, mechanism of decarboxylation, Methods



of formation, physical properties and chemical reactions of dicarboxylic acids, oxalic, succinic and phthalic acid.

Substituted Acids - Methods of formation and chemical reactions of halo acids, hydroxy acids, malic, tartaric, citric and salicylic acids.

Unsaturated Acids - Acrylic and cinnamic acids.

Introduction to acids derivatives - Preparation, properties and uses of acid halides, amides, anhydrides and esters.

Interconversion of acid derivatives by nucleophilic acyl substitution. Mechanism of HVZ reaction, Hofmann-bromamide reaction and ester hydrolysis.

#### UNIT - IV

**Organic Compounds of Nitrogen** : Preparation and chemical reactions of nitroarenes. Reactivity of nitrosubstituted arenes.

Aromatic amines, classification, preparation, properties and uses of primary amino compounds aniline, acetanilide, nitroanilines.

Secondary amino compounds - diphenylamine and N-methylaniline.

Tertiary amino compounds - Triphenylamine and N,N-dimethylaniline.

Aryl alkyl amine - Benzylamine.

Basic strength of amines - similarities and differences between aliphatic and aromatic amines.

Diazonium salt - formation, properties and synthetic uses of benzene diazonium salt, Diazo coupling and its mechanism.

**Organic Sulphur Compounds** : Preparation and properties of thiols, sulphonic acid, sulphonyl chloride, saccharides, chloramine-T, dichloramine-T and sulphonamides.

#### UNIT - V

**Polynuclear Hydrocarbons** : Nomenclature of naphthalene and anthracene derivatives, preparation and properties of naphthalene, anthracene, naphthol, naphthylamine, naphthaquinone and anthraquinone.

Mechanism and orientation of electrophilic substitution reaction in naphthalene and anthracene.

**Organic Compounds** : Preparation, properties and synthetic uses of organo lithium and organo zinc compounds.

#### BOOKS RECOMMENDED

1. A Text Book of Organic Chemistry : K.S. Tiwari, S.N. Mehrotra and N.K. Vishnoi.
2. Modern Principles of Organic Chemistry : M.K. Jain and S.C. Sharma
3. A Text Book of Organic Chemistry : (Vol. I and II), O.P. Agarwal.
4. A Text Book of Organic Chemistry : B.S. Bahl and Arun Bahl.
5. A Text Book of Organic Chemistry : P.L. Soni.
6. Organic Chemistry : (Vol. I, II and III), S.M. Mukherji, S.P. Singh and R.P. Kapoor
7. Organic Chemistry (Hindi Ed.) : Suresh Ameta, P.B. Punjabi and B.K. Sharma, Himanshu Pub.

**PAPER III  
PHYSICAL CHEMISTRY**

**Marks :50  
External :40  
Internal :10**

**UNIT I**

**Thermodynamics-I** : Definition of thermodynamic terms system, surrounding, etc. types of systems, intensive and extensive properties, state and path functions, their differentials, thermodynamics process, concept of heat and work.

First law of Thermodynamics - Statement, definition of internal energy and enthalpy, heat capacity, heat capacities at constant volume and pressure and their relationship. Joule's law, Joule-Thomson coefficient and inversion temperature, calculation of  $w$ ,  $q$ ,  $dU$  and  $dH$  for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process.

Thermo chemistry : Standard state, standard enthalpy of formation. Hess's law of heat summation and its applications, Heat of reaction at constant pressure and at constant volume, Enthalpy of neutralization, bond dissociation energy and its calculation from thermo chemical data, temperature dependence of enthalpy, Kirchhoff's equation.

**UNIT II**

**Thermodynamics - II** : Second law of thermodynamics : need for the law, different statements of the law, Carnot cycle and its efficiency, Carnot theory, thermodynamic scale of temperature.

Concept of entropy : Entropy as a state function, Entropy as a function of  $V$  and  $T$ , entropy as a function of  $P$  and  $T$ . Entropy change in physical change. Clausius inequality, entropy as a criteria of spontaneity and equilibrium, entropy change in ideal gases and mixing of gases.

**Third Law of Thermodynamics** : Nernst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data. Gibbs and Helmholtz function, Gibbs function ( $G$ ) and Helmholtz function ( $A$ ) as thermodynamic quantities.  $A$  &  $G$  as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change, variation of  $G$  and  $A$  with  $P$ . and  $T$ .

**Chemical Equilibrium** : Equilibrium constant and free energy, thermodynamic derivation of law of mass action, distribution law and phase rule, Le Chatelier's principle, Nernst's distribution law for solute, principle of extraction of solute from solution and washing of precipitates.

Reaction isotherm and reaction isochore - Clapeyron equation and Clausius - Clapeyron equation, applications, partial molar quantities, partial molar volume and its distribution, chemical potential and its physical significance, Gibbs-Duhem equation.

### UNIT III

**Macromolecules** : Nomenclature, classification, properties of polymer, mass of macromolecules, number average and weight average molecular mass, determination of molecular weight by osmotic pressure. viscosity and light scattering and sedimentation (ultra centrifuge) methods.

**Surface Chemistry** : Sorption at surfaces, physical and chemical adsorption, Freundlich, Langmuir and Gibbs adsorption isotherms and their derivation, Streaming potential electrophoresis and electroosmosis.

### UNIT IV

**Phase Equilibrium** : Statement and meaning of the terms - phase, component and degree of freedom, derivation of Gibbs phase rule, phase equilibrium of one component system - water CO<sub>2</sub> and S - system.

Phase equilibria of two component system - Solid - liquid equilibria, simple eutectic, Bi-Cd, Pb-Ag systems, desilverization of lead.

Solid solutions - Compound formation with congruent melting point (Mg - Zn) and incongruent melting point, (NaCl - H<sub>2</sub>O), (FeCl<sub>3</sub> - H<sub>2</sub>O) and (CuSO<sub>4</sub> - H<sub>2</sub>O) systems, freezing mixtures, acetone - dry ice.

Liquid - liquid mixtures: Ideal liquid mixtures, Raoult's and Henry's law, Non -ideal system, azeotropes: HCl - H<sub>2</sub>O and ethanol - water systems.

Partially miscible liquids: phenol - water, trimethylamine - water, nicotine - water systems, lower and upper consolute temperature, effect of impurity on consolute temperature.

Immiscible liquids, steam distillation.

### UNIT V

**Electrochemistry** : Types of reverse electrode : gas - metal ion, metal-metal ion, metal-insoluble salt - anion and redox electrodes, electrode reactions, Nernst - equation, derivation of cell E.M.F. and single electrode potential standard hydrogen electrode-reference electrodes - standard electrode potential sign conventions, electrochemical series and its significance electrolytic and Galvanic cells- reversible and irreversible cells, conventional representation of electrochemical cells. EMF of a cell and its measurements, computation of cell EMF. Calculation of thermodynamic quantities of cell reactions ( $\Delta G$ ,  $\Delta H$  and  $K$ ) polarization over potential and hydrogen overvoltage. Concentration cell with or without transport, liquid junction potential application of concentration cells, valency of ions, solubility product and activity coefficient, potentiometric titrations.

**Ionic Equilibria** - Arrhenius theory of electrolyte and its application Ostwald's dilution law, its uses and limitations. Debye - Huckle theory of strong electrolytes, asymmetric electrophoretic. Debye- Falkenhagen and Wien effects, Activity coefficient, mean activity coefficient, ionic strength, Debye- Huckel limiting law.

### BOOKS RECOMMENDED

1. Principles of Physical Chemistry : B.R. Puri and L.R. Sharma.
2. A Text Book of Physical Chemistry : A.S. Negi and S.C. Anand.
3. A Text Book of Physical Chemistry : Kundu and Jain.

4. Physical Chemistry (Hindi Ed.) : Suresh Ameta, R.C. Khandelwal, R. Ameta and J. Vardia, Himanshu Pub.

## CHEMISTRY PRACTICALS

### Distribution of Marks

Exercises	Marks
1. Volumetric Estimation OR Gravimetric Analysis	10
2. Determination of R <sub>f</sub> values and identification of given organic compounds using thin layer/paper chromatography	7
3. Identification of given organic compounds through functional group analysis	7
4. Physical Chemistry Experiments	10
5. Vice-voce	8
6 Records	8

**Total 50 marks**

### LIST OF EXPERIMENTS

1. **Volumetric Analysis** : Any one of the following exercise may be given in the examination :

- Determination of acetic acid in commercial vinegar using NaOH
- Determination of alkali content- antacid tablet using HCl.
- Estimation of calcium content in chalk as calcium oxalate using permanganate.
- Estimation of hardness of water by EDTA.
- Estimation of ferrous and ferric ions by dichromate methods.
- Estimation of copper using thiosulphate.
- Estimation of Mg<sup>2+</sup>, Ca<sup>2+</sup> or Zn<sup>2+</sup> complexometrically.

### Gravimetric Analysis :

Analysis of Cu as CuSCN and Ni as Ni (dimethylglyoxime)

*Note: Candidates are required to prepare standard solutions by proper weighing.*

### 2. Thin Layer Chromatography :

Determination of R<sub>f</sub> values and identification of organic compounds.

- Separation of green leaf pigments (spinach leaves may be used)
- Preparation and separation of 2,4 dinitrophenylhydrazones of acetone, 2- butanol, hexane-2- and 3-ones using toluene and light petroleum(40: 60)
- Separation of a mixture of dyes using cyclohexane and ethyl acetate (8.5:1.5)

**Paper Chromatography:** Determination of R<sub>f</sub> values and identification of organic compounds in a mixture of amino acids / monosaccharides.

### 3. Identification of Organic Compounds:

An organic compound from the following list be given for systematic identification:

- (i) Carboxylic acids- Oxalic, Tartaric, Citric, Succinic, Benzoic, Cinnamic, Salicylic, Phthalic acids, Formic, Acetic, Propanoic and Butanoic acids.
- (ii) Phenols- Phenol, Resorcinol, Hydroquinone, p-Cresol,  $\alpha$ -Naphthol,  $\beta$ -Naphthol.
- (iii) Alcohols- Methyl, Ethyl, Propyl, Isopropyl, n-butyl, isobutyl & tert. butyl alcohol.
- (iv) Carbohydrates- Glucose, Fructose, Cane sugar and Starch.
- (v) Aldehydes- Formaldehyde, Acetaldehyde and Benzaldehyde.
- (vi) Ketones- Acetone, Methyl ethyl ketone, Acetophenone and Benzophenone.
- (vii) Nitro compounds - Nitrobenzene, p-Nitrotoluene and m-Dinitrobenzene.
- (viii) Amino compounds - Aniline, o-, m- and p-toluidine,  $\alpha$ -Naphthylamine and  $\beta$ -Naphthylamine.
- (ix) Anilides - Acetanilide and Benzanilide.
- (x) Amides - Acetamide, Benzamide and Urea.
- (xi) Esters - methyl acetate, Ethyl acetate.
- (xii) Thioamide - Thiourea.
- (xiii) Hydrocarbons - Benzene, Toluene, Naphthalene and Anthracene.
- (xiv) Halogen containing compounds - Chloroform, Chloral hydrate, Iodoform, Chlorobenzene, p-Dichlorobenzene and p-Dibromobenzene.

**4. Physical Chemistry Experiments:** Any one of the following experiments may be given in the examination.

#### Distribution Law

- (i) To study the distribution of iodine between water and CCl<sub>4</sub>.
- (ii) To study the distribution of benzoic acid between benzene and water.
- (iii) To study the distribution of acetic acid between benzene and water

#### Phase Equilibrium

- (i) To study the effect of a solute (e.g. NaCl, succinic acid) on the critical solution temperature of two partially miscible liquids (e.g. Phenol water system) and to determine the concentration of that solute in the given phenol-water system.
- (ii) To construct the phase diagram of two components (e.g. diphenylamine- benzophenone) system by cooling curve method.

#### Adsorption :

- (i) To study the adsorption of acetic acid by activated charcoal and test the validity of Freundlich or Langmuir adsorption isotherm.
- (ii) To study the adsorption of oxalic acid by activated charcoal and test the validity of Freundlich or Langmuir adsorption isotherm.

#### Analysis of sugars:

1. Action of salivary amylase on starch
2. Effect of temperature on the action of salivary amylase on starch.
3. Differentiation between a reducing and a nonreducing sugar.

**Virtual experiments (any two)**

- (i) Various type of titrations
- (ii) Chromatographic separation of compounds from leaf or flower extract / dyes / amino acid / saccarides etc.
- (iii) Some photochemical reactions
- (iv) Isoelectric precipitation of proteins: casein from milk.
- (v) Any other virtual experiment related to the content of syllabus and availability of the experimental facilities.

**BOOKS RECOMMENDED**

1. Practical Chemistry - Giri, Bajpai and Pandey, S. Chand & Co. Ltd., New Delhi.
2. Laboratory Manual in Organic Chemistry, R.K. Bansal, Willey Eastern.
3. Experimental Organic Chemistry, Vol. I and II, P.R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.
4. Experiments in Physical Chemistry - J.C. Ghose, Bharti Bhawan.
5. Experiments in General Chemistry, N.r. Rado and U.C. Agarwal, Eastern Press.
6. Practical Chemistry - Suresh Ameta and P.b. Punjabi, Himanshu Publication.

## ZOOLOGY

The second year TDC examination shall consist of three theory papers, each of three hours duration and a practical examination of five hours duration.

### **Pattern of question paper in the annual examination and distribution of marks:**

Each theory paper in the annual examination shall have three sections i.e. A, B, and C. In section A, total 10 questions will be set in the paper, selecting at least two from each unit. These questions to be answered in a word or so. All questions are compulsory. Each question carries 0.5 mark, total 05 marks.

In section B, there shall be total 10 questions, selecting two questions from each unit, five questions to be answered by the student selecting at least one from each unit. Answer should be given in approximately 250 words. Each question carries 05 marks, total 25 marks.

In section C, 04 descriptive type questions will be set in the examination paper from five units of the syllabus of the paper, selecting not more than one question from a unit. Each question may have two sub divisions. Students are required to answer any two questions approximately in 500 words. Each question is of 10 marks, total 20 marks.

## ZOOLOGY

### PAPER-I

#### LIFE AND DIVERSITY OF ANIMALS-II (VERTEBRATES)

**Marks :50**

**External :40**

**Internal :10**

### UNIT-I

1 Characteristics and classification of Protochordates and Agnatha upto orders with examples emphasizing their biodiversity, economic importance and conservation.

2 Type study- *Herdmania*.

3 Affinities of *Amphioxus* and importance of Ammocoete larva.

#### UNIT-II

4 Characteristics and classification of Pisces (after Berg) and Amphibia upto orders with examples emphasizing their biodiversity, economic importance and conservation.

5 Type study- *Scoliodon*, Fish Migration, Parental care in Amphibian.

#### UNIT-III

6 Characteristics and classification of Reptiles upto orders with examples emphasizing their biodiversity, economic importance and conservation.

7 Type study- *Calotes*. Identification of poisonous and non-poisonous snakes, venom, antivenom, medicinal significance of venom.

8 *Sphenodon*: Characteristics and affinities.

#### UNIT-IV

9 Characteristics and classification of Aves upto orders with examples emphasizing their biodiversity economic importance and conservation.

10 Type study - *Columba*, flight adaptations, perching mechanism, types of feathers.

11 Bird migration.

#### UNIT-V

12 Characteristics and classification of Mammalia upto orders with examples emphasizing their biodiversity, economic importance and conservation.

13 Type study – *Rattus*, (Digestive, respiratory and urinogenital systems only).

14 Dentition, hair and thermoregulation; integumentary derivatives.



**ZOOLOGY  
PAPER-II  
GENETICS AND BIOTECHNOLOGY**

**Marks :50  
External :40  
Internal :10**

**UNIT-I**

- 1 Light and electron microscope structure of chromosome (from nucleosome to organization of chromatids. Morphological classification of chromosome).
- 2 Extra-chromosomal inheritance.
- 3 Chromosomal theory of sex determination, hormonal theory of sex determination, X and Y chromosomes, gynandromorphs.

**UNIT-II**

- 4 Brief history of genetics, Mendelian laws and their significance.
- 5 Linkage and crossing over : kinds of linkage – complete and incomplete linkage, linkage groups, significance of linkage.
- 6 Genetic interaction: Complementary gene, duplicate genes, supplementary gene and epistasis.
- 7 Multiple-gene inheritance, ABO blood group, Rh factor.

**UNIT-III**

- 8 Concept of gene, mutation, recombination, cistron, gene expression -lac-operon and trp-operon.
- 9 Genetic engineering: Restriction enzymes, Palindrome sequences, cloning vehicle, cDNA.
- 10 Applications of genetic engineering. Hybridoma technology.

**UNIT-IV**

- 11 Mutations: Definition, gene mutation, chromosomal mutation, chromosomal aberrations, somatic and germ mutations, numerical alterations of chromosomes, molecular basis of mutation, mutagenic agents
- 12 Polytene and lamp-brush chromosomes.
- 13 Eugenics and genetic counselling.

**UNIT-V**

- 14 Medicines and biotechnology: Microbes in medicine, antibiotics, vaccines, enzymes and antigens.
- 15 Food and dairy microbiology: Fermented food production, dairy products, food preservation, microbial spoilage, alcoholic beverages, and vinegar.
- 16 Role of Biotechnology in health care.

**ZOOLOGY**  
**PAPER-III**  
**APPLIED ZOOLOGY AND MICROBIOLOGY**

**Marks :50**  
**External :40**  
**Internal :10**

**UNIT - I**

- 1 History, general account and scope of sericulture. Distribution of mulberry and non-mulberry silkworm.
- 2 Life history of *Bombyx mori*.
- 3 Rearing techniques of silkworm
- (a) Brief account of environmental conditions of rearing and programming of mulberry cultivation.
- (b) Rearing of silk worm.
- 4 Reeling of silk yarn.
- 5 Brief idea of diseases of silk worm.

**UNIT-II**

- 6 History, scope and general practices of pearl culture.
- 7 Rearing of pearl oyster:
- (a) Indigenous methods of pearl culture.
- (b) Modern methods of pearl culture.
- 8 Economic Importance of pearl and pearl culture.
- 9 Brief idea of diseases and enemies of pearl culture.

**UNIT-III**

- 10 Fin-fish culture and fisheries:
- (a) Culturable fresh water fishes of India.
- (b) Inland, marine and estuarine fisheries.
- (c) Preservation of fishes.
- (d) Economic importance of fishing industry.

**UNIT-IV**

- 11 Concepts of basic microbiology and its significance, theory of spontaneous generation, gram theory of fermentation and disease, work of Louis Pasteur.
- 12 General account of classification, structural organization, physiology and multiplication of bacteria.
- 13 General account of classification, structural organization, physiology and multiplication of bacteria.
- 14 Brief idea of Industrial, Medical and Environmental microbiology.

### UNIT-V

- 15 DNA and RNA viruses
- 16 **AIDS:** Causative agents, Transmission, Pathogenicity, Prevention and Laboratory diagnosis of infections and treatment

### ZOOLOGY - PRACTICAL

S.No.	Exercise	
1	Major dissection	10
2	Minor dissection	05
3	Mounting/Applied Zoology exercise	04
4	Spots	15
5	Viva-voce	08
6	Record	08
<b>Total :-</b>		<b>50</b>

*Major Dissection marks will be given only if virtual dissection is available otherwise marks may be given according to availability of dissection alternate.*

#### General survey of Vertebrates (Museum specimens)

- A Urochordata : *Ciona, Pyrosoma, Doliolum, Salpa,*
- B Cephalochordata : *Amphioxus*
- C Agnatha : *Petromyzon, Ammocoete larva*
- D Pisces : *Echeneis, Sphyrna, Torpedo, Pristis, Labeo, Clarias, Anabas, Hippocampus* (male and female), *Chimaera, Anguilla, Protopterus.*
- E Amphibia : *Ichthyophis, Axolotl larva, Salamander, Bufo, Rana, Hyla, Pipa, Amphiuma, Alytes.*
- F Reptilia : *Testudo, Trionyx, Hemidactylus, Draco, Calotes, Chamaeleon, Varanus, Phrynosoma, Heloderma, Naja, Vipera, Typhlops, Bungarus, Hydrophis, Eryx,* models of Dinosaurs.
- G Aves : *Columba, Psittacula, Passer, Bubo,* model of *Archaeopteryx*
- H Mammalia : *Pteropus, Rhinopoma, Felis, Erinaceous, Hystrix, Crocodylus, Manis.*

#### PREPARED SLIDES :

- 1 Cephalochordata : *Amphioxus*: T.S. through buccal region, T.S. through pharynx showing gonads, T.S. through caudal region.
- 2 Pisces : Placoid, cycloid and Ctenoid scales, V.S. of skin.
- 3 Amphibia : V.S. of skin, T.S. of testis, T.S. of kidney and T.S. of liver.
- 4 Reptilia : V.S. of skin and T.S. of stomach.

5 Aves : T.S. of intestine, T.S. of liver, T.S. of ovary, filoplume W.M.

6 Mammalia : T.S. of pancreas, T.S. of thyroid gland, L.S. of pituitary gland, T.S. of stomach, T.S. of intestine, L.S. of kidney, T.S. of testis and ovary and V.S. of skin, T.S. of lung.

**PERMANENT PREPARATIONS:** Unstained placoid scales, spicules of *Herdmania*.

**DISSECTION (Virtual):** Virtual dissection will be done (if facility of virtual is made available by University)

***Herdmania*** : Neural complex.

***Scoliodon*** : Alimentary canal, scroll valve *in situ*, afferent and efferent branchial arteries, eye muscles, internal ear.

**Digital animals** : Arterial, venous and urino-genital systems.

### **OSTEOLOGY :**

Identification of disarticulated skeleton of *Rana*, *Varanus*, *Gallus* and *Oryctolagus*. Palates of birds.

### **GENETICS:**

***Drosophila*** : Life cycle and its culture. Identification of wild and mutant *Drosophila*.

### **APPLIED ZOOLOGY:**

1 Identification of different stages (from egg to adult) of silkworm.

2 Tools used in silk worm rearing.

3 Mounting of mouth parts and sting apparatus of honey bee.

4 Identification of cultivable varieties of shell fish and fin fish.

5 Gram staining of microbes.

The teacher concerned will provide e-materials to practical in the form of video or demonstrations or written materials including dissections.

### **REFERENCE BOOKS (LATEST EDITIONS):**

#### **LIFE AND DIVERSITY OF ANIMALS (VERTEBRATES)**

1 Ayyar, E.K. and T.N. Ananthakrishnan, Manual of Zoology, Vol.II (Chordata), S.Viswanathan (Printers and Publishers) Pvt. Ltd. , Madras.

2 Jordan, E.L. and P.S.Verma, Chordate Zoology and Elements of Animal Physiology, S. Chand &Co. Ltd., Ram Nagar, New Delhi (English and Hindi Editions).

3 Parker and Haswell, Text Book of Zoology, Vol.II (Chordata), A.Z.T.B.S. Publishers and Distributors, New Delhi- 110051.

4 Waterman, Allyn J. et.al., Chordate Structure and Function, Mac Millan and Co., New York.

5 Kotpal, RL, Modern Text Book of Zoology- Vertebrates, Rastogi Publications, Meerut (English and Hindi Editions).

6 Ganguly, BB, Sinha, AK and Adhikari, S : Biology of Animals, Vol.II, New Central Book Agency(P) Ltd. Kolkatta.

7 Alexander, R.M.: The Chordates (Cambridge University Press).

8 Monielth, A.R: The Chordates (Cambridge University Press).

- 9 Young, J.Z : Life of Vertebrates (Oxford University PressL)  
10 Waterman, A.J: Chrodata - Structure and Function (Macmillan Co.).

**GENETICS AND BIOTECHNOLOGY:**

- 11 Verma, P.S. and V.K.Agarwal, Genetics, S.Chand & Co.  
12 Lewis, C.D. and Lewin, R., Biology of Gene, McGraw Hill, Toppan Co. Ltd.  
13 Gunther S. Stent, Molecular Genetics, macmillan Publishing Co. Inc.  
14 Goodenough, V., Genetics, New York Holt, Rinchart and Winston.  
15 Gardner, Principles of Genetics, Wiley Eastern Pvt., Ltd.  
16 Winchester, Genetics, Oxford IBH Publications  
17 Stickberger, Genetics, MacMillan Publications.  
18 Pai, A.C., Foundations of Genetics, McGraw Hill Publications.  
19 R.A.Meyers (Endocrinology.): Molecular Biology and Biotechnology, VCH Publishers.  
20 Glick : Molecular Biotechnology.  
21 R.W.Old and S.B. Primrose: Principles of Gene Manipulation and Introduction to Genetic Engineering.  
22 Gupta PK : Elements of Biotechnology, Rastogi Publications, Meerut.

**APPLIED ZOOLOGY AND MICROBIOLOGY :**

- 23 Jhingran, VG, Fish and Fisheries of India. Hindustan Publishing Corporation, New Delhi.  
24 Kovaleve, PA, Silkworm Breeding Stocks, Central Silk Board, Merine Drive, Bombay.  
25 Roger, A. Morse, The ABC and XYZ of Bee Culture, A.I. Root and Co., Medina, Ohio 44256.  
26 Metcalf CL and WP Flint, Destructive and Useful Insects, Tata McGraw Hill publishing Co. Ltd.,New Delhi- 110051  
27 Sharma PD, Microbiology, Rastogi Publications Meerut.  
28 Shukla and Upadhyaya : Economic Zoology ( Rastogi Publishers)  
29 Venkitaraman : Economic Zoology (Sudarshana Publishers)

**PRACTICAL:**

- 30 Verma, PS, A manual of practical Zoology Vertebrates S.Chand and Co. Ltd., Ram Nagar, NewDelhi (English and Hindi Editions).  
31 Lal, SS : Practical Zoology Vertebrates, Rastogi Publication, Meerut (English and Hindi Editions).

## **BOTANY THEORY**

### **PAPER-I TAXONOMY AND EMBRYOLOGY OF ANGIOSPERMS**

**Marks :50  
External :40  
Internal :10**

#### **Unit-1**

Taxonomic categories; concept of species, genus and family; Herbarium techniques. Systems of classification of Bentham and Hooker, Engler and Prantl, Hutchinson and Takhtajan.

#### **Unit-2**

International rules of nomenclature, range of floral structure, floral variation, and economic importance of Ranunculaceae, Brassicaceae, Papaveraceae, Capparidaceae, Caryophyllaceae, Malvaceae, Rutiaceae, Cucurbitaceae, Myrtaceae, Leguminosae, Rosa-ceae, Apiaceae (Umbelliferae).

#### **Unit-3**

Range of floral structure, floral variation and economic importance of Rubiaceae, Asteraceae, Primulaceae, Solanaceae, Asclepiadaceae, Convolvulaceae, Apocynaceae, Acanthaceae, Lamiaceae, (Labiatae), Euphorbiaceae, Poaceae (Graminae).

#### **Unit-4**

Classical theory of morphology of flower; Primitive stamens and carpel; Microsporogenesis, Megasporogenesis, Structure and development and male and female gametophytes, Fertilization, Nutrition of Embryo sac.

#### **Unit-5**

Structure, development and types of endosperm and embryo, Polyembryony, Apomixis, Experimental embryology; Culture of anther, endosperm and embryo.

**Note :**

The paper setter is required to set questions of 3 types contained in 3 Sections (**Section A**- 10 questions, **Section B**-10 questions and **Section C**- 4 questions) from the 5 units of each paper. There will be 10 questions in **Section A** which will be asked from all the 5 units, i.e., 2 questions from each unit. These questions have to be answered in one word or a few words only. Each question will be of half mark . All the questions in **Section A** are compulsory.

In **Section B**, 10 questions will be set from the 5 units, i.e., 2 questions from each unit. Students are required to attempt at least 1 question from each unit. Each question will carry 5 marks . The answers of each question should be given in about 250 words. In **Section C** there will be 4 descriptive type questions set from all the 5 units, not more than 1 question from each unit. These questions may also have sub-divisions. The students are required to answer 2 questions, each in approximately 500 words. Each question will carry 10 marks .

In short, pattern of question paper and distribution of marks for UG classes will be as under :

**Section A** : 10 questions, 2 questions from each unit, short answer, all questions compulsory.

Total marks : **05**

**Section B** : 10 questions, 2 question from each unit, 5 question to be attempted, at least 1 from each unit, answer approximately in 250 words.

Total marks : **25**

**Section C** : 04 questions (question may have sub-division), not more than 1 question from each unit, descriptive type, answer in about 500 words, 2 questions to be attempted. Total marks : **20**

**PAPER II**  
**ANATOMY OF ANGIOSPERMS, ECONOMIC**  
**BOTANY AND ETHNOBOTANY**

**Marks :50**  
**External :40**  
**Internal :10**

**Unit-1**

Plant anatomy : Introduction, organization of meri-stems; theories related to their organization; cell wall grossmicroscopic structure and chemistry.

**Unit-2**

Tissue and tissue systems; Parenchyma, Collenchyma, Sclerenchyma, Xylem, Phloem, Secretory structures and periderm.

**Unit-3**

Primary and Secondary Structure : Structure of root, stem and leaf. Primary and secondary anomalous structure with special reference to *Aristolochia*, *Salva-dora*, *Bignonia*, *Achyranthes*, *Amaranthus*, *Boerhaavia*, *Mirabilis*, *Chenopodium* *Dracaena*, *Tinospora*.

**Unit-4**

Study the economic botany of the following :

Cereals : *Triticum*, *Zea*

Pulses : *Glycine max*, *Cajanus cajan*

Fibres : Classification; *Gossypium*,  
*Crotalaria*, *Corchorus*; artificial fibres.

Wood : Classification, mechanical  
properties; *Shorea*, *Tectona*, *Pinus*, *Cedrus*.

Paper : Raw materials and manufacture.

Sugar : Sugarcane, Beet.

**Unit-5**

Study of economic uses of the following :



Medicinal Plants : *Rauwolfia, Datura, Cinchona, Papaver.*

Beverages : Alcoholic; Non-alcoholic: tea and coffee.

Spices and : *Coriandrum, Cuminum, Ferula,*

Condiments *Curcuma, Trigonella, Elettaria,*

*Capsicum, Piper, Zingiber.*

Oil : *Arachis, Cocos, Helianthus.*

Ethnobotany : Introduction; Aims and

Objectives; knowledge of important plants of various groups from Ethnobotanical point of view as food, fodder and Medicine with special reference to Rajasthan.

**Note :**

The paper setter is required to set questions of 3 types contained in 3 Sections (**Section A**- 10 questions, **Section B**-10 questions and **Section C**- 4 questions) from the 5 units of each paper. There will be 10 questions in **Section A** which will be asked from all the 5 units, i.e., 2 questions from each unit. These questions have to be answered in one word or a few words only. Each question will be of half mark. All the questions in **Section A** are compulsory. In **Section B**, 10 questions will be set from the 5 units, i.e., 2 questions from each unit. Students are required to attempt at least 1 question from each unit. Each question will carry 5 marks. The answers of each question should be given in about 250 words. In **Section C** there will be 4 descriptive type questions set from all the 5 units, not more than 1 question from each unit. These questions may also have sub-divisions. The students are required to answer 2 questions, each in approximately 500 words. Each question will carry 10 marks.

In short, pattern of question paper and distribution of marks for UG classes will be as under :

**Section A** : 10 questions, 2 questions from each unit, short answer, all questions compulsory.

Total marks : **05**

**Section B** : 10 questions, 2 question from each unit, 5 question to be attempted, at least 1 from each unit, answer approximately in 250 words. Total marks : **25**

**Section C** : 04 questions (question may have sub-division), not more than 1 question from each unit, descriptive type, answer in about 500 words, 2 questions to be attempted. Total marks : **20**

**PAPER-III**  
**CYTOGENETICS, PLANT BREEDING,**  
**EVOLUTION AND BIOSTATISTICS**

**Marks :50**  
**External :40**  
**Internal :10**

**Unit-1**

Cell Biology - Structure of cell (of both prokaryotes and eukaryotes); membranes; cell organelles, ergasticsubstances. Chromatin- euchromatin, heterochro-matin. Chromosomes - Type and organization; morpho-logy,chemical constituents; Structural changes in chromosomes and their significance.

**Unit-2**

Cell Division - Amitosis, mitosis, meiosis; synepto-nemal complex; Linkage and crossing over. Gene(Chromosomal) mappping; Sex determination.

**Unit-3**

Mendel.s laws of inheritance - Monohybrid and dihy-brid ratio, incomplete dominance; Modifications of dihybridratio; cytoplasmic inheritance (Inheritance of plastids and streptomycin resistance in *Chlamy-domonas*); Principlesof plant breeding. Selection, introduction, clonal propagation, hybridization, mutation breeding.

**Unit-4**

Green Revolution, conservation of germplasm, centres of origin. Cytology in relation to taxonomy; Apomixis;

**Unit-5**

Evolutionary theories, catastrophism, the Lamarck.s theory, development of Darwin.s theory, Evidences of evolution, adaptations, natural selection patterns of evolution, origin of species. Elementary study of bio-statistics;

The paper setter is required to set questions of 3 types contained in 3 Sections (**Section A-** 10 questions, **Section B-**10 questions and **Section C-** 4 questions) from the 5 units of each paper.

There will be 10 questions in **Section A** which will be asked from all the 5 units, i.e., 2 questions from each unit. These questions have to be answered in one word or a few words only. Each question will be of half mark. All the questions in **Section A** are compulsory.

In **Section B**, 10 questions will be set from the 5 units, i.e., 2 questions from each unit. Students are required to attempt at least 1 question from each unit. Each question will carry 5 marks. The answers of each question should be given in about 250 words. In **Section C** there will be 4 descriptive type questions set from all the 5 units, not more than 1 question from each unit. These questions may also have sub-divisions. The students are required to answer 2 questions, each in approximately 500 words. Each question will carry 10 marks.

In short, pattern of question paper and distribution of marks for UG classes will be as under :

**Section A** : 10 questions, 2 questions from each unit, short answer, all questions compulsory. Total marks : **05**

**Section B** : 10 questions, 2 question from each unit, 5 question to be attempted, at least 1 from each unit, answer  
**Section C** : 04 questions (question may have sub-division), not more than 1 question from each unit, descriptive type, answer in about 500 words, 2 questions to be attempted. Total marks : **20**

## PRACTICALS

The practical exercises have been divided into following two groups :

Group-I : Taxonomy, Embryology and Economic Botany.

### GROUP-I

#### A) TAXONOMY

1. Ranunculaceae : *Ranunculus, Nigella, Delphinium*
2. Brassicaceae : *Brassica, Raphanus, Iberis*
3. Papaveraceae : *Argemone, Papaver.*
4. Capparidaceae : *Capparis, Cleome.*
5. Caryophyllaceae : *Stellaria, Spergula, Viscaria, Dianthus (Single), Gypsophylla.*
6. Malvaceae : *Hibiscus, Althaea*
7. Rutaceae : *Citrus, Ruta, Murraya*
8. Leguminosae : *Pisum, Crotalaria; Cassia, Caesalpinia, Bauhinia, Tamarindus; Acacia, Prosopis, Mimosa.*
9. Myrtaceae : *Callistemon, Eucalyptus*
10. Cucurbitaceae : *Citrullus, Cucumis*
11. Apiaceae : *Coriandrum, Foeniculum*
12. Rubiaceae : *Hamelia*
13. Asteraceae : *Helianthus, Tridax, Launaea, Ageratum.*
14. Primulaceae : *Anagallis.*
15. Apocynceae : *Catharanthus, Nerium, Thevetia.*
16. Asclepiadaceae : *Calotropis, Leptadaenia, Cryptostegia*
17. Solanaceae : *Solanum, Nicotiana, Petunia.*
18. Acanthaceae : *Barleria, Adhatoda, Justicia, Peristrophe.*
19. Lamiaceae : *Ocimum, Salvia*
20. Euphorbiaceae : *Euphorbia, Ricinus*
- 21 Poaceae : *Triticum.*

The above list of plants is only suggestive and can be replaced depending on local availability.

**(B) EMBRYOLOGY SLIDES :**

1. Placentation : Types
2. Ovules : Types
- (1) T.S. Anther
10. L.S. Mature Seed : Maize/Gram/Pea
11. L.S. bud with anther and gynoecium.
12. Pollinium whole mount.
13. V.S. Cyathium.
14. V.S. *Ficus* inflorescence.

**(C) ECONOMIC BOTANY AND ETHNOBOTANY**

All plants as prescribed in theory paper.

**GROUP-II****(A) ANATOMY**

1. Stem : *Boerhaavia, Achyranthes, Bignonia, Chenopodium, Leptadaenia, Nyctanthes, Salvadoria, Dracaena, Triticum, Mirabilis, Aristolochia, Amaranthus, Chenopodium.*
2. Root : *Tinospora, Ficus.*

**(B) CYTOLOGY**

Smear preparation of root tips and onion bud for different stages of mitosis and meiosis.

**(C) STATISTICS**

Mean, Mode, Median, Standard Deviation. Monohybrid and Dihybrid crosses and test cross.

**(D) EMASCULATION****MARKING SCHEME**

There shall be a practical examination of five hours duration and the distribution of marks shall be as follows :

	<b>Students</b>	
	<b>Regular</b>	<b>Ex</b>
(a) An angiosperm material for anat-mical study with (i) double stained, labelled cellular sector diagram, identification and (iv) special (anatomical/ecological) character (2.5 marks each (i) to (iv).	10	13
2. Economic/ Ethnobotany.	05	06
Description in semi-technical language of given twig, (i) with diagrams, (ii) description and (iii) identification with characters.	12	14
4. Embryology	05	05
5. Smear preparation for two stages of cell division.	05	05
6. Genetic exercise		
Or		
Emasculation technique.	05	06
7. Statistical exercise.	05	06
8. Spots five (At least one from each paper)	10	10

9. Viva-voce	10	10
10. Records and collection.	08	-
	<b>Total</b>	<b>75 75</b>

### **BOOKS SUGGESTED**

Bhojwani, S.S. and Bhatnagar, S.P.: The Embryology of Angiosperms, Vikas Publishing House, Delhi, 1974.

Dutta, S.C.: Hand Book of Systematic Botany, Asia Publishing House, Bombay, 1979.

Gupta, P.K.: Cytology, Genetics and Evolution, Rastogi Publications.

Hill, A.H.: Economic Botany, McGraw Hill Book Co., 1952.

Mitra, J.N. : Elements of Systematic Botany of Angiosperms and Plant Ecology, The World Press Pvt. Ltd., Calcutta, 1977. Vikas Publishing House, Delhi.

Pandey, B.P.: Economic Botany, S. Chand And Co.Pvt. Ltd., 1988.

Tiagi, Y.D. and Kshetrapal, S. : An Introduction to Taxonomy of Angiosperms. Ramesh Book Depot, Jaipur, 1974.

P.K. Gupta : Genetics.

Sinha, U. and Sinha: Cytogenetics, Plant Breeding and Evolution.

Shukla and Chandel: Cytogenetics and Plant Breeding.

Choudhary, H.K. Elementary Principles of Plant Breeding.

**MATHEMATICS  
PAPER – I  
ADVANCED CALCULUS**

**Marks :70  
External :60  
Internal :10**

**UNIT-I**

Continuity: Cauchy definition of continuity of a function of one variable, Notion of limit and continuity of function of two variable (Not Theorems), discontinuous functions and their kinds, Properties of continuous functions at a point and in closed intervals.

Derivability: Differentiable functions and their properties including Darboux theorem, Examples of continuous and differentiable functions.

**UNIT - II**

Partial differentiations, envelopes and evolutes, Maxima and Minima of two variables and more than two variables including Lagrange's method of undetermined multipliers.

**UNIT -III**

Evaluation of double and triple integrals, Dirichlet's theorem and Liouville's extension, change of order of integration and volume and surface of solid of revolution.

**UNIT - IV**

Jacobians, change of independent variables. Vector Calculus: Direction of derivatives, gradient of scalar functions, irrotational Vectors, definition of gradient, divergence of a vector, curl of a vector, curl of the product of a scalar and vector, divergence of a vector product.

**UNIT - V**

Vector Integration: Gauss's theorem, divergence of the product of a scalar and a vector, Stoke's theorem, surface integral of the curl of a vector, Green's theorem (Excluding the proofs of the theorems)

**References:**

1. Gorakh Prasad : Differential calculus, Pothishala Pvt. Ltd., Allahabad.
2. Gorakh Prasad : Integral calculus, Pothishala Pvt. Ltd., Allahabad.
3. Malik, S.C. : Mathematical Analysis, Wiley Eastern Ltd., New Delhi
4. Shanti Narayan : A Course of Mathematical Analysis, S. Chand and Company, New Delhi.
5. Jain, P.K. and : An Introduction to Real Analysis by, S. Chand and Company, New Delhi.
6. Kaushik, S.K. : Principles of Mathematical Analysis.
7. Walter Rudin : A first course in Real Analysis.
8. Sharma Purohit : Elements of Real Analysis.
9. Bhargava, Goyal : Real Analysis.
10. Sharma, Gokhroo : Real Analysis.
11. Spain, B. : Vector Analysis.
12. Bhargava, Banwari Lal: Sadish Kalan.
13. Gokhroo, Saini : Sadish Kalan.

**MATHEMATICS**  
**PAPER – II**  
**DIFFERENTIAL EQUATIONS**

**Marks :70**  
**External :60**  
**Internal :10**

**UNIT - I**

Exact differential equations and equations of special forms. Simultaneous differential equations.  
Total differential equations.

**UNIT – II**

Linear differential equations of second order and their solutions by:

- (i) The method of finding an integral of the C.F. by Inspection,
- (ii) Changing of independent variables,
- (iii) Removal of the first derivative,
- (iv) Operational factors,
- (v) Undetermined coefficients and
- (vi) Variation of parameters.

**UNIT - III**

Linear partial differential equations of first order: Lagrange's method, Integral surfaces passing through a given curve, orthogonal surfaces, Geometric description of  $Pp+Qq=R$ . Non-Linear partial differential equations of order one. Special methods of their solutions applicable to certain standard forms.

**UNIT -IV**

Charpit's method of solving non linear partial differential equations of first order, Monge's method of integration of equations  $Rr + Ss + Tt = V$ . Higher order homogeneous linear partial differential equation of the first order.

**UNIT - V**

Numerical solutions of ordinary differential equations: Introduction about initial value problem, boundary value problem, Euler's method, short comings. Euler's modified method. Picard's method of successive approximation and Picard's method for simultaneous equations.

**References:**

1. Ray and Sharma : Differential equation.
2. Bansal, Dhani : Differential equation (Vol. II).
3. Raisinghania, M.D. : Advanced differential equations.
4. Murray A. Daniel : Differential equation.
5. Forsyth, A.R. : A Treatise on Differential equation.
6. Ian N. Sneddon : Elements of Partial differential equations., Mc Graw–Hill Book Company.
7. Gokhroo, Saini, Kumbhat: Avkal Samikaran.
8. Gokhroo, Saini, Ojha : Partial differential equations.
9. Coddington, E.A. : An introduction to ordinary differential equation by, Prenticehall of India.

**MATHEMATICS  
PAPER – III  
MECHANICS**

**Marks :65  
External :55  
Internal :10**

**UNIT – I**

Equilibrium of bodies under three or more forces, Friction, common category.

**UNIT –II**

Virtual work, Projectile on inclined plane and Impact.

**UNIT – III**

Velocity and Accelerations (Tangential, normal, radial, transversal), Rectilinear motion, Hooke's law and motion of horizontal and vertical strings.

**UNIT –IV**

Constrained motion (circular and cycloidal), motion under resisting medium (resistance varies as velocity and square of velocity).

**UNIT –V**

Fluid pressure and thrust on immersed plane surfaces. Center of pressure.

**References:**

1. S. L. Loney : Statics, Macmillan and Company, London.
2. R.S. Verma : A Text book of Statics ( Pothishala)
3. Ray & Sharma : A Text book of Hydrostatics
4. N.Sharma : A Text book of Dynamics.
5. M Ray : A Text book of Dynamics.
6. Bhargava & Agrawal : Gati Vigyan



7. Gokhroo, Saini : Uchch Gati Vigyan
8. Gokhroo & Others : Hydrostatics( Hindi Ed.)
9. Gokhroo & Others : Statics ( Hindi Ed.)
10. Bhargava & Others : Hydrostatics (Hindi Ed.)
11. Bhargava & Others : Statics (Hindi Ed.)

**Professional Education Course (PEC)**  
**B.Sc.B.Ed. Integrated Course**  
**PEC - 3 LANGUAGE ACROSS THE CURRICULUM**

**Marks :100**  
**External :80**  
**Internal :20**

Objectives: After the completion of the course, the student teacher will be able to: 1. Understand the language background of students as the first or second language users. 2. Create sensitivity to the language diversity that exists in the classroom. 3. Understand the nature of classroom discourse and develop strategies for using oral language in the classroom. 4. Understand the nature of reading comprehension in the content area & writing in specific content areas. 5. Understand interplay of language and society. 6. Understand function of language and how to use it as a tool. 7. Understand language and speech disorders and make remedial measure, too.

**COURSE**

**UNIT – I**

**Language and society**

1. Relationship between language and society.
2. Multilingualism- concept, status of Indian classroom language.
3. Verbal Communication.
4. Social stimulation- gestures, emotional and facial expressions, postures and movements, articulate speech, physiognomy.

**UNIT- II**

**Language development**

1. Language development in different stages.
2. Speech defects: lisping, slurring, stammering and role of teachers in its resolution.
3. Language acquisition: stages, language and thought.
4. Meta- linguistics: concept, meaning, listening, speaking, reading, comprehension and writing for varying context, language proficiency for teacher.

### **Unit – III**

#### **Developing Listening and Speaking Skills and its barriers and activities**

Listening skills –

sub skills of listening – listening for perception – listening for comprehension three phases of listening – listening materials – importance of listening skills – Barriers to listening skills –

Activities for developing listening skills :

Activities for developing Listening Skills – Listening materials – Listening to specific information and for general understanding – dictation – listening telephone call – commentaries – listening instructions.

Speaking Skills –

Importance of speaking skills – Barrier to speaking skills, Activities for developing speaking skills, conversation, group discussion, debate, interviews, extempore speech.

### **Unit – IV**

#### **Developing Reading And Writing Skills - Its barriers and activities**

Reading Skills – importance – process involved in reading – types of reading – barriers to reading skills –

Activities for developing reading skills – method of teaching reading for beginners – Alphabet – Phonetic – word – phrase and sentence method.

Writing Skills – importance – characteristics of good writing – barriers to writing skills.

Activity for developing writing skills – developing mechanical skill, grammatical skill, judgment skill and discourse skill.

### **Unit – V**

#### **Language At School & laboratory**

Distinction between language as a school-subject and language as a means of learning and communication

The concept of register and style, concept formation, Theories of language development

Language as medium, conflicts between home language and medium of language.

Language laboratory – role language laboratory developing language skills – planning and installing of language laboratory – basic materials for language laboratory – effective uses language laboratory.

#### PRACTICUM (any two)

- Developing a reading comprehension test and administering it.
- Analysis of text books languages and other materials used in different subjects
- Project on language environment of school.
- Presentation for Language use for notice, co-curricular activities and Anchoring.
- Prepare a report on the status of languages given in the constitution of India and language policies given in Kothari commission, NPE 1986, and POA-1992.
- Visit five schools in the neighbourhood and prepare a report on the three-language formula being implemented in the schools.
- Take a few passages from Science, Social Science and Math's textbooks of Classes VI to VII and analyse : 1. How the different registers of language have been introduced? 2. Does the language clearly convey the meaning of the topic being discussed? 3. Is the language learner-friendly? 4. Is the language too technical? 5. Does it help in language learning? Now write an analysis based on the above issues.

## PEC -4 LEARNING AND TEACHING

**Marks :100**  
**External :80**  
**Internal :20**

### **Objectives:**

- Gain an understanding of the process of learning.
- Understands the Conditions Essential for Facilitating Learning and Retention.
- Apply the Principles and Strategies of Major Approaches to Learning in Classroom Environment.
- Understands the Process of Effective Teaching and Qualities of Effective Teachers.
- Understands various Approaches to Teaching and will be able to apply them in the relevant situations.
- Understands the Principles and Strategies for Creating Conducive Classroom Environment.
- Appreciates the role of a teacher as leader, organizer, a facilitator & a humane reflective practitioner.
- Realize the difficulties in learning and teaching.

### **Unit I**

#### **Concept and Nature of Learning:**

- Factors Associated with Learning
- Maxims of Learning and their Educational Implications
- Approaches to Learning (Concept, Associated Concepts Basic Principles and Educational Implications)-Habitual Learning, Associative Learning (Classical and Instrumental Conditioning), Spatial Learning/Cognitive Maps, observational Learning, Learning by Insight, Information Processing Approach, Humanistic Approach, Constructivist Learning Approach.
- Types of Learning-Concept Learning, Skill Learning, Verbal Learning, Learning of Principles and Problem Solving (Meaning, Nature, Stages, Principles and

## Unit II

### Understanding the Components of Learning

- Attention- Meaning, Factors Influencing Attention, Strategies for Enhancing Attention;
- Perception- Meaning, Laws of Perceptual Organization (Gestalt Psychologists'View) and Educational Implications.
- Process of Memory- Sensory Registration, Retention(Storing), Recognition, Recall; Factors Influencing Retention; Strategies for Enhancing Memory.
- Transfer of Learning- Concept, Types, Theories; Strategies for Enhancing Positive Transfer of Learning
- Achievement Motivation- Concept, Intrinsic and Extrinsic Motivation; Strategies for enhancing Achievement Motivation in Students.

## Unit III

### Understanding the Process of Teaching-Learning:

- Teaching as a Profession
- Teaching as an Art and Science.
- Understanding the Process of Teaching as a Profession
- Identifying the need and importance of classroom teaching-learning Reflective teaching/ practice, Skillful teaching
- Applying the knowledge of Maxims of Teaching
- Role of teacher in identifying classroom related problems

## Unit IV

### Teacher and Teaching as a profession

- Various Approaches to Teaching: Behaviourist, Cognitivist, Constructivist, Connectionist, Participatory, Cooperative, Collaborative, Personalized, and Holistic.
- Teacher as a Facilitator and Guide/Philosopher/Friend Teachers' commitment towards fulfilling Felt Need of Learners Professional Characteristics of Teacher in Classroom Management.
- Skills & Competencies of a Teacher Communication: Meaning, mode: input/process/output Basic Model of Communication: Sender, Message, Medium, Receiver & Reach; Factors facilitating communication.
- Effective Classroom Management-Principles and Strategies Leadership Qualities in Teachers.

## Unit V

### Teaching As a Complex Activity

- Concept of Teaching: meaning, definition, characteristics, forms
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- Levels of Teaching: memory, understanding, reflective
- Basic teaching skills and competencies
- Strategies and techniques of teaching

**Practicum:**

Conducts Projects on – Identifying the Learning Difficulties of Students in Different School Subjects and the Possible Reason for them; Providing Remedial Instruction to the Students with Learning Difficulties; Study the Qualities of Effective Teachers through observation, interview, case study etc., Visiting Model Schools and Prepare Reports

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- i) Ohles, J.F. (1970). *Introduction to Teaching*. New York: Random House, INC.
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# ABILITY ENHANCEMENT COURSE

## AEC-3 YOGA & SPORTS

Marks :50  
External :40  
Internal :10

**Objectives: The student teacher will be able to:**

- (i) Understand the meaning and importance of self-concept and self-esteem.
- (ii) Be aware of different factors related to self-concepts and self-esteem. Record a brief history of development of yoga through the ages. Discuss how yoga and yoga practices are important for healthy living.
- (iii) Explain some important principles of yoga.
- (iv) Explain the different limbs of Astaṅga yoga.
- (v) State the different types of yoga.
- (vi) Derive how Hatha yoga and Astaṅga yoga are complementary to each other.
- (vii) Enable the student to have good health.
- (viii) Practice mental hygiene.
- (ix) Possess emotional stability.
- (x) Integrate moral values.
- (xi) Attain higher level of consciousness.
- (xii) Demonstrate some important asanas and pranayama.

### COURSE CONTENT:

#### Unit I

Introduction to Yoga and Yogic Practices: Yoga: meaning and initiation, what is Yoga? Conceptions of Yoga, History of development of yoga, The streams of Yoga: Astanga yoga Raja yoga, Yogic practices for healthy living

#### Unit II

Introduction to Yogic Texts: Historicity of yoga as a discipline, Classification of yoga and yogic texts, Hatha yogic practices, Meditational processes .

### **Unit III**

Yoga and Health: Need of yoga for positive health, Role of mind in positive health as per ancient yogic literature, Concept of health, healing and disease yogic perspectives, Potential cause of ill health, Yogic principles of healthy living

### **Unit IV**

Personality Development and Stress Management through Yoga: Yogic Practices for Personality Development: Surya Namaskar, Asanas: Tadasana, Simhasana, Kukkutasana, Akarna Dhanurasana, Matsyasana, Prnayama, Anuloma-Viloma Pranayama, Bhastrika Pranayama, Banda, Uddiyana Bandha, Dhyana (Meditation), What is Stress, Yoga as a Way of Life for Stress Management: Ahara, Vihara, Achara, Vichara, Vyavahara, Yogic Practices for Stress Management; Asanas, Hastottanasana, Padahastanasana, Trikonasana, Shashankasana, Ushtrasana, Ardha-matsyendrasana, Bhujangasana,

Makarasana, Sarvangasana, Matsyasana, Shavasana; Pranayama, Bhramari Pranayama, Sheetal Pranayama; Yoga for Healthy Living, Shirshasana, Bakasana, Hamsasana, Mayurasana

### **UNIT 5**

Need of Sports, Sports & Life Philosophy, Sports Values, Personality & Sports Performance ,Well being through Sports Indore & Out dore Games, □Rules and Regulations and skills of any one of the Games/events: Hockey, Volleyball, Basketball, Football, Tennis, Table Tennis, Kho-Kho, Track and Field Events.

#### **Practicum:**

- (i) General guidelines for performance of the practice of yoga for the beginners**
- (ii) Guidelines for the practice of āsanas**
- (iii) Guidelines for the practice of prānāyāma**
- (iv) Guidelines for the practice of meditation**
- (v) Select yoga practices for persons of average health for practical yoga sessions**
- (vi) Supine position**
- (vii) Prone position**
- (viii) Sitting position**
- (ix) Standing position**
- (x) Mudras**
- (xi) Prānāyāmas**
- (xii) In addition, school and community based activities may be organised.**

#### **References:**

1. Adair, J. and Allen, M. (1999). Time Management and Personal Development. London: Hawksmere.



2. NCERT (2015). Yoga: A Healthy Way of Living Upper Primary Stage, New Delhi. (Also available in Hindi)
3. NCERT (2015). Yoga: A Healthy Way of Living Secondary Stage, New Delhi. (Also available in Hindi)
4. Rohrer, J. (2002). ABC of Awareness. Oberurnen: UTD Media.
5. Simanowitz, V. and Pearce, P. (2003). Personality Development. Beckshire: Open University Press.
6. Stevens, N. (2008). Learning to Coach. United Kingdom: How to books.

## **ABILITY ENHANCEMENT COURSE**

### **AEC 4- ACTION RESERCH**

**Marks :50**  
**External :40**  
**Internal :10**

#### **Objectives:**

1. To help the pupil in understanding the basics of Action Research
2. To help the pupil in understanding the process of Action Research
3. To help the pupil in applying the cycles of Action Research in the teaching-learning process.
4. To help the pupil in analyzing the importance of validating Action Research at each step.
5. To help the pupil in applying the methods of Action Research to the teaching learning process.
6. To help the pupil in understanding various data collection tools of Action Research.
7. To help the pupil in developing the skill of constructing appropriate tools while conducting an Action Research.
8. To help the pupil in comprehending the components of Action Research Plan.
9. To help the pupil in distinguishing between quantitative and qualitative data analysis in Action Research.
10. To help the pupil in understanding the features of a good Action Research Report.
11. To help the pupil in analyzing the ways of sharing and reflecting Action Research.
12. To help the pupil in developing the spirit of enquiry in the students.

#### **Unit 1**

##### **Basics of Action Research – Types, Approaches & Methods**

- a) Meaning, Principles, Characteristics, Benefits and Limitations of Action Research
- b) Difference between Fundamental and Action Research
- c) Identification of Problem in Action Research – Locating, Delimiting Problem, Research questions
- d) hypothesis, sampling & delimitation
- d) Types of Action Research –Individual teacher action research and Collaborative action research (Meaning, Rationale, uses and limitations)

- e) Approaches of Action Research: Qualitative and Quantitative - Concept and Need
- f) Methods of Action Research –Experimental and Case Study- Meaning, Purpose, Process and limitations

## **Unit 2**

### **Process of Action Research**

- a) Action Research Process –Stephen Kemmi’s Action Cycle, Kurt Lewin’s Force Field Analysis.
- b) Validation of Action research -Concept and types : Self, Peer and Learner
- c) Ethics in Action Research

## **Unit 3**

### **Data Collection- Tools and Techniques**

- a) Tools for Data Collection – (Characteristics, uses and limitations)
  - 1. Questionnaire –Open and Close ended
  - 2. Artifacts: Documents, Records (Student’s journals, logs, audio, videos)
- b) Techniques of Data Collection-
  - 1. Interviews –Structured and Unstructured
  - 2. Observation- Participant and Non-Participant
- c) Role of teacher in Action Research, Action Research for Professional development of teachers

## **Unit 4**

### **Planning, Conducting and Reporting Action Research**

- a) Designing the Action Research Plan (research question, need, significance, aims and objectives, research team, research design, schedule and budget)
- b) Analysis of Data: Quantitative- Descriptive Analysis- Percentage, Mean, Correlation and Graphical representation (uses and limitations)
- c) Qualitative (Immersion reflecting, standing back analyzing; synthesizing; relation to other work; locating reflecting back; returning for more data Presenting disseminating and sharing).

## **Unit 5**

### **Reporting Action Research**

- a) Features of a good quality Action Research Report – Comprehensibility, Authenticity, Truthfulness and Appropriateness.
- b) Sharing and Reflecting - Locally, Action Research Communities, Professional Conferences and print and e- Journals.
- c) Reflection in Action Research

### **PRACTICUM :-**

- a) Design an action research plan.
- b) Make a scrap book depicting TWO case studies related to professional growth of teachers while doing action research.
- c) Prepare a tool for data collection for an action research project of your relevance.
- d) Critically review any action research report for elements of good reporting.

### **References**

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# Curriculum & Pedagogic Studies

## PC- 1 PEDAGOGY OF BIOLOGICAL SCIENCE

Marks :50  
External :40  
Internal :10

### Paper Objectives-

To enable the pupil teacher to

- Develop a broad understanding of the principles and procedures used in Biological Science & Developing their skills necessary for preparing Biological Science education in modern society.
- To construct different plans according to need.
- To devise the instructional Design of biological science properly.
- Appraise the biological paradigm in understanding of the subject.
- Use different methods to teach different concepts.

### UNIT- I

#### BASICS OF BIOLOGICAL SCIENCE

- Nature of modern science, impact of science on society, globalization and science, Justification of including science as a school subject, socio cultural perspectives of biological science , worlds eminent scientists and their path tracking discoveries.
- Pedagogy of Biological Science – Integration of knowledge about the learner, The subject discipline, social context of learning, and researches related to different aspects of

learning.

- Different branches of biological science , relation with other subjects ,
- Constructivism in teaching Biological Science, Vygotskiyan Perspective.

## **UNIT - II**

### **AIMS AND OBJECTIVES OF TEACHING BIOLOGICAL SCIENCE**

- Taxonomy and approaches of educational objectives in biological science.
- Objectives in biological science- Blooms Taxonomy and revised Blooms taxonomy.
- Process and product outcomes.
- Concept of entering and terminal behavior.

## **UNIT- III**

### **PLANNING FOR INSTRUCTION**

- Unit plan, year plan and lesson plan
- Ability to convert an unit plan into lesson plan
- Use of teaching-learning material (Audio-Visual aids)
- Improvised apparatus: significance and preparation
- Use of LCD projector and power point presentation
- Use of Bruner's models as concept attainment and advance organizer models in Teaching of Biological science.
- Planning and Implementation of strategies in Teaching concept – Evaluation Approach

## **UNIT- IV**

### **TEACHING OF BIOLOGICAL SCIENCE & CURRICULUM ORGANIZATION AND LEARNING RESOURCES**

- Inductive-Deductive approach
- Edger Dale's con of experiences.
- Major models & methods for Science Instruction- formal & non-formal and co-curricular approaches Lecture cum demonstration, Heuristic, Discussion, Project, Problem Solving, laboratory and Experimental method.
- Innovative Teaching practices in Biological science.
- Principles and approaches for curriculum development, curricular framing according to

local needs.

- Text Books, Science journals, handbooks, other resource materials for Teaching Biological science.
- Organization of Biology laboratory.

#### **UNIT V**

### **EVALUATION IN BIOLOGICAL SCIENCE & PROFESSIONAL DEVELOPMENT OF A BIOLOGY SCIENCE TEACHER**

- Measurement and Evaluation- Importance and purpose.
- Types of evaluation
- Achievement Test construction, administration and scoring.
- Characteristics of a good test
- Measuring specific behavioral outcomes- Cognitive, Affective and psychomotor outcomes.
- Diagnostic testing and remedial teaching.

Professional development programmes for a bioscience teacher- Participation in seminar, conferences, online sharing membership of professional organizations, Collaboration of school with colleges, universities and other institutions,

## PC-2 PEDAGOGY OF MATHEMATICS

Marks :50  
External :40  
Internal :10

### Objectives

1. To understand the basic concepts associated with academic disciplines
2. To understand place of different disciplines in the school curriculum understand nature, scope & importance of Mathematics at secondary level.
3. To acquaint and formulate aims and instructional objectives in teaching mathematics in Secondary school level as per revised taxonomy.
4. To apply different approaches and methods of teaching mathematics in classroom situations.
5. To set up mathematics club in the school and organize its activities.
6. To use a mathematics laboratory to develop in students an interest in mathematics.
7. To understand the professional competencies, commitments and expectations of mathematics teacher.
8. To develop knowledge of various values of teaching Mathematics
9. To appreciate the role of mathematics in day-to-day life
10. To understand that mathematics is more than formulas and mechanical procedures
11. To channelize, evaluate, explain and reconstruct students' thinking
12. To appreciate the importance of mathematics laboratory in learning mathematics

### Unit 1

#### Basics of Academic Disciplines

- a) Meaning of academic disciplines, Relationship between academic disciplines and Mathematics
- b) Classification of academic disciplines: Belcher -Belgian typology (pure-hard, pure soft, applied-hard, applied-soft types) with emphasis on nature of knowledge in each type.,
- c) Place of Mathematics in the present school curriculum

### Unit 2

#### Introduction to the Teaching of Mathematics & Curriculum

- (a) Meaning, Nature & scope of Mathematics
- (b) Aims and Objectives of teaching Mathematics at Secondary and Higher Secondary Levels (NCF 2009)
- (c) Values of teaching Mathematics (d) Maxims of teaching ,From Known to Unknown ,From Simple to Complex , From Particular to General ,From Concrete to Abstract , From Whole to Part
- (e) Approaches of curriculum construction-Concentric and Topical & Text book .

(f) Pedagogical Analysis, Unit Planning & Lesson planning

### Unit 3

#### Methods and Techniques of Teaching Mathematics

- a) Learner Centered methods ---Inductive Deductive (Teaching Generalizations), Analytical Synthetic (Teaching Proofs)
- b) Activity centered methods—Problem solving, Lecture cum Demonstration
- c) Techniques of teaching Mathematics ---Drill and Review, Assignment in Mathematics

### Unit 4

#### Learning Resources

- a) Mathematic Laboratory & Mathematic club (objectives, significance)
- b) Textbook – Characteristics and Critical analysis
- c) Digital Resources for Teaching Mathematics- Geogebra & Virtual Manipulative (Meaning, Application, Advantages and Limitations)

### Unit 5

#### Professional Development of Teacher

- a) Competencies of Mathematics teacher
- b) Need and Avenues of Continuous Professional Development
- c) Contribution of mathematicians- Aryabhata, Ramaujan, Euclid, Phythagoras
- d) Mathematics teacher merits & demerits, Characteristics & Maths teaching innovation :- team teaching, Program learning, peer group.

#### Suggested tasks: (Any One)

##### PRACTICUM :-

- a) Plan and implement lessons in mathematics using appropriate methods/approaches to teach :

Generalizations

Theorems/ Proofs

Problem Solving

Lecture cum Demonstration

Take up a problem in mathematics (from any area like number system, geometry etc.). Make a group of 3 or 4 students to discuss about the probable ways of solving



- b) Conduct one lesson in the math using manipulative- Physical/ virtual.
- c) Assignment: For any one selected topic, prepare Pedagogical Analysis Plan
- d) Critically appreciate any one textbook of mathematics.
- e) Conduct one lesson in the math using manipulative- Physical/ virtual.
- f) Prepare a diagnostic test in mathematics.
- g) Critically appreciate any one textbook of mathematics.
- h) Collect the names of Mathematicians and Prepare a report about their contribution to Mathematics .

**References:**

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## PC-3 Pedagogy of Physical Science

MARKS :100  
EXTERNAL :80  
INTERNAL : 20

### Objectives

The course will enable the student teachers to -

- Gain insight on the meaning and nature of physical science for determining aims and strategies of teaching- learning
- Appreciate the fact that every child possess natural curiosity about her natural Surroundings
- Appreciate that science is a dynamic and expanding body of knowledge
- understand the process of science and role of laboratory in teaching- learning situation
- \* appreciate various approaches of teaching-learning of physical science
- \* use effectively different activities/ experiments / laboratory experiences for teaching- learning of physical science
- \* identify the concepts of physical science that are alternatively conceptualized by teachers and students in general
- \* explore different ways of creating learning situations considering learning needs and context of the learner and the relevant concept
- \* integrate knowledge in physical science with the other school subject
- \* facilitate development of scientific attitudes in learners
- \* construct appropriate assessment tools for evaluating learning of physical science.
- \* examine the different pedagogical issues in the content of learning physical science.

### Unit 1

#### Nature of Science

□ Science as a domain of inquiry, as a dynamic and expanding body of knowledge, science as interdisciplinary area of learning (e.g. Thermodynamics, Biomolecular Surface Chemistry, etc.), Science is an international enterprise, tentative nature of science, science promotes skepticism and perseverance.

\* Science as a process of constructing knowledge; Scientific methods: a critical view, How science works; Role of science teacher.

\* Science and society- Physical science and society; physical science for environment, health, peace and equity.

\* Contribution of eminent scientists- Isaac Newton, John Dalton, J.C. Bose, Albert Einstein Niels Bohr, C.V. Raman, De Bogle, Bimla Buti, V. Ramakrishan, etc.

### Unit 2

#### Aims and Learning objectives of Physical Science

1. Knowledge and understanding through science ;Nurturing process skills of science , developing scientific attitude and scientific temper.
2. Nurturing curiosity, creativity and aesthetic sense in science (Secondary Stage)/ Physics and Chemistry (Higher Secondary stage).
3. Relating Science (Physics/ Chemistry) education to environment (natural environment, artifacts and people), technology and society and appreciating the issues at the interface of

science, technology and society; Imbibing various values through teaching –learning of Science; Developing problem solving skills.

4. Learning objectives- Meaning; features of a well defined learning objective; Anderson and Krathwohl's taxonomy.

5. Identifying and writing learning objectives for different content areas in Science/ Physics/ Chemistry consistent with the cognitive development of learners (e.g Mechanics, Heat, Electricity, magnetism, Light, Acids, Bases and Salts, Thermodynamics, Metallurgy, Physical and Chemical changes, Nature and state of Matter, etc.); Learning objectives in constructivist perspective.

### Unit 3

#### **Pedagogical shift and Approached and strategies of learning Physical Science**

1. Pedagogical shift from science as a fixed body of knowledge to the process of constructing knowledge; Pedagogical shift in nature of science, knowledge, learners, learning and teachers, assessment, science curriculum and planning teaching -learning experiences (taking examples from science/ Physics/Chemistry, such as Solutions, Chemical Equilibrium, Electrochemistry, Mechanical and Thermal Properties of Matter, Reflection, Refractions, Wave optics, etc.)

2. Democratizing Science learning: Critical pedagogy

3. Need of inclusion in all aspects of teaching- learning of physical sciences –science curriculum, approaches, ICT and professional development of teachers.

4. Approaches and Strategies -- Historical background of learning Physical Science;

Essential components of all approaches and strategies, selecting appropriate approach and strategy.

5. Constructivist approach; Collaborative learning approach, Problem solving approach; Concept mapping; Experiential learning; Cognitive conflict; Inquiry approach, Analogy strategy.

6. Facilitating self- study; Communication in Science -- qualities of an effective Science communicator, developing communication skills in learners.

### Unit 4

#### **Learning Resources in Physical Science**

1. Identification and use of learning resources from immediate environment (e.g Natural pH Indicators, Soaps and Detergents, Baking Soda, Washing Soda, Common Salts, Fruits, Fiber, Pulleys, Projectiles, Lenses and Mirrors, Propagation of Waves in solid, liquid and gas, etc.); Using community resources

-- bringing community to the class and taking class to the community; Pooling of learning resources in school complex/ block /district level.

2. Improvisation of apparatus, identifying some inexpensive sources of chemicals, Science kits.

3. Using laboratory as a learning resource, approaches to laboratory work, planning and organizing laboratory work, safety in laboratories, Physics laboratory, Chemistry laboratory, handling hurdles in utilization of resources.

4. Print and ICT resources -- Textbooks, Journal and Magazines; Dale's cone of experiences ; Different forms of ICT and its applications in science education--audio -aids, video -aids, audio-video aids, educational T.V.; Use of computer for simulation, internet and open learning resources.

5. Factors affecting media selection ICT for inclusive education, skills to be developed in students for meaningful use of ICT.

6. Social networking sites and their use in Science education; Integrating ICT into teaching-learning process taking examples (e.g. Acid, Base, Salt, Dual Nature of Radiation, Radioactivity, etc.)

### Unit 5

#### **Planning for teaching- learning of Physical Science & Professional Development .**

1. Need of planning teaching-learning experiences; Identification and organization of concepts – basic principles and factors need to be considered for it; Basic elements of a Physical Science lesson with examples from Science/Physics/Chemistry.
2. Facilitating formation of groups; Planning and organizing activities in Physical Science, planning laboratory work and ICT application in learning Science/ Physics/Chemistry.
3. Reflective planning; Unit plan; Developing lesson designs on different topics and through various approaches taking examples from Upper Primary, Secondary and Higher Secondary stage (Physical and Chemical Changes, Redox Reaction, Light, Magnetic Effect of Electric Current, etc.)
4. Professional development – Teaching as a profession, need for pre- service and in- service professional development programme, major shift in teacher education programme.
5. Various opportunities for in-service professional development – interaction with peer teachers, reading, attending training programme, membership of professional organisation, sharing through conferences, seminars and Journals, travel, cultivating science hobbies, mentoring, teacher's exchange programme, acquiring higher qualification, collaborating with universities and other schools etc.
6. Role of reflective practices in professional development – questionnaires, research and portfolio.

#### **PRACTICUM :-**

1. Actual experience of Science/Physics/Chemistry laboratory of practicing school (report submission)
2. Planning and conducting experiments for Science/Physics/Chemistry
  - \* Managing records
  - \* Setting-up of apparatus
    - Storage of chemicals and apparatus
  - \* Safety measures being taken in the laboratories and steps taken by the student-teacher
  - \* Design of laboratory – structure and physical facilities
    - \* Designing laboratory experiences for using in teaching-learning process in classroom situation – two innovative activities and two improvised apparatus (artifacts).
- (3) Report of one Action Research carried out in the practicing school
- (4) Report on measures being taken for inclusive teaching-learning and gender issues in practicing school and involvement of the student-teacher
- (5) Presentation (s) used for teaching-learning in the class
- (6) Report on a case study on identifying and addressing issue of alternative concepts in Physical science
- (7) Critical review of a recently published research paper in Science/Physics/Chemistry Education Journal
- (8) Critical review of a Textbook of Science/Physics/Chemistry.

# PC-4 PEDAGOGY OF GENERAL SCIENCE

Marks :100  
External :80  
Internal :20

- Develop insight on the meaning and nature of General science for determining aims and strategies of teaching- learning.
- Appreciate that science is a dynamic and expanding body of knowledge.
- Appreciate the fact that every child possesses curiosity about his/her natural
- Identify and relate everyday experiences with learning of science.
- Appreciate various approaches of teaching- learning of science.
- Explore the process skill in science and role of laboratory in teaching- learning.
- Use effectively different activities / experiments/ demonstrations / laboratory experiences for teaching-learning of science.
- Integrate the science knowledge with other school subjects.
- Analyze the contents of science with respect to pots, branches, process skills, knowledge organization and other critical issues.
- Develop process-oriented objectives based on the content themes/units.
- Identify the concepts of science that are alternatively conceptualized by teachers and students in general.

## Unit-I

### Nature and Scope of General Science

Concept, Nature, Need & Importance of Science & Science Teaching. Main discoveries and development of science (special reference to ancient India)

Science as a domain of enquiry, as a dynamic and expanding body of knowledge, science as a process of constructing knowledge. Science as interdisciplinary area of learning (Physics, chemistry, biology etc) science for environment, health, peace & equity, science and society., Fact, concept, principles, laws and theories-their characteristics in context of general science.

## Unit-II

### Teaching-learning of social science

Questioning; Collaborative strategies; games, simulations, dramatization, roleplays; Values clarification; problem-solving, Discussion, story-telling, project and decision-making, use of media and technology, concept mapping.

Methods: Interactive verbal learning; experiential learning through activities, experiments; Investigative field visits.

Planning, organizing and conducting of small community survey.

## Unit-III

### Teaching-learning of General Science

Principles of science and its applications consistent with the stages of cognitive development of learners.

Pedagogical shift from science as fixed body of knowledge to constructing knowledge, scientific method – observation, enquiry, hypothesis, experimentation, data collection, generalization

(teacher-educator will illustrate taking examples from different stage-specific content areas keeping in mind the variation, e.g. structure and function, molecular aspects, interaction between living and non-living, biodiversity, etc.): Communication in sciences.

Questioning; Collaborative strategies; simulations, Demonstration, lab Method, Problem Solving, Heuristics Project Method, Inductive and deductive Method, Heuristic, use of media and technology, concept mapping Innovative methods of science teaching.

#### **Unit-IV**

##### **ICT & Materials in Teaching-learning of General Science**

Use of ICT: Video clips, Power points presentations, films etc.

Planning, preparation and presentation of Instructional Material.

Techniques: Using textbooks and atlas as a part of oral lessons, non-oral working lessons; using medium and large scale maps; using pictures, photographs, satellite imagery and aerial photographs; using audio-visual aids, CDs, multimedia and internet; case study approach.

Planning, Organization and activity of science club.

#### **Unit-V**

##### **Teaching-learning Resources in General Science and Evaluation**

People as resource: the significance of oral data.

Types of primary and secondary sources: data from field, textual materials, journals, magazines, newspapers, etc.

Using the library for secondary sources and reference material, such as dictionaries and encyclopedias.

Various teaching aids, Audio-visuals & online resources.

Meaning, concept and construction of Achievement test, diagnostic and remedial test.

Blue print: Meaning, concept, need and construction.

Open-book tests: Strengths and limitations, Continuous and Comprehensive Evaluation (CCE) in Sciences. Characteristics of Assessment in Sciences

##### **References:**

Sharma, Dr.H.L. (1989), "School Science Education in India", Published by commonwealth Publishers 4378/4B, Ansari Road, Murari Lal Street New Delhi-110002

Sood, J.K. 1987, Teaching Life Sciences Kohli Publishers, Chandigarh.

Sharma, L.M. 1977, Teaching of Sciences & Life Sciences Dhanpat Rai & Sons, Delhi,

Kulshrestha, S.P. 1988, Teaching of Biology, Loyal Book Depot, Meerut.

Yadav, K. 1993, Teaching of Life Sciences, Anmol Publishers, Daryaganj, Delhi.

Yadav M.S. 2000, Modern Methods of Teaching Sciences Anmol Publisher Delhi.

Singh U.K. & 2003, Science Education Common Wealth Publishers Darayaganj, Daryaganj, A.K. New Delhi.

Venkataiah, S. 2001, Science Education in 21st Century Anmol Publishers, Delhi.

Yadav, M.S. (Ed.) 2000, Teaching Science at High Level Anmol Publishers, Delhi.

Edger, Marlow & Rao D.B. 2003, Teaching Science Successfully, Discovery Publishing House, New Delhi.

## PC-5 PEDAGOGY OF Chemistry

Marks :100  
External :80  
Internal :20

### Objectives:

Upon completion of the course, the student teacher will be able to:

- 1) Understand the nature, scope and importance of Physical science with special reference to secondary school content.
- 2) Understand the aims and objectives of teaching Physical science.
- 3) State the specific behavioral changes under each objective.
- 4) Understand and make use of different approaches & methods of teaching Physical science.
- 5) Prepare objective based lesson plans and use them in their internship.
- 6) Understand and employ several teaching techniques helpful to develop scientific attitude and scientific method.
- 7) Plan, use and maintain the physical science laboratory systematically.
- 8) Understand the principles of text-book construction.
- 9) Understand the importance of appropriate instructional materials (hardwares and softwares) in teaching Physical science and use them by preparing/selecting them in their practice teaching.
- 10) Understand the importance of principles of curriculum construction in the organisation of Physical science contact.
- 11) Get mastery in Physical science content and imbibe the special qualities of Physical Science teacher.
- 12) Prepare and use different tools of evaluation to assess the achievements of students in Physical Science.
- 13) Develop professionally by attending lectures of professional interest, reading journals, and magazines and enroll as members of professional organisation.
- 14) Organise co-curricular activities in science i.e. seminars, field trips, exhibitions discussions etc through the science club.
- 15) Apply the knowledge of physical science to develop scientific thinking and scientific outlook.
- 16) Develop skills in analyzing the content in terms of concepts and in learning experiences.
- 17) Construct and administer unit test, conduct experiments improves teaching aids.

### CONTENT

#### Unit 1

##### Meaning, Nature and Impact of Chemistry

Concept of science - Science as process and science as a product;

Nature and Scope of Science

Impact of Science and Technology on modern living.

Scientific Attitude - Meaning definition and importance.

Qualities of a person who possesses scientific attitude.

Scientific Method-Meaning, importance and steps involved (with an illustration).

## Unit 2

### **Aims and Objectives of Teaching Physical Science**

Aims of teaching Chemistry in Secondary school:

- 1 Personal development aim,
- 2 Learner's academic and process skills development aim,
- 3 Disciplinary aim and
- 4 Cultural aim.

Objectives of teaching Chemistry:

- 1 Bases for formulation of objectives
- 2 Objectives of teaching Chemistry at Secondary level; (To be Discussed keeping in view of the objectives of teaching Chemistry enunciated in the chemistry syllabi of secondary school of M.P.); Instructional objectives of teaching physical science and stating them in observable behavioral changes ; i) Knowledge ii) Understanding, iii) Application, iv) Skill, v) Attitude, vi) Interest, vii) Appreciation.

## Unit 3

### **Approaches and Methods of Teaching Physical Science**

Enquiry Approach -Meaning, Uses with Illustrations, Advantages and disadvantages.

Inductive Approach-Meaning, Uses with Illustrations, Advantages and disadvantages.

Deductive Approach-Meaning, Uses with Illustrations, Advantages and disadvantages.

Problem Solving Approach- Meaning, Uses with Illustrations, Steps, Advantages and disadvantages.

Demonstration Method- Meaning, uses, Advantages and disadvantages.

Lectures-Cum-Demonstration Method- Meaning, uses with Illustration, Advantages and disadvantages.

Laboratory Method- Meaning, uses with Illustration, Advantages and disadvantages.

Guided Discovery Method - Meaning, uses with Illustration, Advantages and disadvantages.

Biographical Method-Meaning, uses with Illustration, Advantages and disadvantages.

Individual Instruction Techniques and Active Learning Strategies.

Concept Mapping: Its use for summarizing a unit and evaluating students understanding

## Unit 4

### **Instructional Design, Resources and Teaching Aid for teaching Physical Science:**

Lesson Planning-Meaning, Steps, Importance and Format of Lesson Plan according to active learning strategies.

Unit Plan-Meaning, Steps, Importance and Format of Lesson Plan Resource Unit-Meaning, Steps, Importance and Format of Lesson Plan Audio-Visual Aids (Preparation and Use)

i Charts;

ii Models;

iii OHP transparencies;

iv Filmstrips;

v slides;

vi Video tapes;

vii Films;

viii Educational C.D.'s

Mass Media –



- i Television (T.V.);
- ii Radio - Meaning and importance. Community Resources and Self learning materials –
- iii Meaning and importance. Chemistry Laboratory-Planning, Equipments; Importance, Safety measures & organizing of Laboratory; Importance & organizing library; Choice of book for library.

### **References**

- Ahmed, Shaikti R. (1983) *Management of Laboratory Science Programme: Report of Orientation Programme in Educational Planning and Administration*, New Delhi; NIEPA Mimeo.
- Bhandula & Chand (1986) *Teaching of Science*, Prakash Brothers, Ludhiana
- Bose, A. H. Sood, J.K. and Vaidya, N. (1970), *Strategies in Science Education*. Regional Institute of Education, Ajmer.
- Carin/Sund *Teaching Science Through Discovery*; C.E. Merrill Publishing Co. London.
- Cleaveland J. M. (1964) *Physical Science* C.E. Merrill Publishing Co., Ohio.
- Craig (1958) *Science for the Elementary School Teacher*; Ginn & Co., New York
- Das R. C. (1985) *Science Teaching in Schools*, Sterling Publishers, Pvt. Ltd., New Delhi.

## THRID YEAR B.Sc. B.Ed.

COURSE	NOMENCLATURE
GC 3	General Studies I
EL 11	Physics (I)
	Physics (II)
	Physics (III)
	Physics Practical
EL 12	Chemistry I
	Chemistry II
	Chemistry III
	Chemistry Practical
EL 13	Zoology I
	Zoology II
	Zoology III
	Zoology Practical
EL 14	Botany I
	Botany II
	Botany III
	Botany Practical
EL 15	Mathematics I
	Mathematics II
	Mathematics III
PEC 5	Knowledge & Curriculum
PC 1	Pedagogy of General Science
PC 2	Pedagogy of Physics
PC 3	Pedagogy of Chemistry
PC 4	Pedagogy of Biology
PC 5	Pedagogy of Mathematics
TEP 2	Teaching Enhancement Programme
	Preorty lesson & Integrated lesson Activevity based (Second Pedagogy sub.) only five lesson per activites.
SIP 1	School Internship Programme
	Criticism (Related Two Pedagogy Subject) 10% Technology based lesson is compulsory
SIP 2	Final Lesson (External Assessment)

**GENERIC COURSE**  
**GC - 3 GENERAL STUDIES FIRST**

तृतीय वर्ष में सामान्य अध्ययन पाठ्यक्रम

**सामान्य अध्ययन प्रथम**

- नोट : 1. उक्त पाठ्यक्रम में 4 इकाई होगी एवं प्रत्येक इकाई से 25 प्रश्न होंगे।  
2. प्रश्न पत्र में 100 प्रश्न होंगे, प्रत्येक प्रश्न 1 अंक का होगा, इस प्रकार प्रश्न पत्र 100 अंको का होगा।  
3. प्रश्न पत्र में प्रश्न वस्तुनिष्ठ प्रकार (द्वारमबजपअम जलचम) के होंगे।

इकाई 1	<p><b>1. राजस्थान का भूगोल</b></p> <ul style="list-style-type: none"><li>▪ प्रमुख भौतिक विषेशताएं, मुख्य भू भौतिक विभाग</li><li>▪ प्राकृतिक संसाधन , खनिज, मृदा,</li><li>▪ अपवाह प्रणाली, सिंचाई परियोजनाएं</li></ul> <p><b>2. भारत का भूगोल</b></p> <ul style="list-style-type: none"><li>▪ प्रमुख भौतिक विषेशताएं, मुख्य भू भौतिक विभाजन</li><li>▪ भारत के खनिज एवं मृदा लोहा, मैंगनीज, कोयला, खनिज तेल व गैस ,आण्विक खनिज</li></ul>
इकाई 2	<p><b>1. राजस्थान की अर्थव्यवस्था</b></p> <ul style="list-style-type: none"><li>▪ राजस्थान का औद्योगिक परिदृश्य</li><li>▪ सूतीवस्त्र, चीन, सीमेन्ट, लघु उद्योग</li><li>▪ राजस्थान में उर्जा परिदृश्य</li><li>▪ राजस्थान की वृहद् परियोजनाएं</li><li>▪ राजस्थान में परिवहन</li></ul> <p><b>2. भारत की अर्थव्यवस्था</b></p> <ul style="list-style-type: none"><li>▪ राश्ट्रीय आय</li><li>▪ मुद्रा स्फीति : अवधारणा,प्रभाव एवं नियंत्रण तंत्र</li><li>▪ भारतीय रिजर्व बैंक</li><li>▪ बैंक एवं बीमा</li><li>▪ सब्सिडी एवं लोक वितरण प्रणाली</li></ul>
इकाई 3	<p><b>1. राजस्थान का इतिहास</b></p> <ul style="list-style-type: none"><li>▪ राजस्थान की प्रमुख सभ्यताएं – कालीबंगा, आहड, गणेश्वर, बैराठ</li></ul>

	<ul style="list-style-type: none"> <li>▪ <u>प्रमुख राजवंश</u> – गुर्जर प्रतिहार, गुहिल, चौहान, राठौड, कुच्छवाह</li> <li>▪ ऐतिहासिक व्यक्तित्व – पृथ्वीराज चौहान, राणा सांगा, महाराणा प्रताप, महाराणा कुभा, चन्द्रसेन, सूरजमल, मालदेव।</li> <li>▪ <u>मध्यकालीन प्रशासनिक व राजस्व व्यवस्था</u></li> <li>▪ <u>राजस्थान का स्वतंत्रता आंदोलन</u>– किसान एवं जनजातीय आंदोलन, प्रजामण्डल आंदोलन</li> <li>▪ <u>राजस्थान का एकीकरण</u></li> </ul> <p>2. <u>भारत का इतिहास</u></p> <ul style="list-style-type: none"> <li>▪ प्राचीन भारत : हड़प्पा सभ्यता, वैदिक संस्कृति, मौर्य काल, गुप्त काल</li> <li>▪ मध्य भारत: सल्तनत काल, मुगल काल।</li> <li>▪ आधुनिक भारत : स्वतन्त्रता संघर्ष, धार्मिक एवं सामाजिक सुधार आन्दोलन।</li> </ul>
इकाई 4	<p>1. <u>राजस्थान की प्रशासनिक व्यवस्था</u>–</p> <ul style="list-style-type: none"> <li>▪ राज्यपाल</li> <li>▪ मुख्यमंत्री</li> <li>▪ राजस्थान कीविधानसभा</li> <li>▪ राजस्थान लोक सेवा आयोग</li> <li>▪ मुख्य सचिव एवं सचिवालय</li> <li>▪ लोकायुक्त</li> </ul> <p><u>भारत की प्रशासनिक व्यवस्था :</u></p> <ul style="list-style-type: none"> <li>▪ राष्ट्रपति</li> <li>▪ प्रधानमंत्री</li> <li>▪ संसद</li> <li>▪ संघ लोक सेवा आयोग</li> <li>▪ केबिनेट सचिव एवं सचिवालय</li> <li>▪ लोकपाल</li> </ul>

## PHYSICS

### Note:

1. Each theory question paper in the annual examination shall have three sections:

**Section A** shall contain one compulsory question of 5 marks having 10 parts. Two parts shall be set from each unit. The candidate is required to answer each part in one or few words. **(Total: 5 Marks)**

**Section B** shall contain five compulsory questions of 5 marks each with internal choice. One question with internal choice will be set from each unit. The answer may be given in approximately 250 words. **(Total 25 Marks)**

**Section C** shall contain four descriptive questions covering all units and candidates have to answer any two questions of ten marks each. The answer may be given in approximately 500 words. There can be two parts in a question from this section. **(Total 20 Marks)**

### Paper-I:

#### Quantum mechanics and Atomic & Molecular Physics

Marks :50

External :40

Internal :10

### Unit-I

#### Introductory Schrodinger theory :

Rise and fall of Plank-Bohr quantum theory Duality of radiation and matter, de Broglie's hypothesis, justification for the relation, experimental confirmation Phase and group velocities of a wave ; formation of a wave packet, illustrations. Uncertainty principle relating to position and momentum, relating to energy and time, application complementarity principle, photon interpretation of two slit interference, Einstein-de-Broglie relations as a link between particle and wave properties, general equation of wave propagation, propagation of matter waves, time dependent and time independent schrodinger equations, physical meaning of  $\psi$ , conditions to be satisfied by schrodinger equation as an operator equation. Postulatory approach to wave mechanics, operators, observable and measurements. Operators, eigen values and eigen functions; linear operators, product of two operators, commuting and non commuting operators, simultaneous eigen functions, orthogonal functions. Hermitian operators, their eigen values, Hermitian adjoint operators, expectation values of an operator.

### Unit – II

Simple one dimensional problem ; particle in a box with rigid walls. Concept of a potential well. Wave functions and energies for the ground and excited states ; quantization of energy qualitative discussion of the solutions for a shallow potential well. Application of Operator methods ; Simple harmonic oscillator, step-up and step-down operators, eigen functions and eigen values of the ground state and excited state, zero point energy probability density and its variations with degree of excitation ; orthogonality of wave functions. Other one dimensional problems ; step potential, penetration through rectangular barrier. Transmission coefficients, barriers of special shapes, quantum mechanical tunneling, particle in of three dimensional cubical box, degeneracy.

### UNIT-III

### **Angular momentum and spin**

Central force ; orbital angular momentum, operators for its cartesian components, commutation relations, mutual as well as with  $L^2$  , operators  $L_+$  and  $L_-$ , their interpretation as step operators eigen values of  $L^2$  , half integral values for quantum numbers. Angular momentum operators in spherical polar coordinates ; evaluation of their eigenfunctions explicitly in terms of the coordinates, their degeneracy. Schrodinger equation for hydrogen atom in spherical polar coordinates ; separations into radial and angular variation, qualitative discussion of spherical harmonics. Angular momentum and magnetic moment of electron due to orbital motion Bohr magneton.

### **Unit – IV**

#### **Mono valent and divalent atoms**

Back ground from quantum theory : The four quantum numbers ; spectral terms arising from L-S coupling, s,p,d,f, notation, selection rules. Half life of excited states, width of a spectral line. Spectra of mono and divalent atoms : Doublet fine structures of hydrogen lines ; screening constant for monovalent atoms, series limits, doublet structure for alkali spectrum. Spectra of helium and alkaline earth atoms, singlet and triplet series. Effect of magnetic field on energy levels : Gyromagnetic ratios for orbital and spin motions ; vector model, Lande g factor, strong and weak field effects, illustrative cases of H, Na, Ca and Hg. X-ray spectra : The continuous x-ray spectrum, Duane and Hunt limit. Characteristic x-rays : Mosley's law, doublet fine structure, H-like character of x-ray states, x-ray absorption spectra, absorption edges.

### **Unit – V**

Sharing of electrons : formation of molecular orbitals,  $H_2^+$  ions  $H_2^-$  molecule, electronic levels, singlet and triplet characters. Rotational energy levels, internuclear distance.

Vibrational energy levels, force constants, anharmonicity dissociation energy, isotope effects on rotational and vibrational energies. Raman effect (brief study).

Spectra of diatomic molecules : Pure rotation spectra ; selection rules, vibration rotation spectra, selection rules, vibration-rotation spectra ; selection rules, P, Q and R branches.

Electronic band systems, sequences and progressions Frank-Condon principle. (Statement only, no derivation)

Recent developments in Physics including discussion of Nobel prizes in Physics (no questions to be set in the theory examination).

Text books:

1. Quantum mechanics : S.P. Singh, M.K. Bagde and Kamal Singh (S.Chand and Co)
2. Quantum Mechanics by G.R. Chatwal and Anand SK, Himalaya Publishing Co.

#### **Reference books**

1. Quantum Mechanics Alistair I M Rac. ELBS (Low Price edition)
2. Quantum mechanics , S. N. Biswas, Books and Allied, Calcutta (P) Ltd.
3. Atomic and Nuclear Physics ; A.B. Gupta, mew central book agency pvt. Ltd.

### **PAPER-II:**

# ELECTRODYNAMICS, ELECTROMAGNETIC WAVES AND RELATIVITY

Marks :50  
External :40  
Internal :10

## UNIT I

Motion of charged particles in  $\mathbf{E}$  and  $\mathbf{B}$  fields: Case of cathode ray oscillograph, positive ray parabola, velocity selector, magnetic focusing, mass spectrography. Faraday's law for electromagnetic induction: Faraday's law integral and differential forms; self-inductance of a solenoid and of a straight conductor, energy stored in an inductor and in the magnetic field. Displacement current; modified Ampere's law, Maxwell's equation for time-dependent electromagnetic field in vacuum and in material media, boundary conditions.

## UNIT II

Electromagnetic potentials: Magnetic vector potential  $\mathbf{A}$  and scalar potential  $\phi$ . Poisson's equation for  $\mathbf{A}$  in terms of current density, solutions for line surface currents. Coulomb and Lorentz gauge transformations, Lorentz law in terms of potentials. Maxwell's equations and electromagnetic waves: Plane-wave solution for Maxwell's equation; orthogonality of  $\mathbf{E}$ ,  $\mathbf{B}$  and propagation vector. Poynting vector; energy and momentum propagation, reflection and transmission at dielectric boundaries (normal incidence), polarization by reflection, Brewster's angle.

## UNIT III

Electromagnetic waves in conductors: Modified field equation; attenuation of the wave, reflection at and transmission through a conducting surface. Total internal reflection Radiation from accelerated charges: Modification (Conceptual only) of Coulomb's law to include velocity and acceleration dependent terms in  $\mathbf{E}$  field. Radiation from an oscillating dipole and its polarization. Radial and spherical power of electromagnetic radiation, Radiation pressure equation in free space and medium

## UNIT IV

The Lorentz transformations: Galilean transformations; Newtonian relativity, instances of their failure; electromagnetism, aberration of light, Michelson-Morley experiment; Einstein's basic postulates and geometric derivation of Lorentz transformations; invariance of Maxwell's equations, length contraction, simultaneity, synchronization and time dilation, Einstein's velocity addition rule, Doppler effect in light. Relativistic gravitational Red Shift.

## UNIT V

Relativistic dynamics: Variation of mass with velocity, mass energy equivalence, relativistic formulae for Momentum and energy. The structure of space-time: Four vectors; invariance of an interval, time-like, spacelike and light-like intervals, Minkowski space. Relativistic electrodynamics: Electric field of a point charge in uniform motion; transverse components, magnetism as a relativistic phenomenon, transformation of  $\mathbf{E}$  and  $\mathbf{B}$  fields. Recent developments in Physics including discussion of Nobel prizes in Physics (no questions to be set in the theory examination).

**Text and Reference books:**

1. D.J. Griffiths: Introduction to Electrodynamics, Prentice Hall of India, 1989.
2. Reitz and Milford: Introduction to Electrodynamics, Addison-Wesley.
3. A.M. Portis: Electromagnetic Fields
4. J.B. Marion: Classical Electromagnetic radiation (Academic Press)
5. R.P. Feynmann, R.B. Leighton and M. Sands: The Feynmann lectures in physics, Vol. II (B.I. Publications).
6. B. Saraf et al. : Physics through experiments Vol. I – EMF, constant and varying, Vikas Publishing House.
7. D.R. Corson and P. Lorrain: Introduction to Electromagnetic fields and waves, Freeman-Taraporevala, Bombay,1970.
8. E.C. Jordan and K.G. Balmain: Electromagnetic waves and radiating systems, 2nd Ed., Prentice Hall of India, New Delhi, 1971.
9. Electrodynamics ,Electromagnetic Waves and Relativity (In Hindi) Kalra, Kakani and Bhandari

**Paper-III**

**SOLID STATE, NUCLEAR AND PARTICLE PHYSICS**



### UNIT – I

Crystal geometry: crystal lattice, crystal planes and Miller indices, unit cells. Typical crystal structures, coordination number, packing fraction, symmetry elements, rotation, inversion and reflection, point groups and crystal classes, space groups.

Crystallography: Bloch functions, Bloch's theorem, diffraction of X-rays by a crystal lattice. Laue's formulation of X-ray diffraction, reciprocal lattice, Brillouin zones, Laue spots, rotating crystal and Debye-Scherrer methods

Introduction to nano particles, Definition, length scales, Importance of nanoscale and Technology.

### UNIT – II

Types of binding in solids: covalent binding and its origin, ionic binding, energy of binding, transition between covalent and ionic binding, metallic binding, Van der Waals binding, hydrogen bond.

Conduction in metals : Drude's theory, DC conductivity, AC conductivity, plasma frequency, thermal conductivity of metals, Fermi-Dirac distribution, thermal properties of free-electron gas, Sommerfeld's theory of conduction in metals.

### UNIT – III

Conduction in semiconductor: Bands in solids, metals, insulators and semiconductors. Motion of free electrons on a chain of atoms, effective mass, electrons and holes, donor and acceptor impurities, donor impurity levels. Thermal excitation of carriers, electrical conductivity. Elementary ideas of Hall effect in metals and semiconductors and magnetoresistance. Charge transport in semi-conductors: Ionization energy of impurity atoms, carrier concentration in doped semiconductors at high and low temperatures, control of conductivity of semiconductors by impurities and current flow in semi-conductors.

### UNIT – IV

Structure of nucleus: discovery of the nucleus, composition. Basic properties: charge, mass, size, spin, magnetic moment, electric quadrupole moment, binding energy, binding energy per nucleon and its observed variation with mass number of the nucleus. Coulomb energy, volume energy, surface energy, other corrections, explanation of the binding energy curve. Liquid drop model of the nucleus.

Nuclear forces: two-nucleon system, deuteron problem, binding energy, nuclear potential well, results of p-p and n-p scattering experiments, meson theory of nuclear forces e.g. Bartlett, Heisenberg, Majorana forces and potentials (No derivations)

Radioactivity: decay constant and half-life, spectra of emitters, Geiger-Nuttall law, Gamow's explanation. Beta decay: elementary Fermi's theory (No derivations). Antineutrino. Nuclear radiation, energy levels.

### UNIT – V

Detectors for charged particles: Ion chamber, Geiger counter, resolving time, cloud chamber.

Accelerators: Need for accelerators; cyclic accelerators, cyclotron, betatron, synchrocyclotron, variable energy cyclotron, phase stability. Brief introduction to Accelerator facilities in India. Rutherford scattering formula, different types of nuclear reactions. Artificial radioactivity: Nuclear fission, neutron reactions, Fermi and transuranic elements, chain reaction, criticality, moderators. Brief discussion of Reactor facilities in India. Discovery of cosmic rays: hard and soft components, discovery of muon, pion, heavy mesons and hyperons, mass and life time determination for muon and pion. Primary cosmic rays: Extensive air showers, solar modulation of primary cosmic rays, effect of earth's magnetic field on the cosmic ray trajectories. Elementary particles: Discovery and important properties, Standard Model Strangeness, conservation of strangeness in particle interactions, quark hypothesis, high energy electron scattering from protons, basic interactions of quarks and leptons, interrelation between particle physics and cosmology. Big Bang theory (Brief study. No derivations) Brief introduction to Larger Hadron Collider "Big Bang" experiments at CERN Recent developments in Physics including discussion of Nobel prizes in Physics (no questions to be set in the theory examination).

### **Text Book**

1. Nuclear Physics, Brijlal & Subramannian
2. Solid State Physics, Charles Kittel
3. Solid State Physics, Nuclear Physics and Particle Physics (In Hindi) Kalra, Kakani and Mandot

### **Reference books:**

- 1 D.J. Griffiths: Introduction to Electrodynamics, Prentice Hall of India, 1989.
- 2 Reitz and Milford: Introduction to Electrodynamics, Addison-Wesley.
- 3 A.M. Portis: Electromagnetic Fields
- 4 J.B. Marion: Classical Electromagnetic radiation (Academic Press)
- 5 R.P. Feynmann, R.B. Leighton and M. Sands: The Feynmann lectures in physics, Vol. II (B.I. Publications).
- 6 B. Saraf et al. : Physics through experiments Vol. I – EMF, constant and varying, Vikas Publishing House.
- 7 D.R. Corson and P. Lorrain: Introduction to Electromagnetic fields and waves, Freeman-Taraporevala, Bombay, 1970.
- 8 E.C. Jordan and K.G. Balmain: Electromagnetic waves and radiating systems, 2nd Ed., Prentice Hall of India, New Delhi, 1971.

## CHEMISTRY PAPER I

## UNIT I

**Hard and Soft Acids and Bases (HSAB)** : Classification of acids and bases as hard and soft. Pearson's HSAB concept, acid-base strength and hardness and softness. Symbiosis, theoretical basis of hardness and softness, electro-negativity and hardness and softness.

**Metal-Ligand Bonding in Transition Metal Complexes** : Limitation of valence bond theory, an elementary idea of crystal field theory, crystal field splitting in octahedral, tetrahedral and square planar complexes, factors affecting the crystal-field parameters, John- Teller effect.

## UNIT II

**Magnetic Properties of Transition Metal Complex** : Types of magnetic behaviour, methods of determining magnetic susceptibility, spin-only formula. L-S coupling, correlation of  $m$  and  $m_{eff}$  values, orbital contribution to magnetic moments, application of magnetic moment data for 3d-metal complexes.

**Electronic Spectra of Transition Metal Complexes** : Types of electronic transitions, selection rule for d-d transitions, spectroscopic ground states, spectro-chemical series. Orgel-energy level diagram for d. and d9 states, discussion of the electronic spectrum of  $[\text{Ti}(\text{H}_2\text{O})_3]^3$  complex ion.

## UNIT III

**Bioinorganic Chemistry**: Essential and trace elements in biological processes, metallo-porphyrins with special reference to haemoglobin and myoglobin. Biological role of alkali and alkaline earth metal ions with special reference to  $\text{Ca}^{2+}$ .

**Electro analytical Methods** : EMF measurements, pH,- determination using hydrogen, glass, quinhydrone, antimony and calomel electrodes, potentiometric titrations.

**Volumetric Estimation** : Theory of oxidation - reduction titrations. Theory of complexometric titrations.

## UNIT IV

**Organometallic Chemistry** - Definition, nomenclature and classification of organometallic compounds.

Preparation, properties, bonding and applications of alkyl and aryl of Li, Al, Hg, Sn and Ti, a brief account of metal- ethylenic complexes and homogeneous hydrogenation, mononuclear carbonyls and the nature of bonding in metal carbonyls.

**Thermodynamic and Kinetic Aspects of Metal Complexes** - A brief outline of thermodynamic stability of metal complexes and factors affecting the, stability, Substitution reactions of square planar complexes.

## UNIT V

**Molecular Symmetry and Group Theory** : Symmetry elements, molecular point groups, group theory and basic properties, similarity transformation and classes, orthogonality theorem, multiplication tables and character tables of  $C_{2v}$  and  $C_{2v}$  groups.

**Mathematical Techniques** : Least square treatment applied to linear equation  $y = my + c$ , correlation coefficient,  $S_m$  and  $S_c$ .

**Recent Developments in Inorganic Chemistry:** Question will not be asked from the recent development section.

**BOOKS RECOMMENDED**

1. Group theory and its chemical applications : P.K. Bhattacharya.
2. Inorganic chemistry : J.E. Huysse, Principles of Structure and Reactivity, 3rd Ed.
3. Selected topics in inorganic chemistry : W.U. Malik, G.D. Tuli and R. Madan.
4. Principles of Inorganic Chemistry : D. Banerjee.
5. Modern Aspect of Inorganic Chemistry : H.J. Emeleus and A.G. Sharpe.
6. Inorganic Chemistry (Hindi ed.) : Ameta, Sharma and Metha.

**PAPER II**

# ORGANIC CHEMISTRY

Marks :50  
External :40  
Internal :10

## UNIT I

**Electromagnetic Spectrum : Absorption Spectra** : Ultraviolet (UV) absorption spectroscopy-absorption laws (Beer-Lambert Law), molar absorptivity, presentation and analysis of UV spectra, types of electronic transition, effect of conjugation. Concept of chromophore and auxochrome. Bathochromic, hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated dienes and enones. Infrared (IR) absorption spectroscopy- molecular vibrations, Hooke's, selection rules, intensity and position of IR bands, measurement of IR spectrum, fingerprint region, characteristic absorptions of various functional groups and interpretation of IR spectra of simple organic compounds.

**Nuclear Magnetic Resonance (NMR) spectroscopy** : Proton Magnetic Resonance (PMR) spectroscopy, nuclear shielding and deshielding, chemical shift and molecular structure, spin-spin splitting and coupling constants, areas of signals, interpretation of PMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1, 1,2 - tribromoethane, ethyl acetate, toluene and acetophenone.

Problem pertaining to the structure elucidation of simple organic compounds using UV, IR and PMR spectroscopic techniques.

## UNIT II

**Heterocyclic compounds** : Introduction, molecular orbital picture and aromatic characteristics of pyrrole, furane, thiophene and pyridine, method of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reactions in pyridine derivatives, comparison of basicity of pyridine, piperidine and pyrrole.

Introduction to condensed five and six membered heterocycles, preparation and reactions of indole, quinoline and isoquinoline with special reference to Fischer Indole synthesis, Skraup's synthesis and Bischler – Napieralski synthesis. Mechanism of electrophilic substitution reactions of indole, quinoline and isoquinoline.

**Photochemistry**: Principles: electronic excitation, excited states, modes of dissipation of energy, energy transfer and quantum efficiency, photoreduction and photochemistry of butadienes

## UNIT III

**Organic synthesis via Enolates** - Acidity of alpha hydrogen, alkylation of diethylmalonate and ethylacetoacetate, synthesis of ethyl acetoacetate, Claisen condensation. Keto - Enol tautomerism of ethyl acetoacetate, alkylation of 1,3- dithianes, alkylation and acylation of enamines.

**Carbohydrates** - Classification and nomenclature, monosaccharides, mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses, configuration of glucose and fructose, erythro and threo diastereomers. Conversion of glucose into mannose, formation of glycosides, ether and esters. Determination of ring size of glucose and fructose, Cyclic structure of D (+) - glucose. Mechanism of mutarotation.

An introduction to disaccharide (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination.

## UNIT IV

**Amino Acids, Peptides, Proteins and Nucleic Acids** - Classification, structure and stereochemistry of aminoacids, acid-base behavior, isoelectric point and electrophoresis. Preparation and reactions of  $\alpha$ -amino acids.

Structure and nomenclature of peptides and proteins, classification of proteins, peptide structure determination, and group analysis, selective hydrolysis of peptides. Classical peptide synthesis, solid-phase peptide synthesis.

Structures of peptide and proteins. Levels of protein structure. Protein denaturation! renaturation. Nucleic acids: Introduction, constituents of nucleic acids. Ribonucleosides and ribonucleotides. The double helical structure of DNA.

**Fats, Oils and Detergents** - Natural Fats, edible and industrial oils of vegetable origin, common fatty acids, glycerides, hydrogenation of unsaturated oils, saponification value, iodine value, acid value, soaps synthetic detergents, alkyl and aryl sulphates.

## UNIT V

**Synthetic Polymers** - Addition or chain - growth polymerization, free radical vinyl polymerization, ionic - vinyl polymerizations Ziegler-Natta polymerization and vinyl polymers. Condensation or step-growth polymerization, polyesters, polyamides, phenol formaldehyde resins, urea-formaldehyde resins, epoxy resins and polyurethanes. natural and synthetic rubbers.

**Synthetic Dyes** - Colour and constitution (electronic concept), classification of dyes. Chemistry and synthesis of methyl orange, Congo red, Malachite green, Crystal violet, Phenolphthalein, Fluorescein, Alizarin and Indigo.

**Recent Developments in Organic Chemistry:** Question will not be asked from the recent development section.

### BOOKS RECOMMENDED

1. Organic Chemistry, Vol. I and II, S.M. Mukherji, S.P. Singh and R.P. Kapoor, Wiley Eastern Ltd.
2. A Text Book of Organic Chemistry, Vol. I and II, K.S. Tewari, S.N. Mehrotra and N.K. Vishnoi.
3. Organic Chemistry, M.K. Jain and S. Sharma.
4. A Text Book of Organic Chemistry, Vol. I and II, O.P. Agarwal.
5. A Text Book of Organic Chemistry, Raj. K. Bansal.
6. Organic Chemistry, Vol. I and II, I.L. Finar.
7. Organic Reaction and their Mechanisms, P.S. Kalsi.
8. Introduction of Petrochemicals, Sukumar Maiti.
9. Organic Chemistry (Hindi Ed.) Suresh Ameta, Punjabi and Sharma.
10. Organic Chemistry, Morrison and Boyd, Prentice Hall.
11. Fundamentals of Organic Chemistry, Solomons, John Wiley.
12. Organic Chemistry, P.L. Soni.
13. A Text Book of Organic Chemistry, V.K. Ahluwalia and Maduri Goyal, Narosa Publishing House Pvt. Ltd.

## PAPER III PHYSICAL CHEMISTRY

### UNIT I

**Elementary Quantum Mechanics** : Black-body radiation, Planck's radiation law, photo-electric effect, heatcapacity of solids, Bohr's model of hydrogen atom (no derivation) and its defects, Compton effect. Sinusoidal wave equation, Hamiltonian operator, Schrodinger wave equation and its importance, physical interpretation of the wavefunction, postulates of quantum mechanics, particle in one-dimensional box.

Schrodinger wave equation for H-atom, separation into three equations (without derivation), quantum numbers and their importance hydrogen like wave functions, radial wave functions, angular wave function. Molecular orbital theory, basic ideas- criteria for forming M. O. from A. O., construction of M. O.s by LCAO- H<sub>2</sub>

ion, calculation of energy levels from wave functions, physical picture of bonding and antibonding wave functions, concept of s, s, p p<sup>4</sup>. orbitals and their characteristics. Hybrid orbitals- sp, sp<sup>2</sup>, sp<sup>3</sup>, calculation of coefficients of A.O.s used in these hybrid orbitals.

Introduction to valence bond model of H<sub>2</sub>, M.O. and V. B. models.

### UNIT II

**Spectroscopy** - Introduction: electromagnetic radiation, regions of the spectrum basic features of different spectrometers statement of the Born- Oppenheimer approximation degrees of freedom.

Rotational Spectrum - Diatomic molecules. energy levels of a rigid rotator (semi- classical principles) selection rules, spectral intensity, distribution using population distribution (Maxwell - Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotor, isotope effect.

**Vibrational Spectrum** - Infrared spectrum, energy level of simple harmonic oscillator, selection rules, pure vibrational spectrums intensity, determination of force constant and qualitative relation of force constant and bond energies, effect of anharmonic motion and isotope on the spectrum, idea of vibrational frequencies of different functional groups.

Raman spectrum: Concept of polarizability, pure rotational and pure vibrational Raman spectra of diatomic molecules, selection rules.

**Electronic Spectrum** - Concept of potential energy curves for bonding and antibonding molecular orbitals, qualitative description of selection rules and Franck Condon principle.

Qualitative description of s, p and n M.O., their energy levels and the respective transitions.

### UNIT III

**Photochemistry** - Interaction of radiation with matter, difference between thermal and photochemical processes, laws of photochemistry, Grotthus - Drapper law, Stark - Einstein law, Jablonski diagram depicting various processes occurring in the excited state, qualitative description of fluorescence, phosphorescence non-radiative process (internal conversion, intersystem crossing), high and low quantum yields, photosensitization photochemical equilibrium, photoionization photodimerisation of anthracene, photoinhibition. chemical actinometry.

**Solutions, Dilute Solutions and Colligative Properties** : Ideal and non-ideal solutions, methods of expressing concentrations of solutions, activity and activity coefficient. Dilute solution:

colligative properties. Raoult's law, relative lowering of vapour pressure, molecular weight determination, Osmosis, law of osmotic pressure and its measurement.

Determination of molecular weight from osmotic pressure, elevation of boiling point and depression of freezing point, thermodynamic derivation of relation between molecular weight and elevation in boiling point and depression in freezing point, experimental methods for determining various colligative properties, abnormal molar mass, degree of dissociation and association of solute, Vant-Hoff factor.

#### UNIT IV

**Ionic Conductance** - Electrical transport, conduction in metal and electrolytes, solutions, specific conductance, equivalent conductance and molecular conductance, effect of dilution on conductance, migration of ions, Kohlrausch's law and its applications, transport numbers and its determination by Hittorf's method and moving boundary methods, ionic mobility, application of conductivity measurement, conductometric titrations.

#### UNIT V

**Chemical Kinetics** and Catalysis - Rate of reaction, factors influencing the rate of reaction, concentration, temperature, pressure, solvent, light and catalysis, order of a reaction, zero-order, first order and second order reaction, half life and mean life, conductometric, potentiometric, polarimetric and spectrophotometric methods of determination of order of reactions, method of integration, half life method and isolation method, experimental methods of kinetics, elementary idea about opposing, parallel, consecutive and chain reaction, effect of temperature on reaction rates. Arrhenius equation, concept of activation energy and its measurement, simple collision theory (hard sphere model), transition state theory (equilibrium hypothesis) limitations.

Theory of unimolecular reactions, catalysis, theory and mechanism, classification of catalysis, enzyme catalysis and its mechanism.

**Recent Developments in Physical Chemistry:** Question will not be asked from the recent development section.

#### BOOKS RECOMMENDED

1. Principles of Physical Chemistry : B.R. Puri and L.R. Sharma.
2. A Text Book of Physical Chemistry : A.S. Negi and S.C. Anand.
3. A Text Book of Physical Chemistry : Kundu and Jain.
4. Physical Chemistry (Hindi Ed.) : Suresh Ameta, R.C. Khandelwal, R. Ameta and J. Vardia, Himanshu Pub.

### THIRD YEAR CHEMISTRY PRACTICALS

#### Distribution of Marks



<b>Exercises</b>		<b>Marks</b>
1.	Synthesis of Inorganic complex and organic compound	10
2.	Analysis by Colorimetry/Solvent extraction/Ion exchange method	07
3.	Qualitative analysis : Organic mixture analysis	07
4.	One Physical experiment	10
5.	Vice-voce	08
6.	Records	08

**Total 50 marks**

## LIST OF EXPERIMENTS

### 1. Synthesis of Inorganic complexes and organic compounds

Any one of the following preparation may be asked in the examination keeping in view that not more than five students are given the same preparation in a batch of 20 students and nature of preparation should be equally distributed both from the organic and inorganic list.

#### Inorganic Complexes

- (a) Preparation of sodium trisoxalato ferrate (III)
- (b) Preparation of Ni-DMG complex.
- (c) Preparation of cis-and trans-bisoxalato diaquo chromate (III) ion.
- (d) Cuprous chloride
- (e) Sodium thiosulphate
- (f) Ferrous sulphate from Kipp's waste
- (g) Mercury tetrathiocyanate

#### Organic Synthesis

- (a) Acetylation of salicylic acid, aniline, glucose and hydroquinone, benzylation of aniline and phenol.
- (b) Aliphatic electrophilic substitution : Preparation of iodoform from ethanol and acetone.
- (c) Aromatic electrophilic substitution ;

Nitration -

Preparation of m-dinitrobenzene from nitrobenzene.

Preparation of p-nitroacetanilide from acetanilide.

Halogenation -

Preparation of p-bromoacetanilide from acetanilide.

Preparation of 2,4,6-tribromophenol from phenol.

(d) Diazotization/coupling - Preparation of methyl orange and methyl red.

(e) Oxidation : Preparation of benzoic acid from toluene

(f) Reduction : Preparation of aniline from nitrobenzene.

Preparation of m-nitroaniline from m-dinitrobenzene.

### 2. (i) Analysis by Colorimetry

(a) Job's method (b) Mole - ratio method

Adulteration - Food stuffs

Effluent analysis, water analysis

(ii) **Solvent Extraction** : Separation and estimation of Mg (II) and Fe (II).

(iii) **Ion Exchange** : Separation and estimation of Mg (II) and Zn (II).

**3. Qualitative Analysis** : Analysis of an organic mixture containing two solid components separable by water, dil. NaHCO<sub>3</sub> and dil. NaOH.

**4. Physical Chemistry Experiment** : Any one of the experiments may be given in the examination.

#### **Chemical Kinetics**

Study the kinetics of the following reactions.

*Initial rate method:* Iodide-persulphate reaction

*Integrated rate method:*

a. Acid hydrolysis of methyl acetate with hydrochloric acid.

b. Saponification of ethyl acetate.

c. Compare the strengths of HCl and H<sub>2</sub>SO<sub>4</sub> by studying kinetics of hydrolysis of methyl acetate

#### **Conductometry**

(i) To determine the strength of the given acid conductometrically using standard alkali solution.

(ii) To determine the solubility and solubility products of a sparingly soluble electrolyte conductometrically.

(iii) To study the saponification of ethyl acetate conductometrically.

(iv) To determine the ionization constant of a weak acid conductometrically.

#### **Potentiometry**

(i) To titrate potentiometrically the given ferrous ammonium sulphate solution using KMnO<sub>4</sub>/K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> as titrant and calculate the redox potential of Fe<sup>3+</sup>/Fe<sup>2+</sup> system on the hydrogen scale.

(ii) To determine the strength of a given solution of HCl/CH<sub>3</sub>COOH by titrating with standard NaOH solution potentiometrically/pH metrically.

#### **Refractometry, Polarimetry**

(i) To verify law of refraction of mixtures (e.g. of glycerol and water) using Abbe's refractometer.

(ii) To determine the specific rotation of a given optically active compound.

#### **Colourimetry**

(i) To verify Beer - Lambert law for KMnO<sub>4</sub>/K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> and determine the concentration of the given solution of the substances.

(ii) Estimation of iron colorimetrically.

(iii) Estimation of phosphate colorimetrically.

#### **Virtual Experiments: (any two)**

1. Preparation of inorganic/ organic compounds.

2. Kinetic study of acid/base catalyzed hydrolysis of esters.

3. Mechanochemical solvent free reactions.

4. Determination of optical rotation by Polarimetry.\

5. Instrumentation Techniques in spectroscopy (UV, IR, NMR etc)

6. Water Softening

7. Demineralized water

8. Any other virtual experiment related to the content of syllabus and availability of the experimental facilities.

### **BOOKS RECOMMENDED**

1. Practical Chemistry - Giri, Bajpai and Pandey, S. Chand & Co. Ltd., New Delhi.
2. Laboratory Manual in Organic Chemistry, R.K. Bansal, Willey Eastern.
3. Experimental Organic Chemistry, Vol. I and II, P.R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.
4. Experiments in Physical Chemistry - J.C. Ghose, Bharti Bhawan.
5. Experiments in General Chemistry, N.r. Rado and U.C. Agarwal, Eastern Press.
6. Practical Chemistry - Suresh Ameta and P.b. Punjabi, Himanshu Publication.

## **ZOOLOGY**

**Pattern of question paper in the annual examination and distribution of marks:**

Each theory paper in the annual examination shall have three sections i.e. A,B, and C. In section A, total 10 questions will be set in the paper, selecting at least two from each unit. These questions to be answered in a word or so. All questions are compulsory. Each question carries 0.5 mark, total 05 marks.

In section B, there shall be total 10 questions, selecting two questions from each unit, five questions to be answered by the student selecting at least one from each unit. Answer should be given in approximately 250 words. Each question carries 05 marks, total 25 marks.

In section C, 04 descriptive type questions will be set in the examination paper from five units of the syllabus of the paper, selecting not more than one question from a unit. Each question may have two sub divisions. Students are required to answer any two questions approximately in 500 words. Each question is of 10 marks, total 20 marks.

**PAPER-I**  
**ANIMAL PHYSIOLOGY, BIOCHEMISTRY AND IMMUNOLOGY**

Marks :50  
External :40  
Internal :10

**UNIT-I**

1 Histology and function of the gastro-intestinal tract, liver, pancreas, lungs, kidney, testis and ovary.

2 Histology, functions and disorders of endocrine glands – pituitary, pancreas, adrenal, thyroid and parathyroid. 3 Digestion and absorption of food in alimentary canal.

**UNIT-II**

4 Metabolism of carbohydrates: Glycolysis, decarboxylation of pyruvic acid, Krebs cycle, electron transport system and oxidative phosphorylation; glycogenesis and glycogenolysis.

5 Metabolism of proteins: Essential and non-essential amino acids, metabolism of amino acids, biosynthesis of glutamic acid..

6 Metabolism of lipids : Biosynthesis of saturated fatty acids and  $\beta$ -oxidative pathways of fatty acid,; formation of ketone bodies..

**UNIT-III**

7 Respiration: Mechanism of respiration, vital capacity of lungs, transport of gases, dissociation curve of oxyhaemoglobin and control of respiration, chloride shift.

8 Blood: structure and functions of blood cells, ABO blood groups and Rh factor, mechanism of blood clotting.

9 Ultrastructure of cardiac and skeletal muscles. Physiology of muscle contraction.

**UNIT-IV**

10 Excretion : Structure and function of nephron, control of renal function.

11 Nerve physiology: Ultrastructure of neuron, synapse, conduction of nerve impulse and neuromuscular junctions.

12 Reproductive physiology: Hormonal control of testicular and ovarian functions with reference to estrous and menstrual cycles.

#### **UNIT-V**

13 Immunology: Definition, types of immunity: innate and acquired, humoral and cell mediated.

14 Cell of immunity: macrophages, lymphocytes (B and T types), T-helper cells, T-killer cells, plasma cells and memory cells.

15 Antibody : definition structure and functions of each class of immunoglobulins.

16 Antigen: antigenicity of molecules, haptens. Antigen – antibody reactions, precipitation reaction, agglutination reaction, neutralizing reaction, complementary and lytic reactions and phagocytosis.

#### **PAPER-II**

## **ECOLOGY AND BIOSTATISTICS**

**Marks :50**  
**External :40**  
**Internal :10**

### **UNIT-I**

- 1 Terminology and scope of Ecology.
- 2 Habitat and niche
- 3 Ecosystem: Components of ecosystem, energy flow and nutrient cycles, food chain, foodweb and ecological pyramids.
- 4 General idea of population and community ecology

### **UNIT-II**

- 5 Freshwater environment: Physico-chemical features and biotic communities, productivity and eutrophication.
- 6 Marine environment: Characteristics, zonation, fauna and their adaptation, deep sea and estuarine fauna.
- 7 Terrestrial environment: General characteristics of desert, grass land and forest ecosystems.

### **UNIT-III**

- 8 Environmental pollution: Biodegradable and non-biodegradable pollutants.
- 9 Air pollution: Source, nature, prevention and control, green house effect, ozone depletion and global warming.
- 10 Water pollution: Source, nature and abatement.
- 11 General account of noise pollution and radioactive pollution.

### **UNIT-IV**

- 12 Conservation of natural resources: Wild life management, brief idea of national parks and wild life sanctuaries of India. Threatened and endangered species of India.
- 13 Environmental planning and environmental impact assessment.
- 14 Brief account of environmental Acts and Legislations (enacted after 1970).

### **UNIT-V**

- 15 Concepts and applications of Biostatistics.
- 16 Frequency distribution, graphical presentation, mean, mode, median, standard deviation and standard error.
- 17 Correlation, T-test, Chi-square test.
- 18 Shanon and Weinner diversity index.

## **PAPER-III** **ETHOLOGY AND EVOLUTION**

Marks :50  
External :40  
Internal :10

### UNIT-I

- 1 Introduction and history of Ethology.
- 2 Methods of studying behaviour.
- 3 Neuroanatomical, neurophysiological, neurochemical, focal and scan sampling techniques.
- 4 Evolutionary approach to behaviour, levels of natural selection.
- 5 Human Ethology, general aspects.
- 6 Orientation taxes and kinesis.
- 7 Brief idea of learning.

### UNIT-II

- 8 Social organization with reference to dominance, hierarchy, social competition and territoriality.
- 9 Reproductive behaviour with reference to courtship, mating, parental investment and stickle back fish (sexual dimorphism).
- 10 Elementary idea of role of pheromones and hormones in insects and vertebrates in relation to behaviour.
- 11 Adaptation and behaviour of Tiger.

### UNIT-III

- 12 Origin of life
- 13 History of evolutionary thought Lamarckism and Neo-Lamarckism
- 14 Darwinism and Neo-Darwinism
- 15 Evidences of organic evolution.
- 16 Concept of micro and mega -evolution

### UNIT-IV

- 17 Variation: Kinds and sources, role in evolution.
- 18 Isolation and speciation, definition, isolating mechanism, origin of species and processes of speciation.
- 19 Adaptation: Definition, kinds of adaptations, adaptive radiation, convergence and divergence.
- 20 Geological time scale

### UNIT-V

- 21 Brief account of Zoogeographical regions of world
- 22 Fossils and their evolutionary significance.
- 23 Phylogeny of horse.
- 24 Evolution of man.

## ZOOLOGY - PRACTICAL

Duration : 5 Hrs. M.M. :50

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<b>S.No</b>	<b>Exercise</b>	
1	Dissection	10
2	Ecology/ Ethology exercise	05
3	Physiological and Biochemical exercise	04
4	Spots	(1-10) 15
5	Viva-voce	08
6	Record	08
		<b>Total :- 50</b>

*Major Dissection marks will be given only if virtual dissection is available otherwise marks may be given according to availability of dissection alternate.*

### **ETHOLOGY AND EVOLUTION.**

- 1 Habituation in earthworm/mosquito larvae.
- 2 Feeding behaviour of housefly/stored product pest.
- 3 Antennal grooming behaviour of cockroach.
- 4 Trial and error and latent learning in rat /mice.
- 165
- 5 Phototaxis and chemotactic behaviour in *Paramecium*.
- 6 Visit to a zoo/natural habitat of wild animals.
- 7 Demonstration of social behaviour by honey bee colony.
- 8 Adaptive modifications in the feet of birds.
- 9 Adaptive modification in the beak of birds.
- 10 Adaptive modification in the mouth parts of insects.
- 11 To study nests and nesting habits of the birds and social insects.
- 12 To study the phototaxis behavior in insect larvae.
- 13 Study of circadian functions in animals (daily eating, sleep and temperature patterns)

### **BIOCHEMICAL, PHYSIOLOGICAL AND ECOLOGICAL EXERCISES**

- 1 Various biochemical tests of
  - (a) Proteins
  - (b) Carbohydrates
  - (c) Lipids
- 2 Action of salivary amylase.
- 3 RBC and WBC counts.
- 4 Estimation of Haemoglobin.
- 5 Blood groups (ABO and Rh).
- 6 Measurement of blood-pressure.
- 7 Abnormal and normal values of constituents of urine.
- 8 Water analysis: pH, alkalinity, dissolved oxygen, chloride and transparency.
- 9 Soil analysis: texture, moisture, organic and inorganic contents.

### **DISSECTIONS:**



- **Digital animals:** Virtual dissection will be done (if facility of virtual is made available by University).
- Virtual dissection of Scoliodon cranial nerves and brain

### **MUSEUM SPECIMENS/ SLIDES SHOWING ADAPTATIONS :**

Students are required to write about specific adaptations of following animals in relation to habitand habitat only:

**Cursorial :** *Acinonyx jubatus, Equus caballus, Moschus moschiferous.*

**Flight :** *Columba livia, Pteropus, Draco, Exocoetus, Papilio.*

**Arboreal :** *Chamaeleon, Hyla, Presbytis.*

**Aquatic :** *Physalia, Chiton, Hydrophis, Labeo Anguilla, Notopterus*

**Fossorial :** *Pheretima, Teredo, Chaetopterus, Talpa, Lepus, Ichthyophis, Naja.*

**Parasitic :** *Taenia, Fasciola, Enterobius, Ascaris, Schistosoma, Hirudinaria, Pediculus, Ixodes.*

- The teacher concerned will provide e-materials to practical in the form of video or demonstrations or written materials including dissections.

### **REFERENCE BOOKS (LATEST EDITIONS):**

#### **ANIMAL PHYSIOLOGY :**

- 1 William S. Hoar, General and Comparative Physiology, Prentice Hall of India Pvt. Ltd.
- 2 Wood, D.W., Principles of Animal Physiology.
- 3 Prosser CL., Comparative Animal Physiology, Satish Book Enterprise.
- 4 Eckert, Animal Physiology. (W.H. Freeman).
- 5 Ganong : Review of Medical Physiology (Lange).

#### **BIOCHEMISTRY :**

- 6 Stryer, L : Biochemistry (Freeman)
- 7 Conn et al : Outlines of Biochemistry (Wiley)
- 8 R.K.Murray et al, Harpers Biochemistry, Lang Medical Book.

#### **IMMUNOLOGY**

- 9 Roitt I : Essential Immunology (ELBS)
- 10 Kuby : Immunology (W.H. Freeman).

#### **ECOLOGY**

- 11 Odum : Ecology (Amerind).
- 12 Odum : Fundamentals of Ecology (Saunders).
- 13 Ricklefy : Ecology (W.H.Freeman).

#### **BIostatISTICS :**

- 14 Green, R.H.Sampling design and statistical methods for environmental biologists. JohnWiley and Sons New York.
- 15 Snedecor, G.W. and W.G. Cochran. Statistical methods. Affiliated East-West Press, NewDelhi (Indian Ed.)
- 16 P.N.Arora and P.K.Malhan, Biostastics, Himalaya Publishing House, Bombay.

#### **ETHOLOGY**

- 17 Drickamer & Vessey: Animal Behaviour, Concepts, Processes and Methods (Wadsworth).
- 18 Grier : Biology of Animal Behaviour (Mosby College)
- 19 Immelmann : Introduction to Ethology (Plenum Press)
- 20 Lorenz : The Foundation of Ethology (Springer-Verlag)

21 Manning : An Introduction to Animal Behaviour (Addison-Wesley)

22 Reena Mathur : Animal Behaviour, Rastogi Publications, Merrut.

**EVOLUTION :**

23 Dobzhansky, Ayala, Stebbins & Valentine : Evolution (WH Freeman)

24 Dobzhansky : Genetics and Origin of species (Columbia University Press)

25 Major : Population, Species and Evolution

26 White : Animal Cytology and Evolution.

27 Moody : Introduction to Evolution

28 Savage : Evolution (Holt, Reinhart and Winston).

**PRACTICAL :**

29 Verma, PS, A manual of practical Zoology Vertebrates S.Chand and Co. Ltd., Ram Nagar, New Delhi(English and Hindi Editions).

30 Lal, SS : Practical Zoology Vertebrates, Rastogi Publication, Meerut (English and Hindi Editions).

31 Verma PS & Srivastava PC, Advanced Practical Zoology, S.Chand & Co.

**Botany**

**PAPER I**  
**ENVIRONMENTAL BIOLOGY AND PHYTOGEOGRAPHY**

**Marks :50**  
**External :40**  
**Internal :10**

**Unit-1**

Definition, scope and aims of ecological studies, relation with other sciences; factors affecting plant growth and distribution - climatic, edaphic, biotic and topographic. **-10 hours**

**Unit-2**

Plant population - natality, mortality, age and sex ratio, growth rate, biotic potential. Plant Community – characteristic characters (qualitative and quantitative characters); Plant succession - xerosere, hydrosere. Ecosystem concept- structure and function : food chain, food web, trophic levels, ecological pyramids, energy flow and biogeochemical cycles. **-10 hours**

**Unit-3**

Pollution : air, water, land, noise and their control. Conservation and management of natural resources, endangered plants and their conservation; biosphere reserves, National Parks and sanctuaries; Chipko movement. **-10 hours**

**Unit-4**

Biodiversity and its Conservation; Hotspots in India. Morphological, Anatomical and Physiological adaptations of hydrophytes, xerophytes and halophytes; natural vegetation of Rajasthan. Plant indicators. **-10 hours**

**Unit-5**

Phytogeography - definition, aims, objectives, scope and relation with other disciplines; phytogeographical regions of world and India; continuous and discontinuous distributions, endemism, continental drift theory, land bridges, age and area hypothesis, migration. **-10 hours**

**Note:**

The paper setter is required to set questions of 3 types contained in 3 Sections (**Section A**- 10 questions, **Section B**-10 questions and **Section C**- 4 questions) from the 5 units of each paper. There will be 10 questions in **Section A** which will be asked from all the 5 units, i.e., 2 questions from each unit. These questions have to be answered in one word or a few words only. Each question will be of half mark. All the questions in **Section A** are compulsory.

In **Section B**, 10 questions will be set from the 5 units, i.e., 2 questions from each unit. Students are required to attempt at least 1 question from each unit. Each question will carry 5 marks. The answers of each question should be given in about 250 words. In **Section C** there will be 4 descriptive type questions set from all the 5 units, not more than 1 question from each unit. These questions may also have sub-divisions. The students are required to answer 2 questions, each in approximately 500 words. Each question will carry 10 marks. In short, pattern of question paper and distribution of marks for UG classes will be as under:

- **Section A:** 10 questions, 2 questions from each unit, short answer, all questions compulsory. Total marks : **05**

- **Section B:** 10 questions, 2 question from each unit, 5 question to be attempted, at least 1 from each unit, answer approximately in 250 words. Total marks : **25**
- **Section C:** 04 questions (question may have sub-division), not more than 1 question from each unit, descriptivetype, answer in about 500 words, 2 questions to be attempted. Total marks : **20**

**PAPER II**  
**PLANT PHYSIOLOGY AND BIOCHEMISTRY**

### UNIT 1

Different models of cell membrane to explain structure and function; water relations – osmosis, diffusion, diffusion pressure deficit (DPD), turgor pressure, wall pressure; concept of water potential. Mechanism and factors affecting transpiration, role of macro and micro elements, carrier concept of ion absorption. -10 hours

### Unit-2

Photosynthesis - photosynthetic pigments; light absorption and mechanism of carbon fixation, C<sub>3</sub> and C<sub>4</sub> plants.

Brief account of CAM, photorespiration, CO<sub>2</sub> compensation point. Factors affecting photosynthesis. Enzymes :general characteristics, traditional and modern methods of enzyme classification, mode of action. Isozymes. -10hours

### Unit-3

Respiration - glycolysis, Krebs cycle, electron transport system and oxidative phosphorylation, factors affecting respiration. Synthesis and degradation of fatty acids. -10 hours

### Unit-4

Plant Growth Regulators : auxins, gibberellins, cytokinins, ethylene and abscisic acid, their physiological effects and application in agriculture and horticulture; Seed dormancy, senescence, photoperiodism and vernalization. -10hours

### Unit-5

Principles and use of following techniques: pH metry, centrifugation, colorimetry, chromatography. Microscopy:light and compound; scanning electron microscopy. -10 hours

**Note:** The paper setter is required to set questions of 3 types contained in 3 Sections (**Section A**- 10 questions, **Section B**- 10 questions and **Section C**- 4 questions) from the 5 units of each paper. There will be 10 questions in **Section A** which will be asked from all the 5 units, i.e., 2 questions from each unit. These questions have to be answered in one word or a few words only. Each question will be of half mark. All the questions in **Section A** are compulsory. In **Section B**, 10 questions will be set from the 5 units, i.e., 2 questions from each unit. Students are required to attempt at least 1 question from each unit. Each question will carry 5 marks. The answers of each question should be given in about 250 words. In **Section C** there will be 4 descriptive type questions set from all the 5 units, not more than 1 question from each unit. These questions may also have sub-divisions. The students are required to answer 2 questions, each in approximately 500 words. Each question will carry 10 marks. In short, pattern of question paper and distribution of marks for UG classes will be as under:

- **Section A:** 10 questions, 2 questions from each unit, short answer, all questions compulsory. Total marks : **05**
- **Section B:** 10 questions, 2 question from each unit, 5 question to be attempted, at least 1 from each unit, answer approximately in 250 words. Total marks : **25**

- **Section C:** 04 questions (question may have sub-division), not more than 1 question from each unit, descriptivetype, answer in about 500 words, 2 questions to be attempted. Total marks : **20**

**PAPER III**

## MOLECULAR BIOLOGY AND BIOTECHNOLOGY

Marks :50  
External :40  
Internal :10

### Unit-1

Bacterial genome. Methods of genetic recombination in bacteria (Transformation, Transduction and Conjugation).

Principles of recombinant DNA technology. Basic tools and techniques. *Neurospora* genetics. Molecular aspects of biological nitrogen fixation. -10 hours

### Unit-2

Structure, chemistry and types of nucleic acids. Replication of DNA. Central dogma, transcription and translation, genetic code. Gene regulation - operon model, two component regulatory system. -10 hours

### Unit-3

History of plant tissue culture, contribution made by Haberlandt, White, Nobecourt, Gautheret, Steward, Reinert, Morel and Vasil. Highlights of work done by Indian Scientists. Basic tools and techniques of plant tissue culture, maintenance of aseptic conditions, Laminar Air Flow Bench, Autoclave, Growth Chamber, methods of sterilization, culture media and their preparation. -10 hours

### Unit-4

Explant types, initiation of cultures, maintenance of cultures, callus and liquid suspension culture, single cell culture, protoplast isolation, purification, culture and regeneration. Regeneration *in vitro* through organogenesis, somatic embryogenesis, androgenesis and haploid production. -10 hours

### Unit-5

Methods of gene transfer in plants - microinjection, electroporation, particle - gun technology, *Agrobacterium* mediated gene transfer. Plant tissue culture in Industry. Secondary plant products with special reference to alkaloids. Prospects of drug production in cell cultures and Bioreactor. -10 hours

#### Note:

The paper setter is required to set questions of 3 types contained in 3 Sections (**Section A**- 10 questions, **Section B**-10 questions and **Section C**- 4 questions) from the 5 units of each paper. There will be 10 questions in **Section A** which will be asked from all the 5 units, i.e., 2 questions from each unit. These questions have to be answered in one word or a few words only. Each question will be of half mark. All the questions in **Section A** are compulsory.

In **Section B**, 10 questions will be set from the 5 units, i.e., 2 questions from each unit. Students are required to attempt at least 1 question from each unit. Each question will carry 5 marks. The answers of each question should be given in about 250 words. In **Section C** there will be 4 descriptive type questions set from all the 5 units, not more than 1 question from each unit. These questions may also have sub-divisions. The students are required to answer 2 questions, each in approximately 500 words. Each question will carry 10 marks.

In short, pattern of question paper and distribution of marks for UG classes will be as under:

- **Section A:** 10 questions, 2 questions from each unit, short answer, all questions compulsory. Total marks : **05**
- **Section B:** 10 questions, 2 question from each unit, 5 question to be attempted, at least 1 from each unit, answer approximately in 250 words. Total marks : **25**
- **Section C:** 04 questions (question may have sub-division), not more than 1 question from each unit, descriptivetype, answer in about 500 words, 2 questions to be attempted. Total marks : **20**

**MATHEMATICS  
PAPER – I  
REAL ANALYSIS**



### UNIT - I

Real number system:

(i) Field, ordered field, upper and lower bounds of a set in an ordered field. Supremum and infimum of a set and their properties. Completeness, Archimedean and denseness properties of an ordered field, the set  $Q$  of rational numbers as a non-complete dense Archimedean ordered field and the set  $R$  of real numbers as a complete dense Archimedean ordered field, (ii) Open interval, closed interval, neighbourhood of a number. Real line  $R$ -Interior points and limit points of a set in  $R$ , open sets and closed sets in  $R$  and their properties, Nested Interval property. Bolzano-Weierstrass theorem, Heine Borel theorem, Compact set and connected set and their properties.

### UNIT - II

(i) Sequence, Bounded sequence, monotonic sequence, limit of a sequence, convergent sequence, properties of convergent sequence, Cauchy first and second theorems on limits, subsequence and its properties, Cauchy sequence and its properties, Cauchy general principle of convergence, Examples of convergent sequences.

(ii) Series: Convergence and divergence of an Infinite series of real numbers, the necessary and sufficient conditions, various tests of convergence problems and their illustrations with regard to infinite series of positive terms. Series: Alternating series and Leibnitz test, absolute and semi (or conditional) convergence.

### UNIT-III

Riemann Integration: Upper and Lower Darboux sum, Upper and Lower Riemann integrals, Riemann integrability of a bounded function in a closed interval, the necessary and sufficient condition for  $R$  integrability in terms of Darboux sums, properties of  $R$ -integrable functions, Fundamental theorem of integral Calculus.

### UNIT - IV

(i) Uniform convergence of sequences and series of functions, various tests including  $M_n$ -test and Weierstrass  $M$ -test, relations of uniform convergence with the continuity of the limit and the sum functions and also with term by term differentiation and term by term integration.

(ii) Fourier series representation of periodic functions which are even, odd and none of these in the full interval or half the interval.

### UNIT - V

(i) Convergence of improper integrals - various tests and their applications, Evaluation of such integrals.

(ii) Equivalent sets and their examples, nature of the relations of equivalence. Denumerable and non numerable sets, countable and uncountable sets, Nature of subsets of a countable set and that of a denumerable (countable) sets, union of denumerable (countable) sets, Denumerability

of the sets of integers and rational numbers and nondenumerability of the closed unit interval  $[0, 1]$  and the sets of real numbers and irrational numbers.

**References:**

1. T. M. Apostol : Mathematical Analysis.
2. R. R. Goldbeg : Real Analysis
3. Walter Rudin : Principles of Mathematical Analysis
4. P.K. Jain & S. K. Kaushik : An introduction to Real Analysis.
5. D. Somasundaram & B. Chaudhary : A First Course of Mathematical Analysis.
6. G. F. Simmon : Introduction to Topology.
7. Bhargava & Goyal : Real Analysis.
8. Gokhroo & others : Real Analysis.
9. Sharma & Purohit : Elements of Real Analysis.

**PAPER – II  
ABSTRACT ALGEBRA**

**Marks :65**

### UNIT – I

Rings, definition and examples of various kinds of rings, integral domain, division ring, field, characteristic of a ring and integral domain, subring and subfield With examples. Left and right ideals with examples and properties, Principal ideal, principal ideal ring. Maximal, prime and Principal ideals in Commutative rings and their theorems.

### UNIT -II

Quotient ring, Homomorphism and isomorphism in rings, kernel of homomorphism, Fundamental theorem of ring homomorphism. The three isomorphism theorems in rings, Embedding of a ring into a ring with unity and also into a ring of endomorphism of some abelian groups, Quotient field of an integral domain.

### UNIT - III

Definition and various examples of vector spaces, subspaces and examples, Intersection, sum and direct sum of two subspaces, Linear span, Linear dependence, independence and their basic properties and problems.

### UNIT- IV

Basis, Dimension and examples, Finite dimensional vector spaces, Existence theorem for a basis, Extension theorem, Invariance of the number of elements of a basis set, Existence of complementary subspaces of a subspace of a finite dimensional vector space, Dimension of sum (and direct sum) of two subspaces, Quotient space and its dimension.

### UNIT - V

Linear transformations, Rank and Nullity of a linear transformation, Sylvester law of nullity, to obtain a matrix from a linear transformation and vice-versa and their problems relating to the same and different bases. The algebra of linear transformations, dual space and dual basis and dimension of dual space, bidual space and natural isomorphism (Reflexivity).

#### References:

1. Surjeet Singh and Quazi Zarneeruddin : Modern Algebra.
2. I.N.Herstein : Topics in Algebra.
3. R.S.Agrawal : Algebra.
4. Gokhroo, Saini : Advance Abstract Algebra.
5. Shanti Narayan : A Text-Book of Modern Abstract Algebra.
6. Hoffman and Kunze : Linear Algebra, (Second Edition).
7. Purohit, Pareek and Sharma : Linear Algebra.
8. Halmos, Paul R : Finite - Dimensional Vector spaces.

### PAPER -III DISCRETE MATHEMATICS

Marks :65

### UNIT – I

Sets and propositions – cardinality, Mathematical Induction, Principle of Inclusion and exclusion. Computability and formal language- ordered set. Language phrase structure Grammars. Types of Grammars and languages.  
Permutation and combinations: Simple problems.

### UNIT –II

Relations and functions:- Binary Relations, Equivalent Relations and Partitions, Partial order relations and lattices, Pigeon Hole principle. Graphs and planar graphs: - Basic Terminology; Multigraphs, weighted graphs, paths and circuits shortest paths. Eulerian paths and circuits. Planar graphs.

### UNIT – III

Trees: Rooted trees, Binary tree, Decision or sorting tree, spanning tree, minimal spanning tree. Pumping lemma. Finite state machine: Equivalent machines, Finite state machine as Recognizers. Analysing Algorithms– Time complexity, complexity of problems.

### UNIT –IV

Recurrence Relations and Recursive Algorithms: Linear Recurrence Relations with constant coefficients, Homogeneous solutions, Particular solution, Total solution, Solution by the method of generating functions.

### UNIT – V

Brief review of groups and Rings. Boolean Algebras – Lattices and Algebraic structures. Duality, Distribution and complemented Lattices, Boolean Lattice and Boolean Algebras, Boolean function and expressions, Propositional calculus, Design and Implementation of Digital network - Switching circuits.

#### References:

1. C.L. Liu : Elements of Discrete Mathematics
2. K.D. Joshi : Foundation of Discrete Mathematics
3. Mradula Garg & R. Panday : विविक्त गणित
4. Gokhroo et.al :

## PAPER- III NUMERICAL ANALYSIS AND OPERATIONS RESEARCH

Marks :65

### UNIT - I

Differences, Relation between differences and derivatives, differences of Polynomial, Newton-Gregory formula for forward and backward interpolation, divided differences. Newton's General interpolation formula, Lagrange's interpolation formula.

### UNIT - II

Gauss's central difference formula, Stirling's and Bessel's interpolation formula, Inverse interpolation. Numerical differentiation, Derivatives from Interpolation formulae, Method of operators, Numerical Integration: Newton-Cotes Quadrature formula, Trapezoidal, Simpson's one third, Simpson's three-eighths rules.

### UNIT-III

Gauss Quadrature formulae, Estimation of errors in quadrature formula, location of roots by Descartes' method of sign, Newton's theorem on multiple roots, Numerical solution of Algebraic and Transcendental equations, Bisection method, Regula-Falsi method, Method of integration .

### UNIT-IV

Introduction to linear programming problems, Mathematical formulation Graphical method of solution of linear programming problems (Problems of two variables only), Theory of convex sets, Theory of Simplex method and its applications to simple linear programming problems.

### UNIT - V

Concepts of duality in linear programming, formation of dual problems, Elementary theorems of duality.

Assignment and transportation problems and their optimum solutions.

### References:

1. C. E. Froberg : Introduction to Numerical Analysis
2. M. K. Jain, S. R. K. Iyengar and R.K. Jain : Numerical methods: Problems & solutions
3. G. Hadley : Linear Programming
4. Kanti Swaroop, P. K. Gupta and Man Mohan : Operation Research
5. H.C. Saxena : Numerical Analysis
6. Goyal, Mittal : Numerical Analysis
7. Goyal, Mittal : Numerical Analysis (Hindi ed.)
8. Goyal, Mittal : Numerical Analysis (Hindi ed.)
9. Goyal, Mittal : Operations Research
10. S.D.Sharma : Operations Research
11. Gokhroo, Saini, Jain : Operations Research (Hindi ed.)
12. Bhargava, Bhati, Sharma : Linear Programming (Hindi ed.)
13. Gokhroo, Saini, Jain : Linear Programming (Hindi ed.)

### PAPER- III

# MATHEMATICAL STATISTICS

Marks :65  
External :50  
Internal :10

## UNIT -I

Probability: Definitions of Probability, Addition and Multiplication laws, Conditional probability , Independent events, Baye's Theorem.

## UNIT II

Random variable, Distribution function, Probability mass & density functions, probability distribution, Joint, marginal and conditional probability functions.

## UNIT -III

Mathematical expectation and Moments, Addition & Multiplication law, Covariance, Expectation and Variance of linear combination of two variables, Moment generating, cumulant generating & characteristic functions.

## UNIT -IV

Theoretical Probability distributions- Binomial, Poisson and Normal distributions and their properties.

## UNIT -V

Curve fitting by the principle of least squares, fitting of straight line and parabola, Bivariate linear correlation and regression.

Books Recommended:

1. Mathematical Statistics, J. N. Kapur & H.C. Saxana, S. Chand & Co., New Delhi.
2. Fundamentals of Mathematical Statistics, V. K. Kapoor & S.C. Gupta, Sultan Chand Sons, New Delhi.
3. Mathematical Statistics by Dr. Gokhroo & Saini.

### NOTE:

Candidates who have offered Statistics as an optional subject will not be permitted to offer the paper III (B) and III (C). Candidates who have offered Computer science as an optional subject will not be permitted to offer paper III (B).

**PROFESSIONAL EDUCATION COURSE**

**PEC 5 -KNOWLEDGE & CURRICULUM**

### **OBJECTIVE OF THE COURSE :**

- To enable student teachers to understand the meaning of the term knowledge and Curriculum.
- To develop understanding into the epistemological basis of education
- To develop understanding of modern child-centered education
- To develop understanding social & cultural influence on education.
- To examine relationship of Curriculum to education.
- To develop understanding into curriculum its determinates ,process & evaluation.

### **UNIT :1**

#### **Construction of Knowledge**

- Meaning & Nature of knowledge
- Information , knowledge ,conception & perception
- Sources of knowledge : Empirical V/s Revealed Knowledge
- Types of knowledge :(1) Disciplinary knowledge  
(2) Course Content Knowledge  
(3) Indigenous Knowledge  
(4) Scientific Knowledge
- Relevance of knowledge construction through dialogue
- Contestations to Knowledge  
(a) Dominance  
(b) Marginalization (c) Subversion
- Role of curriculum in challenging Marginalization with reference to class ,caste ,gender , & religion .

### **UNIT :2**

#### **Metaphysics**

- Meaning of Metaphysics ,aims & objective ,types of Metaphysics – ontology cosmology , theology , Methods , Techniques & Maxims of Teaching , Role of teacher.
- Axiology & Education , Meaning of Axiology ,need ,types of axiology , Value ,methods & techniques , role of teacher .

### **UNIT :3**

#### **Basis of Modern Child – Centered Education**

(Concept , basis & educational significance )

1 Activity Method (M.K. Gandhi )

2. Discovery Method (John Dewey )

3. Child Centered (Giju Bhai badheka )

- Education : Meaning (etymological ), definitions & characteristics of education
- Epistemological basis of education distinction between knowledge & information ,teaching & training
- Change in education due to industrialization , democracy & individual autonomy
- understanding Education in relation to equity , equality & social Justice (B.R. Ambedkar )
- Interrelationship of education with reference to Nationalism (Krishnamurti) & Secularism (tagore )

#### UNIT : 4

##### **Curriculum – Concept , Types ,Determinates & Development**

1.Curriculum –Meaning & Concept of Curriculum ,Relationship With Curriculum Frame work ,Syllabus & Text books .

2. Determinants of Curriculum (Philosophical , Psychological, Sociological,Political)

3. Types of curriculum (Subject – centered , & Child – Centred ,Hidden Curriculum & enacted Curriculum )

4. Principles of Curriculum Development

5. Process of Curriculum Development

(a) Formulating aims & objectives

(b) Criteria for selecting knowledge & representing knowledge in the form of different subjects .

(c) Selection & organization of Learning Situations .

4. Participatory approach to Curriculum development : Representation of social groups in curriculum construction.

#### UNIT : 5

##### **Curriculum Implementation and Evaluation**

a) Teachers' role in generating dynamic curricular experiences through (i) flexible interpretation of curricular aims, (ii) contextualization of learning, (iii) varied learning experiences (iv) learning resources

b) Need and evaluation of effective curriculum construction with reference to existing pedagogies and Instructional approaches, teacher training, textbooks and instructional materials.

c) Role of MHRD and NCERT in curriculum reform

##### **Practicum:-**



- a. Seminar Presentation Critical appraisal of Philosophy & Practice Of Education Advocated by Gandhi, Dewey, Freire
- b. Critical Writing : Critically examine role of hidden curriculum with references to school rituals ,celebrations and rules and discipline .
- c. Report writing choose syllabus for any one school subject, Read text books (of at least 2 Standards from 6 to 9 class) for the same .Deliberate on of modern values like equity ,equality and social Justice Reflected in it and write a report on it.

## Reference

1. Schilvest, W.H. (2012), Curriculum: prospective paradigm and possibility.M.C MLLAN publication.
2. Hirst, Paul, H. Knowledge and the curriculum. Routledge publication.
3. Letha ram mohan (2009). Curriculum instrchon and evaluation. Agerwal publication, Agra.
4. Scolt, dand (2003). Curriculum studies: curriculum knowledge. Routledge falmes, m.y.
5. Kelly, AV. (2009). The curriculum: theory and practice sage publication Singapore.
- 6<sup>प</sup> श्रीवास्तव, एच.एस.एवं चतुर्वेदी, एम. जी (2010). पाठ्यचर्या और शिक्षण ि
- 7<sup>प</sup> यादव, शियाराम, 2011. पाठ्यक्रम विकास अग्र
8. Shulman L. S. (1986) those who understand: knowledge growth in teaching. Educational researcher.
9. Sinha, S. (2000) Acquiring literacy in schools, seminar.
10. Sternberg, R.J. (2013). intelligence, competence, and expertise, in A.J. Elliot & C.S. Dweck (Eds), handbook of competence and motivation .
11. Tagore, R. (2003) Civilization and progress in crisis in civilization and other essays.: rupa &co. New Delhi.
12. Pathak, A (2013) Social implications of schooling: knowledge pedagogy and consciousness. Aakar books, New Delhi.

## Curriculum & Pedagogic Studies

## PC-1 PEDAGOGY OF BIOLOGICAL SCIENCE

Marks :100  
External :80  
Internal :20

### Paper Objectives-

To enable the pupil teacher to

- Develop a broad understanding of the principles and procedures used in Biological Science & Developing their skills necessary for preparing Biological Science education in modern society.
- To construct different plans according to need.
- To devise the instructional Design of biological science properly.
- Appraise the biological paradigm in understanding of the subject.
- Use different methods to teach different concepts.

### UNIT- I

#### BASICS OF BIOLOGICAL SCIENCE

- Nature of modern science, impact of science on society, globalization and science, Justification of including science as a school subject, socio cultural perspectives of biological science , worlds eminent scientists and their path tracking discoveries.
- Pedagogy of Biological Science – Integration of knowledge about the learner, The subject discipline, social context of learning, and researches related to different aspects of learning.
- Different branches of biological science , relation with other subjects ,
- Constructivism in teaching Biological Science, Vygotskiyan Perspective.

### UNIT -II

#### AIMS AND OBJECTIVES OF TEACHING BIOLOGICAL SCIENCE

- Taxonomy and approaches of educational objectives in biological science.
- Objectives in biological science- Blooms Taxonomy and revised Blooms taxonomy.
- Process and product outcomes.
- Concept of entering and terminal behavior.

### UNIT- III

#### PLANNING FOR INSTRUCTION

- Unit plan, year plan and lesson plan
- Ability to convert an unit plan into lesson plan
- Use of teaching-learning material (Audio-Visual aids)
- Improvised apparatus: significance and preparation
- Use of LCD projector and power point presentation
- Use of Bruner's models as concept attainment and advance organizer models in Teaching of Biological science.
- Planning and Implementation of strategies in Teaching concept – Evaluation Approach

### UNIT- IV

#### TEACHING OF BIOLOGICAL SCIENCE & CURRICULUM ORGANIZATION AND LEARNING RESOURCES

- Inductive-Deductive approach
- Edger Dale's con of experiences.
- Major models & methods for Science Instruction- formal & non-formal and co-curricular approaches Lecture cum demonstration, Heuristic, Discussion, Project, Problem Solving, laboratory and Experimental method.
- Innovative Teaching practices in Biological science.

Principles and approaches for curriculum development, curricular framing according to local needs.

- Text Books, Science journals, handbooks, other resource materials for Teaching Biological science.
- Organization of Biology laboratory.

### UNIT VI

#### EVALUATION IN BIOLOGICAL SCIENCE & PROFESSIONAL DEVELOPMENT OF A BIOLOGY SCIENCE TEACHER

- Measurement and Evaluation- Importance and purpose.
- Types of evaluation
- Achievement Test construction, administration and scoring.

- Characteristics of a good test
- Measuring specific behavioral outcomes- Cognitive, Affective and psychomotor outcomes.
- Diagnostic testing and remedial teaching.  
Professional development programmes for a bioscience teacher- Participation in seminar, conferences, online sharing membership of professional organizations, Collaboration of school with colleges, universities and other institutions,

# PC-2 PEDAGOGY OF MATHEMATICS

Marks :100  
External :80  
Internal :20

## Objectives

1. To understand the basic concepts associated with academic disciplines
2. To understand place of different disciplines in the school curriculum understand nature, scope & importance of Mathematics at secondary level.
3. To acquaint and formulate aims and instructional objectives in teaching mathematics in Secondary school level as per revised taxonomy.
4. To apply different approaches and methods of teaching mathematics in classroom situations.
5. To set up mathematics club in the school and organize its activities.
6. To use a mathematics laboratory to develop in students an interest in mathematics.
7. To understand the professional competencies, commitments and expectations of mathematics teacher.
8. To develop knowledge of various values of teaching Mathematics
9. To appreciate the role of mathematics in day-to-day life
10. To understand that mathematics is more than formulas and mechanical procedures
11. To channelize, evaluate, explain and reconstruct students' thinking
12. To appreciate the importance of mathematics laboratory in learning mathematics

## Unit 1

### Basics of Academic Disciplines

- a) Meaning of academic disciplines, Relationship between academic disciplines and Mathematics
- b) Classification of academic disciplines: Belcher -Belgian typology (pure-hard, pure soft, applied-hard, applied-soft types) with emphasis on nature of knowledge in each type.,
- c) Place of Mathematics in the present school curriculum

### Unit 2: Introduction to the Teaching of Mathematics & Curriculum

- (a) Meaning, Nature & scope of Mathematics
- (b) Aims and Objectives of teaching Mathematics at Secondary and Higher Secondary Levels (NCF 2009)
- (c) Values of teaching Mathematics (d) Maxims of teaching ,From Known to Unknown ,From Simple to Complex , From Particular to General ,From Concrete to Abstract , From Whole to Part
- (e) Approaches of curriculum construction-Concentric and Topical & Text book .
- (f) Pedagogical Analysis ,Unit Planning & Lesson planning

## Unit 3

### Methods and Techniques of Teaching Mathematics

- a) Learner Centered methods ---Inductive Deductive (Teaching Generalizations), Analytical Synthetic (Teaching Proofs)
- b) Activity centered methods—Problem solving, Lecture cum Demonstration
- c) Techniques of teaching Mathematics ---Drill and Review, Assignment in Mathematics

## Unit 4

## Learning Resources

- a) Mathematic Laboratory & Mathematic club (objectives, significance)
- b) Textbook – Characteristics and Critical analysis
- c) Digital Resources for Teaching Mathematics- Geogebra & Virtual Manipulative (Meaning, Application, Advantages and Limitations)

## Unit 5

### Professional Development of Teacher

- a) Competencies of Mathematics teacher
- b) Need and Avenues of Continuous Professional Development
- c) Contribution of mathematicians- Aryabhata, Ramaujan, Euclid, Phythagoras
- d) Mathematics teacher merits & demerits, Characteristics& Maths teaching innovation :- team teaching, Program learning, peer group.

### Suggested tasks: (Any One)PRACTICUM :-

- a) Plan and implement lessons in mathematics using appropriate methods/approaches to teach :  
Generalizations  
Theorems/ Proofs  
Problem Solving  
Lecture cum Demonstration

Take up a problem in mathematics (from any area like number system, geometry etc.). Make a group of 3 or 4 students to discuss about the probable ways of solving

- b) Conduct one lesson in the math using manipulative- Physical/ virtual.
- c) Assignment: For any one selected topic, prepare Pedagogical Analysis Plan
- d) Critically appreciate any one textbook of mathematics.
- e) Conduct one lesson in the math using manipulative- Physical/ virtual.
- f) Prepare a diagnostic test in mathematics.
- g) Critically appreciate any one textbook of mathematics.
- h) Collect the names of Mathematicians and Prepare a report about their contribution to Mathematics .

### References:

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## PC-3 Pedagogy of Physical Science

Marks :100  
External :80  
Internal :20

### Objectives

The course will enable the student teachers to -

- \* gain insight on the meaning and nature of physical science for determining aims and strategies of teaching- learning
- \* appreciate the fact that every child possess natural curiosity about her natural surroundings
- \* appreciate that science is a dynamic and expanding body of knowledge
- \* understand the process of science and role of laboratory in teaching- learning situation
- \* appreciate various approaches of teaching-learning of physical science
- \* use effectively different activities/ experiments / laboratory experiences for teaching- learning of physical science
- \* identify the concepts of physical science that are alternatively conceptualized by teachers and students in general
- \* explore different ways of creating learning situations considering learning needs and context of the learner and the relevant concept
- \* integrate knowledge in physical science with the other school subject
- \* facilitate development of scientific attitudes in learners
- \* construct appropriate assessment tools for evaluating learning of physical science.
- \* examine the different pedagogical issues in the content of learning physical science.

### Unit 1

#### Nature of Science

□ Science as a domain of inquiry, as a dynamic and expanding body of knowledge, science as interdisciplinary area of learning (e.g. Thermodynamics, Biomolecular Surface Chemistry, etc.), Science is an international enterprise, tentative nature of science, science promotes skepticism and perseverance.

\* Science as a process of constructing knowledge; Scientific methods: a critical view, How science works; Role of science teacher.

\* Science and society- Physical science and society; physical science for environment, health, peace and equity.

\* Contribution of eminent scientists- Isaac Newton, John Dalton, J.C. Bose, Albert Einstein Niels Bohr, C.V. Raman, De Bogle, Bimla Buti, V. Ramakrishan, etc.

### Unit 2

#### Aims and Learning objectives of Physical Science

1. Knowledge and understanding through science ; Nurturing process skills of science , developing scientific attitude and scientific temper.
2. Nurturing curiosity, creativity and aesthetic sense in science (Secondary Stage)/Physics and Chemistry (Higher Secondary stage).
3. Relating Science (Physics/ Chemistry) education to environment (natural environment, artifacts and people), technology and society and appreciating the issues at the interface of science, technology and society; Imbibing various values through teaching –learning of Science; Developing problem solving skills.
4. Learning objectives- Meaning; features of a well defined learning objective; Anderson and Krathwohl's taxonomy.
5. Identifying and writing learning objectives for different content areas in Science/ Physics/ Chemistry consistent with the cognitive development of learners (e.g Mechanics, Heat, Electricity,



magnetism, Light, Acids, Bases and Salts, Thermodynamics, Metallurgy, Physical and Chemical changes, Nature and state of Matter, etc.); Learning objectives in constructivist perspective.

### Unit 3

#### **Pedagogical shift and Approached and strategies of learning Physical Science**

1. Pedagogical shift from science as a fixed body of knowledge to the process of constructing knowledge; Pedagogical shift in nature of science, knowledge, learners, learning and teachers, assessment, science curriculum and planning teaching-learning experiences (taking examples from science/ Physics/Chemistry, such as Solutions, Chemical Equilibrium, Electrochemistry, Mechanical and Thermal Properties of Matter, Reflection, Refractions, Wave optics, etc.)
2. Democratizing Science learning: Critical pedagogy
3. Need of inclusion in all aspects of teaching-learning of physical sciences – science curriculum, approaches, ICT and professional development of teachers.
4. Approaches and Strategies -- Historical background of learning Physical Science; Essential components of all approaches and strategies, selecting appropriate approach and strategy.
5. Constructivist approach; Collaborative learning approach, Problem solving approach; Concept mapping; Experiential learning; Cognitive conflict; Inquiry approach, Analogy strategy.
6. Facilitating self-study; Communication in Science -- qualities of an effective Science communicator, developing communication skills in learners.

### Unit 4

#### **Learning Resources in Physical Science**

1. Identification and use of learning resources from immediate environment (e.g. Natural pH Indicators, Soaps and Detergents, Baking Soda, Washing Soda, Common Salts, Fruits, Fiber, Pulleys, Projectiles, Lenses and Mirrors, Propagation of Waves in solid, liquid and gas, etc.); Using community resources-- bringing community to the class and taking class to the community; Pooling of learning resources in school complex/ block /district level.
2. Improvisation of apparatus, identifying some inexpensive sources of chemicals, Science kits.
3. Using laboratory as a learning resource, approaches to laboratory work, planning and organizing laboratory work, safety in laboratories, Physics laboratory, Chemistry laboratory, handling hurdles in utilization of resources.
4. Print and ICT resources -- Textbooks, Journal and Magazines; Dale's cone of experiences ; Different forms of ICT and its applications in science education-- audio-aids, video-aids, audio-video aids, educational T.V.; Use of computer for simulation, internet and open learning resources.
5. Factors affecting media selection ICT for inclusive education, skills to be developed in students for meaningful use of ICT.
6. Social networking sites and their use in Science education; Integrating ICT in teaching-learning process taking examples (e.g. Acid, Base, Salt, Dual Nature of Radiation, Radioactivity, etc.)

### Unit : 5

#### **Planning for teaching-learning of Physical Science & Professional Development .**

1. Need of planning teaching-learning experiences; Identification and organization of concepts – basic principles and factors need to be considered for it; Basic elements of a Physical Science lesson with examples from Science/Physics/Chemistry.
2. Facilitating formation of groups; Planning and organizing activities in Physical Science, planning laboratory work and ICT application in learning Science/ Physics/ Chemistry.
3. Reflective planning; Unit plan; Developing lesson designs on different topics and through various approaches taking examples from Upper Primary, Secondary and Higher Secondary stage (Physical and Chemical Changes, Redox Reaction, Light, Magnetic Effect of Electric Current, etc.)
4. Professional development – Teaching as a profession, need for pre-service and in-service professional development programme, major shift in teacher education programme.

5. Various opportunities for in-service professional development –interaction with peer teachers, reading, attending training programme, membership of professional organisation, sharing through conferences, seminars and Journals, travel, cultivating science hobbies ,mentoring, teacher’s exchange programme, acquiring higher qualification, collaborating with universities and other schools etc.

6. Role of reflective practices in professional development–questionnaires, research and portfolio.

**PRACTICUM :-**

1. Actual experience of Science/Physics/Chemistry laboratory of practicing school (report submission)

2. Planning and conducting experiments for Science/Physics/Chemistry

\*Managing records

\* Setting-up of apparatus

Storage of chemicals and apparatus

\*Safety measures being taken in the laboratories and steps taken by the student-teacher

\* Design of laboratory – structure and physical facilities

\*Designing laboratory experiences for using in teaching-learning process in classroom situation – two innovative activities and two improvised apparatus (artifacts).

(3) Report of one Action Research carried out in the practicing school

(4) Report on measures being taken for inclusive teaching-learning and gender issues in practicing school and involvement of the student-teacher

(5) Presentation (s) used for teaching-learning in the class

(6) Report on a case study on identifying and addressing issue of alternative concepts in Physical science

(7) Critical review of a recently published research paper in Science/Physics/Chemistry Education Journal

(8) Critical review of a Textbook of Science/Physics/Chemistry.

# PC-4 PEDAGOGY OF GENERAL SCIENCE

Marks :100  
External :80  
Internal :20

- Develop insight on the meaning and nature of General science for determining aims and strategies of teaching- learning.
- Appreciate that science is a dynamic and expanding body of knowledge.
- Appreciate the fact that every child possesses curiosity about his/her natural
- Identify and relate everyday experiences with learning of science.
- Appreciate various approaches of teaching- learning of science.
- Explore the process skill in science and role of laboratory in teaching- learning.
- Use effectively different activities / experiments/ demonstrations / laboratory experiences for teaching-learning of science.
- Integrate the science knowledge with other school subjects.
- Analyze the contents of science with respect to parts, branches, process skills, knowledge organization and other critical issues.
- Develop process-oriented objectives based on the content themes/units.
- Identify the concepts of science that are alternatively conceptualized by teachers and students in general.

## Unit-I

### Nature and Scope of General Science

Concept, Nature, Need & Importance of Science & Science Teaching.

Main discoveries and development of science (special reference to ancient India)

Science as a domain of enquiry, as a dynamic and expanding body of knowledge, science as a process of constructing knowledge. Science as interdisciplinary area of learning (Physics, chemistry, biology etc) science for environment, health, peace & equity, science and society., Fact, concept, principles, laws and theories-their characteristics in context of general science.

## Unit-II

### Teaching-learning of social science

Questioning; Collaborative strategies; games, simulations, dramatization, roleplays; Values clarification; problem-solving, Discussion, story-telling, project and decision-making, use of media and technology, concept mapping.

Methods: Interactive verbal learning; experiential learning through activities, experiments; Investigative field visits. Planning, organizing and conducting of small community survey.

## Unit-III

### Teaching-learning of General Science

Principles of science and its applications consistent with the stages of cognitive development of learners.

Pedagogical shift from science as fixed body of knowledge to constructing knowledge, scientific method – observation, enquiry, hypothesis, experimentation, data collection, generalization (teacher-educator will illustrate taking examples from different stage-specific content areas keeping in mind the variation, e.g. structure and function, molecular aspects, interaction between living and non-living, biodiversity, etc.): Communication in sciences. Questioning; Collaborative strategies; simulations, Demonstration, lab Method, Problem Solving, Heuristics Project Method, Inductive and deductive Method, Heuristic, use of media and technology, concept mapping Innovative methods of science teaching.

#### **Unit-IV**

##### **ICT & Materials in Teaching-learning of General Science**

Use of ICT: Video clips, Power points presentations, films etc.

Planning, preparation and presentation of Instructional Material.

Techniques: Using textbooks and atlas as a part of oral lessons, non-oral working lessons; using medium and large scale maps; using pictures, photographs, satellite imageries and aerial photographs; using audio-visual aids, CDs, multimedia and internet; case study approach.

Planning, Organization and activity of science club.

#### **Unit-V**

##### **Teaching-learning Resources in General Science and Evaluation**

People as resource: the significance of oral data.

Types of primary and secondary sources: data from field, textual materials, journals, magazines, newspapers, etc.

Using the library for secondary sources and reference material, such as dictionaries and encyclopedias.

Various teaching aids, Audio-visuals & online resources.

Meaning, concept and construction of Achievement test, diagnostic and remedial test.

Blue print: Meaning, concept, need and construction.

Open-book tests: Strengths and limitations

Continuous and Comprehensive Evaluation (CCE) in Sciences.

Characteristics of Assessment in Sciences

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## PC-5 PEDAGOGY OF Chemistry

Marks :100  
External :80  
Internal :20

### Objectives:

Upon completion of the course, the student teacher will be able to:

- 1) Understand the nature, scope and importance of Physical science with special reference to secondary school content.
- 2) Understand the aims and objectives of teaching Physical science.
- 3) State the specific behavioral changes under each objective.
- 4) Understand and make use of different approaches & methods of teaching Physical science.
- 5) Prepare objective based lesson plans and use them in their internship.
- 6) Understand and employ several teaching techniques helpful to develop scientific attitude and scientific method.
- 7) Plan, use and maintain the physical science laboratory systematically.
- 8) Understand the principles of text-book construction.
- 9) Understand the importance of appropriate instructional materials (hardwares and softwares) in teaching Physical science and use them by preparing/selecting them in their practice teaching.
- 10) Understand the importance of principles of curriculum construction in the organisation of Physical science contact.
- 11) Get mastery in Physical science content and imbibe the special qualities of Physical Science teacher.
- 12) Prepare and use different tools of evaluation to assess the achievements of students in Physical Science.
- 13) Develop professionally by attending lectures of professional interest, reading journals, and magazines and enroll as members of professional organisation.
- 14) Organise co-curricular activities in science i.e. seminars, field trips, exhibitionsdiscussions etc through the science club.
- 15) Apply the knowledge of physical science to develop scientific thinking and scientific out look.
- 16) Develop skills in analyzing the content in terms of concepts and in learning experiences.
- 17) Construct and administer unit test, conduct experiments improves teaching aids.

### CONTENT

#### Unit 1

##### Meaning, Nature and Impact of Chemistry

Concept of science - Science as process and science as a product;

Nature and Scope of Science

Impact of Science and Technology on modern living.

Scientific Attitude - Meaning definition and importance.

Qualities of a person who possesses scientific attitude.

Scientific Method-Meaning, importance and steps involved (with an illustration).

#### Unit 2

##### Aims and Objectives of Teaching Physical Science

Aims of teaching Chemistry in Secondary school:

1 Personal development aim,

2 Learner's academic and process skills development aim,

3 Disciplinary aim and

4 Cultural aim.

Objectives of teaching Chemistry:

1 Bases for formulation of objectives

2 Objectives of teaching Chemistry at Secondary level; (To be Discussed keeping in view of the objectives of teaching Chemistry enunciated in the chemistry syllabi of secondary school of M.P.); Instructional objectives of teaching physical science and stating them in observable behavioral changes ; i) Knowledge ii) Understanding, iii) Application, iv) Skill, v) Attitude, vi) Interest, vii) Appreciation.

### Unit 3

#### Approaches and Methods of Teaching Physical Science

Enquiry Approach -Meaning, Uses with Illustrations, Advantages and disadvantages.

Inductive Approach-Meaning, Uses with Illustrations, Advantages and disadvantages.

Deductive Approach-Meaning, Uses with Illustrations, Advantages and disadvantages.

Problem Solving Approach- Meaning, Uses with Illustrations, Steps, Advantages and disadvantages.

Demonstration Method- Meaning, uses, Advantages and disadvantages.

Lectures-Cum-Demonstration Method- Meaning, uses with Illustration, Advantages and disadvantages.

Laboratory Method- Meaning, uses with Illustration, Advantages and disadvantages.

Guided Discovery Method - Meaning, uses with Illustration, Advantages and disadvantages.

Biographical Method-Meaning, uses with Illustration, Advantages and disadvantages.

Individual Instruction Techniques and Active Learning Strategies.

Concept Mapping: Its use for summarizing a unit and evaluating students understanding

### Unit 4

#### Instructional Design, Resources and Teaching Aid for teaching Physical Science:

Lesson Planning-Meaning, Steps, Importance and Format of Lesson Plan according to active learning strategies.

Unit Plan-Meaning, Steps, Importance and Format of Lesson Plan

Resource Unit-Meaning, Steps, Importance and Format of Lesson Plan Audio-Visual Aids (Preparation and Use)

i Charts;

ii Models;

iii OHP transparencies;

iv Filmstrips;

v slides;

vi Video tapes;

vii Films;

viii Educational C.D.'s

Mass Media –

i Television (T.V.);

ii Radio - Meaning and importance.

Community Resources and Self learning materials –

iii Meaning and importance.

Chemistry Laboratory-Planning, Equipments;

Importance, Safety measures & organizing of Laboratory;

Importance & organizing library; Choice of book for library.

#### References

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## **SIP 1- INTERNSHIP PROGRAMME (School Intership Phase-I)**

School Internship is designed to lead to the development of broad repertoire of perspectives, professional capacities, teacher dispositions, sensibilities and skills. During the internship, a student-teacher shall work as a regular teacher and participate in all the school activities, including planning, teaching and assessment, interacting with school teachers, community members and children.

### **Objectives –**

After completion of the Internship the student - teachers will be able to –

1. Develop the understanding of the school and its management.
2. Develop the ability to plan and manage the class-room teaching.
3. Develop the sensibility towards diverse needs of learners in school.
4. Develop ability to discharge various responsibilities expected from a teacher.
5. Organize and conduct the co- curricular activities.
6. Get acquainted with various school records maintained by the school.
7. Maintain records expected from a teacher.
8. Develop skills of conducting community contact programmes.
9. Get acquainted with the functioning of SMC.

### **Execution of the Internship Programme**

The internship programme shall be divided into 2 years. In the first year, 4 weeks will be allotted.

This will include one week of school observation and three weeks of practice - teaching during which each student - teacher has to teach 2 periods per day (one period each for 2 pedagogy subjects). Besides teaching, the student - teacher has to complete his/her tasks and assignments related to the courses mentioned in the first year. The three weeks practice teaching will also include the delivery of criticism lessons (one in each pedagogy subject) and also observation of 5 lessons of peers of each of the two subjects. This practice of teaching programme is adopted so as to give a proper training of teaching skills and thorough guidance to the student-teachers by the subject lecturer.



## Practice Teaching

S. No.	Activity	Marks
1.	Practice Teaching in both the pedagogy subjects in Schools (for three weeks) (At least 18 lessons in each subject)	50+50=100
2.	Peer Group Lesson Observation(ordinary+criticism-5 lesson in each round (5+5)	5+5=10
3.	Criticism Lessons (1-1 in both pedagogy subjects)	10+10=20
4.	Test (Blue print + question paper + Evaluation Key+Remedial Teaching)	10+10=20
	<b>Total Marks</b>	<b>150</b>

## SAP – 2 - EXTERNAL ASSESSMENT

### ONE FINAL LESSON OF PEDAGOGY OF A SCHOOL SUBJECT

[III YEAR]

- The weightage of final lesson will be 100 marks. Final lesson will be conducted at the end of first academic year i.e. after the completion of 1st phase of internship.
- During the final practical examination each candidate will have to teach one Lesson in any one of the two teaching subjects. However, he shall have to prepare lesson plan in both the teaching subjects and should be prepared to deliver lesson in both the subjects if required.
- The Board of examiners for external examination will consist of:
  - a.The Principle of the college concerned.
  - b.One senior member of the college.
  - c.Two external examiners appointed by the university.

Note: - The selection of the faculty member and two examiners be such that, as far as possible, Board of Examiners represent all the three faculties-Humanities, Languages and Science

	EXTERNAL EVALUATION[III Year]	
Course No.		Marks
SIP 2	Final Lesson OF First Pedgogy Subject (Final Practical Exam)	100
	<b>Total Marks (III Year)</b>	<b>100</b>

## FOURTH YEAR B.Sc. B.Ed.

COURSE	NOMENCLATURE
GC 4	General Studies II
GC5	Environmental Studies
PEC 6	Educational Management & Crating an inclusive School
PEC 7	Gender, School and Society
PEC 8	Assesment For Learning
PEC 9	Understanding the self
PEC 10	Understaning ICT and its Application in Education
PEC 11	Drama & Art
SIP III	School Internship (Phase II, 16 Weeks) Internal Assessment Engagement with the field: Tasks and Assignment for Courses 1 & 9.
SIP IV	Viva-Voce for School Internship subject
SIP V	II Pedagogy Subject

चार वर्षीय बी.एस.सी. बी.एड

चतुर्थ वर्ष सामान्य अध्ययन पाठ्यक्रम

**GC 4 –सामान्य अध्ययन द्वितीय**

- नोट :
1. उक्त पाठ्यक्रम में 4 इकाई होगी एवं प्रत्येक इकाई से 25 प्रश्न होंगे।
  2. प्रश्न पत्र में 100 प्रश्न होंगे, प्रत्येक प्रश्न 1 अंक का होगा, इस प्रकार प्रश्न पत्र 100 अंको का होगा।
  3. प्रश्न पत्र में प्रश्न वस्तुनिष्ठ प्रकार (ट्रमबजपअम जलचम) के होंगे।

इकाई 1	<ol style="list-style-type: none"> <li>1. <u>राजस्थान भूगोल</u>– <ul style="list-style-type: none"> <li>▪ जलवायु</li> <li>▪ प्राकृतिक वनस्पति एवं वन्य जीव</li> <li>▪ कृषि एवं पशुपालन</li> <li>▪ जनगणना</li> </ul> </li> <li>2. <u>भारत की भूगोल</u> <ul style="list-style-type: none"> <li>▪ जलवायु</li> <li>▪ भारत की प्रमुख अपवाह प्रणाली</li> <li>▪ हरित क्रांति ,कृषि एवं कृषि आधारित गतिविधियाँ</li> </ul> </li> </ol>
इकाई 2	<ol style="list-style-type: none"> <li>1. <u>राजस्थान अर्थव्यवस्था</u>– <ul style="list-style-type: none"> <li>▪ राजस्थान की अर्थव्यवस्था का वृहद् परिदृष्य</li> <li>▪ राजस्थान सरकार की जनकल्याणकारी योजनाएं</li> <li>▪ राजस्थान के प्रमुख पर्यटक स्थल</li> </ul> </li> <li>2. <u>भारत अर्थव्यवस्था</u>–</li> </ol>

	<ul style="list-style-type: none"> <li>▪ भू – मडलीकरण एवं उसके प्रभाव</li> <li>▪ ई – कामर्स</li> <li>▪ मानव विकास सूचनांक – गरीबी एवं बेराजगारी अवधारणा प्रकार कारण एवं निदान</li> <li>▪ सामुदायिक विकास की वर्तमान फलेगषिप योजनाए</li> </ul>
इकाई 3	<ol style="list-style-type: none"> <li>1. <u>राजस्थान की सांस्कृतिक परम्परा</u>– <ul style="list-style-type: none"> <li>▪ राजस्थान की स्थापत्य कला – महल, किले, स्मारक</li> <li>▪ राजस्थान की चित्रकला, हस्तकला</li> <li>▪ राजस्थान के मेले एवं त्यौहार</li> <li>▪ लोक देवता, लोक देवियां एवं लोक संत</li> <li>▪ लोकनृत्य एवं लोकसंगीत</li> <li>▪ राजस्थानी साहित्य की महत्वपूर्ण कृतियां और क्षेत्रीय बोलियां</li> </ul> </li> <li>2. <u>राजस्थान में स्थानीय 'गासन व्यवस्था</u> <ul style="list-style-type: none"> <li>▪ पंचायतीराज व्यवस्था</li> <li>▪ नगरीय 'गासन व्यवस्था</li> </ul> </li> </ol>
इकाई 4	<ol style="list-style-type: none"> <li>1. <u>विज्ञान एवं शिक्षा</u> <ul style="list-style-type: none"> <li>▪ दैनिक जीवन में विज्ञान का महत्व</li> <li>▪ उपग्रह एवं अन्तरिक्ष प्रौद्योगिकी</li> <li>▪ सूचना प्रौद्योगिकी</li> <li>▪ हरित प्रभाव</li> <li>▪ ग्लोबल वार्मिंग एवं जलवायु परिवर्तन</li> <li>▪ राजस्थान में स्कूल शिक्षा</li> <li>▪ राजस्थान में उच्च शिक्षा</li> </ul> </li> <li>2. <u>खेल और जीवन</u> <ul style="list-style-type: none"> <li>▪ <u>जीवन दर्शन और खेल : एक परिचय</u></li> <li>▪ <u>खेल मूल्य:व्यक्तित्व का समग्र विकास</u></li> <li>▪ <u>प्रमुख राष्ट्रीय एवं अन्तर्राष्ट्रीय खेल</u></li> <li>▪ <u>राष्ट्रीय एवं अन्तर्राष्ट्रीय खिलाडी</u></li> <li>▪ <u>रा"ट्रीय एवं अन्तर्राष्ट्रीय खेल प्रतियोगिताएँ</u></li> </ul> </li> </ol>

### सन्दर्भित पुस्तके:

राजस्थान भूगोल –LR भल्ला,

राजस्थान इतिहास– गोपीनाथ 'ार्मा,

राजस्थान अर्थव्यवस्था– नाथुरामका,

राजस्थान संस्कृति– जय सिंह नीरज, राजस्थान सुजस और राजस्थान बोर्ड राजस्थान अध्ययन की 9–10 वीं की बुक्स।

भारत का भूगोल– महेश बर्नवाल, माजिद हुसैन (जडभद्ध

भारतीय अर्थव्यवस्था– लाल एंड लाल, रमेश सिंह ( जडभ ),

विज्ञान एवं प्रौद्योगिकी –NCERT 7 से 10

आधुनिक भारत का इतिहास– बिपिन चन्द्रा, ग्रोवर।

भारतीय राजव्यवस्था ड लक्ष्मीकान्त (जडभद्ध

भारतीय संविधान क्व बसु,

संविधान एवं राजनीति – सुभाष कष्यप,।

भूगोल – माजिद हुसैन, महेश बर्नवाल, संविन्द्र सिंह (विष्व भूगोल)

इतिहास-टै 'र्मा, र् बाषम, सतीष चन्द्रा, बिपिन चन्द्रा, ग्रेवर यषपाल,

अर्थव्यवस्था – रमेश सिंह, टाटा मैकग्रा हिल।

संविधान एवं राजव्यवस्था-ठज्ञ 'र्मा, लक्ष्मीकांत, सुभाष कष्यप।

स्पोर्ट्स ए वे ऑफ लाईफ – कनिष्क पाण्डेय, अनामिका प्रकाषन

Sports A way of Life – kanishka pandey, wiley India Pvt. ltd.

## GC- 5 ENVIRONMENTAL STUDIES

Marks :100

**Objective:** To create awareness among students about environment protection.

### Course Outcomes:

Based on this course, the Engineering graduate will understand / evaluate / develop technologies on the basis of ecological principles and environmental regulations which in turn helps in sustainable development.

### CourseContent:

#### Unit I

Definition and Scope of environmental studies, multidisciplinary nature of environmental studies, Concept of sustainability & sustainable development.

**Ecology andEnvironment:** Concept of an Ecosystem-its structure and functions, Energy Flow in an Ecosystem, Food Chain, Food Web, Ecological Pyramid & Ecological succession, Study of following ecosystems: Forest Ecosystem, Grass land Ecosystem & Aquatic Ecosystem & Desert Ecosystem.

#### Unit II

**Natural Resources:** Renewable & Non-Renewable resources; Land resources and land use change; Land degradation, Soil erosion & desertification.

**Deforestation:** Causes & impacts due to mining, Dam building on forest biodiversity & tribal population. **Energy Resources:** Renewable & Non-Renewable resources, Energy scenario & use of alternate energy sources, Case studies.

**Biodiversity:** Hot Spots of Biodiversity in India and World, Conservation, Importance and Factors Responsible for Loss of Biodiversity, Biogeographical Classification of India

#### Unit III

**Environmental Pollutions:** Types, Causes, Effects & control; Air, Water, soil & noise pollution, Nuclear hazards & human health risks, Solid waste Management; Control measures of urban & industrial wastes, pollution case studies

#### Unit IV

**Environmental policies & practices:** Climate change & Global Warming (Greenhouse Effect), Ozone Layer - Its Depletion and Control Measures, Photochemical Smog, Acid Rain Environmental laws: Environment

protection Act; air prevention & control of pollution act, Water Prevention & Control of Pollution Act, Wild Life Protection Act, Forest Conservation Acts, International Acts; Montreal & Kyoto Protocols & Convention on biological diversity, Nature reserves, tribal population & Rights & human wild life conflicts in Indian context

## Unit V

### Human Communities & Environment:

Human population growth; impacts on environment, human health & welfare, Resettlement & rehabilitation of projects affected person: A case study, Disaster Management; Earthquake, Floods & Droughts, Cyclones & Landslides, Environmental Movements; Chipko, Silent Valley, Vish Role of Indian & other regions & culture in environmental conservation, Environmental communication & public awareness; Case studies.

### Field Work:

1. Visit to an area to document environmental assets; river/forest/flora-fauna etc.
2. Visit to a local polluted site: urban/ rural/industrial/agricultural.
3. Study of common plants, insects, birds & basic principles of identification.
4. Study of simple ecosystem; pond, river etc.

### Text Books:

1. "Environmental Chemistry", De, A. K., New Age Publishers Pvt.Ltd.
2. "Introduction to Environmental Engineering and Science", Masters, G. M., Prentice Hall India Pvt.Ltd.
3. "Fundamentals of Ecology", Odum, E. P., W. B. Saunders Co.

### Reference Books:

1. "Biodiversity and Conservation", Bryant, P. J., Hypertext Book
2. "Textbook of Environment Studies", Tewari, Khulbe & Tewari, I.K. Publication

**Professional Educaiton Course**  
**PEC- 6 EDUCATIONAL MANAGEMENT AND CREATING**  
**INCLUSIVE SCHOOL**

**Marks :100**  
**External :80**  
**Internal :20**

Objectives: After completing the course the student Teachers will be able to -

1. Develop understanding about concept and importance of Educational Management
2. Understand the educational Management structure at different levels.
3. Understand the role of Heads and Teachers in School Management.
4. Understand the importance of Management of different resources in school system
5. Develop an institutional plan for a secondary school
6. Understand the characteristics of inclusive school and appreciate diversity
7. Develop skills and practices for creating inclusive school so as to address the special needs of children with different backgrounds.

**COURSE CONTENT**

**UNIT-1**

**Introduction to Educational Management**

1. Concept, need, Functions & recent trends in Education Management
2. Characteristics of Effective Educational Management.
3. Management structure of education in India at different levels –Centre, State and Local.
4. Educational Management in the state of Rajasthan with special reference to School Education.



## UNIT-2

### Management of Resources

1. Leadership role of Principal –Characteristics & skills. Role in building the climate of a school.
2. Material resource Management.
3. Human Resource Management –Recruitment, Orientation and Professional development of Teachers.
4. Financial Management –Budgeting, Monitoring and Auditing.
5. School community Symbioses –Utilization of Community resources for school development, role of PTA and SMC.
6. Managing school supervision- Concept, need, principles, scope and techniques of supervision.

## UNIT-3

### Management of School Activities

1. Time Management –School Calendar, preparation of time table –concept, principles, types
2. Curricular & Co curricular activities- Their importance, Principles, planning and effective organization.
3. Institutional Planning, Concept, Areas and Steps

## UNIT-4

### Inclusive Education:

1. Meaning, Need and Importance of inclusive education
2. Historical overview of education of children with disabilities –from welfare to right
3. Policies related to inclusive education

4. Barriers of Learning and Participation
5. Challenges in Inclusive Education.

## **UNIT-5**

### **Creating inclusive School**

1. Characteristics of inclusive school
2. Understanding student needs.
3. Inclusive Practices –Collaboration, Team work peer strategies and innovative instructional practices.
4. Role of Teacher in inclusive education
5. Role of Principal in managing inclusive schools.
6. Role of Government for promoting inclusive education.

### **PRACTICUM**

**(One from each of the following two sections)**

#### **Section -A**

1. Study of an institutional plan of a school
2. A critical study of a secondary school time-table
3. Study the management of co-curricular activities of a school.
4. Study the leadership role of Headmaster of a Secondary School.

#### **Section -B**

1. Case-study of an inclusive school.
2. Case study of an individual with disability.
3. Study of inclusive practices of a secondary school.

## REFERENCES

1. Agrawal, J.C. (2010) Shiksha Vyavastha Ka Adhar Tatha Prabandhan, Agra, Agrawal Publications.
  2. Allen, L.A. (1995) –Management and Organization, McGraw-Hill Auckland.
  3. Baquer, A & Sharma, A. (1997) Disability: Challenges VS Responses: CAN, New Delhi.
  4. Bhatnagar, Suresh (1996), Shaikshik Prabandh Avam Shiksha Ki Samasyaye, Meerut, Surya Publication.
  5. Dave, Amritlal Avam Anya (2015), Bharat Me Shaikshik Vyavastha Avam Vidyalaya Prabandh, Meerut, R. Lall Book Depot.
  6. Farrell, M. (2004) Special Educational Needs: A Resources for Practitioners, New Delhi, Sage Publications.
  7. Hearty, S. & Alur, M. (eds.) (2002) Education and Children with Special Needs: From Segregation to Inclusion. New Delhi, Sage Publications.
  8. Jaswant Singh (1959), How to be successful the school Headmaster, Jalandhar, University Publishers.
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  10. Kochar, S.K. (1970, Secondary School Administration, New Delhi, Sterling Publishers.
  11. Kochhar, S.K. (1994) –Secondary School Administration, Sterling Publishers, New Delhi.
- Mahajan, Baldev (1996), Educational Administration in Rajasthan, New Delhi, Vikas Publishing House (Private) Limited.

## PEC- 7GENDER, SCHOOL AND SOCIETY

Marks :100  
External :80  
Internal :20

### Objectives

- To develop understanding of some key concepts and terms and relate them with their context in understanding the power relations with respect to Educating and Education
- To develop an understanding of the paradigm shift from Women studies to Gender Studies based on the historical backdrop.
- To reflect on different theories of Gender and Education and relate it to power relations.
- Changing Perspectives with Legal Provisions: Right to Inheritance etc

### Unit I

- Gender, Sex, Sexuality
- Patriarchy, Masculinity and Feminism
- Gender bias, Gender Stereotyping, and Empowerment
- Equity and Equality in Education w.r.t. relation with caste, class, religion, ethnicity, disability and region with respect to Gender: Present status in India and prospects
- Polyandrous, Matrilineal and Matriarchal Societies in India :Relevance and Status of Education

### Unit II

- Paradigm shift from Women's studies to Gender studies
- Historical backdrop: Some landmarks from social reform movements
- Theories on Gender and Education and their application in the Indian context
- Socialisation theory
- Gender difference
- Structural theory
- Deconstructive theory

### Unit III

- Power Control in Patriarchal, Patrilineal, Matriarchal and Matrilineal Societies: Assessing affect on Education of Boys and Girls
- Gender Identities and Socialisation Practices in: Family, other formal and informal organisation.
- Schooling of Girls: Inequalities and Resistances (issues of Access, Retention and Exclusion).
- Collection of folklores reflecting socialisation processes.

### Unit IV

- Changing Perspectives with Legal Provisions: Right to Inheritance etc
- Social Construction of Masculinity and Femininity
- Patriarchies in interaction with other social structures and identities

## Unit V

- Reproducing Gender in School: Curriculum, Text-books, Classroom Processes and Student-Teacher interactions
- Overcoming Gender Stereotypes
- Working towards gender equality in the classroom: Need and Strategies
- Empowerment of Women: Strategies and Issues

### PRACTICUM (any one)

- Prepare an analytical report on portrayal of women in print and electronic media
- Analysis of textual material from the perspective of gender bias and stereotyp
- Field visit to school to observe the schooling processes from a gender perspectives
- Critical analysis of any theme of the course content in about eight to ten pages

### Suggested Readings:

- Ambasht, et al (1971). Developmental Needs of Tribal People, NCERT
- Bhattacharjee, Nandini (1999). Through the looking-glass: Gender Socialisation in a Primary School in T. S. Saraswathi (ed.) Culture, Socialization and Human
- Development: Theory, Research and Applications in India. Sage: New Delhi.
- Frostig, M, and Maslow, P. (1973). Learning Problems in the Classroom: Prevention and Remediation. Grune & Stratton: New York.
- Geetha, V . (2007). Gender. Stree: Calcutta.
- Ghai, A. (2005). Inclusive education: A myth or reality In Rajni Kumar, Anil Sethi &
- Ghai, Anita (2008). Gender and Inclusive education at all levels In Ved Prakash & K. Biswal (ed.) Perspectives on education and development: Revising Education commission and after, National University of Educational Planning and Administration: New Delhi
- Jeffery, P. and Jeffery, R. (1994). Killing My Heart's Desire: Education and Female
- Autonomy in Rural India. in Nita Kumar (ed.) Women as Subjects: South Asian Histories. New Delhi: Stree in association with the Book Review Literacy Trust: Kolkata pp 125-171.

**Objectives:**

- Understand the nature of assessment and evaluation and their role in teaching- learning process.
- Understand the importance of assessment in continuous and comprehensive manner
- Plan assessment tasks, techniques, strategies and tools to assess learner's competence and performance in curricular and co-curricular areas,
- Devise marking, scoring and grading procedures,
- Analyse, manage and interpret assessment data.
- Devise ways of reporting on student performance
- Develop the skills of reflecting-on and self-critiquing to improve performance.

**Unit I**

**Introduction to Assessment & Evaluation:**

- (a) Concept of test, measurement, Assessment, examination, appraisal and evaluation in education and their inter relationships.
- (b) Purpose and objectives of assessment/ Evaluation- for placement, providing feedbacks, grading promotion, certification, diagnostic of learning difficulties.
- (c) Importance of assessment & evaluation for Quality Education –as a tool in Pedagogic decision making (writing instructional objectives, selection of content, teaching learning resources, methodology, strategies & assessment procedures followed).
- (d) Forms of assessment: -
  - (i) (Formative, Summative, diagnostic; prognostic, placement; Norm referenced; Criterion referenced based on purpose)
  - (ii) (Teacher made tests Standardized tests: based on nature & scope)
  - (iii) (Oral, written, performance: based on mode of response)
  - (iv) (Internal, External, self, peer, & teacher, group Vs individual- based on context)
  - (v) Based on nature of information gathered (Quantitative, Qualitative)
  - (vi) CCE, school based assessment; Standard Based- based on Approach
- (e) Recent trends in assessment and evaluations:
  - Assessment for learning, assessment of learning and assessment as learning; Relationship with formative and summative, Authentic assessment.
  - Achievement surveys- State, National and International; Online assessment; On demand assessment/ evaluation.
  - Focus on Assessment and Evaluation in Various Educational commissions and NCFs

## Unit II

### Developing Assessment Tools, Techniques and Strategies

- (b) Concept of Cognitive, Affective, Psychomotor domain of learning
- (c) Relationship between educational objectives, learning experiences and evaluation.
- (d) Revised taxonomy of objectives (2001) and its implications for assessment and stating the objectives-
  - Knowledge dimensions: - factual, conceptual, procedural and meta-cognition.
  - Cognitive, Affective, Psychomotor domains – Classification of objectives
- (e) Stating objectives as learning outcomes: General, Specific.
- (f) Construction of achievement tests- steps, procedure and uses (Teacher made test/Unit Tests)
  - Constructing table of specifications & writing different forms of questions –(VSA, SA, ET & objective type, situation based) with their merits and demerits; assembling the test, preparing instructions, scoring key and marking scheme; and question wise analysis
- (g) Construction of diagnostic test –Steps, uses & limitation; Remedial measures- need types and strategies
- (h) Quality assurance in tools – Reliability: Meaning & Different methods of estimating reliability (Test-retest; equivalent forms, split- half); Validity: Meaning & Different methods of estimating reliability (Face, content, construct), Objectivity and Practicability/ Usability
- (i) Inter dependence of validity, reliability and objectivity

## Unit III

### Continuous and Comprehensive Evaluation

- (a) Concept of CCE, need for CCE its importance; relationship with formative assessment and problems reported by teachers and students
- (b) Meaning & construction of process-oriented tools- Interview; Inventory; observation schedule; check-list; rating scale; anecdotal record;
- (c) Assessment of group Processes-Nature of group dynamics; Socio-metric techniques; steps for formation of groups, criteria for assessing tasks; Criteria's for assessment of social skills in collaborative or cooperative learning situations.
- (d) Promoting Self-assessment and Peer assessment –concepts and criteria's
- (e) Portfolio assessment – meaning, scope & uses; developing & assessing portfolio; development of Rubrics

## Unit IV

### Trends in Assessment

- (a) Grading –Meaning, types, and its uses
- (b) Marking System Vs Grading System
- (c) Semester System (CBCS) Choice Based Credit System

## Unit V

### Analysis, Interpretation, Reporting and Communicating of student's Performance

- a) Interpreting student's performance
  - (i) Descriptive statistics (measures of central tendency & measures of variability, percentages, rank correlation)
  - (ii) Graphical representation (Histogram, Frequency Curves)
- (b) Norms –Meaning, types, and its uses
- (c) Reporting student's performance –Progress reports, cumulative records, profiles and their uses, Portfolios, Using descriptive Indicators in report cards
- (d) Role of feedback to stake holders (Students, Parents, Teachers) and to improve teaching – learning process; Identifying the strengths & weakness of learners.

### Sessional Work:

1. Discussion on existing assessment practices in schools and submitting the report.
2. Constructing a table of specification on a specific topic (subject specific)
3. Constructing a unit test using table of specifications and administering it to target group and interpreting the result.
4. Construction of any one of the process oriented tools and administering it to group of students & interpreting it.
5. Analysis of question papers: teacher made and various Boards
6. Analysis of report cards - State and Central (CBSE)
7. Analysis of various education commission reports and NCFs for knowing various recommendations on Assessment and Evaluation

### References:

1. Ebel, R.L. and Fresbie, D.A. (2009). *Essentials of Educational Measurement*, New Delhi.: PHI Learning PVT. LTD.
2. Garrett, H.E. (2008). *Statistics in Psychology and Education*, Delhi.: Surjeet Publication.
3. Gupta, S.K. (1994). *Applied Statistics for Education*, Mittal Publications.
4. Mehta, S.J. & Shah, I.K. (1982). *Educational Evaluation. Ahmedabad*, Anand Prakashan (Gujarati).
5. NCERT (2015) *Learning Indicator*, New Delhi.
6. NCERT (2015) *CCE Packages*, New Delhi.
7. Rani, P. (2004). *Educational Measurement and Evaluation*, New Delhi.: Discovery Publishers.



8. Rawat, D.S. (1970). *Measurement, Evaluation and Statistics in Education*, New Delhi.: New Raj Book Depot.
9. Reynolds, C.R., Livingston, R.B., and Willson, V. (2011). *Measurement and Assessment in Education*, New Delhi.: PHI Learning PVT. LTD.
10. Ten Brink, T.D. (1974). *Evaluation—A Practical Guide for Teachers*, New York: McGraw Hill Book Co.
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14. Ved Prakash, et.al. (2000). *Grading in Schools*, NCERT, Published at the publication Division by the secretary, NCERT, Sri Aurobindo Marg, New Delhi.
15. Tierney, R. J., Carter, M. A., & Desai, L. E. (1991). *Portfolio Assessment in the Reading-Writing Classroom*, Norwood, MA: Christopher-Gordon Publishers
16. Glatthorn, A. A. (1998). *Performance Assessment and Standards-based Curricula: The Achievement Cycle*, Larchmont, NY: Eye no Education
17. Gredler, M. E. (1999). *Classroom Assessment and Learning*, USA: Longman.
18. Likert, R. (1932). *A Technique for the Measurement of Attitudes*, Archives Psychology, 40.
19. Mehrens, W. A. & Lehmann, I. J. (1991). *Measurement and Evaluation in Education and Psychology*, (8th ed.) Chapter 10: Describing Educational Data.
20. Oosterhof, A. (1994). *Classroom Applications of Educational Measurement (Second Edition)*, New York: Macmillan College Publishing Company Inc.
21. Popham, W. J. (2002). *Classroom Assessment: What teachers need to know (Third Edition)*, Boston: Allyn & Bacon.

## SPEC- 9 UNDERSTANDING THE SELF

Marks :100  
External :50  
Internal :50

**Objectives:** After completion of the course, the pupil teachers will be able to:

- Understand the development of self as a person and as a teacher.
- Develop sensibilities, dispositions and skills to facilitate personal growth of their students in the classroom.
- Know the development of self concept and the professional identity.
- Develop social relational sensitivity.
- Build resilience within to deal with conflicts.
- Analyze self identity (one's implicit beliefs, culture, assets and limitations of oneself).
- Become aware of the impact of political, historical, and social forces on their identity formation.
- Learn and practice effective communication skills.
- Understand the philosophy of yoga.
- Practice Yoga to enhance abilities of body and mind.

### COURSE CONTENT

#### UNIT 1

##### Exploration Into Self

- Meaning and Nature of Self and Self Concept. Role of Home, Neighborhood, Community, Peer Group, School in their development. Importance of Building social Relations.

(a) Pupil teachers are required to explore their own self, self concept and self esteem by Administering tests of self efficacy, Self concept, self esteem and self identity under the Supervision of facilitators and prepare their personality profile.

(b) Pupil Teachers will be required to administer above tests to five school students and prepare student profile. On the basis of this profile they are required to prepare a teaching

strategy to Enrich self concept, classroom learning and enhance achievement of students

Note: Records of the above to be submitted for evaluation

- Self Esteem and Self Identity: Meaning and Nature; Development process: parenting practices, role of caste class, gender, age, religion, school, role models in the development of self esteem and self identity. Development of Teachers Personality: role of social, cultural, Political, academic, Psychological and organisational factors.

Pupil teachers are required to:

- Write down biographies of the best teachers they have come across
- Interview Successful teachers, professionals, businessmen and prepare a report of their interview.
- Collect success stories of high achievers in the field of academics/ sports / athletes/ actors and analyse them to identify their unique personality factors contributing to their success.
- Identify their own best contribution as a teacher, identify challenging situations they have come across during class room teaching.

Note : Reports of the above will be presented and discussed in the group situation and to be submitted for evaluation.

3. Motivation: Meaning and importance of achievement motivation for achieving excellence. Importance of Goal Determination and Goal Achievement. Achieving self actualisation in teaching Profession.

(Mode: Workshop in Small Groups)

Identify influences of motives in his/her achievement in schools, college/jobs/personal relations. Pupil teachers will reflect on their own contribution to enrichment of their family, society and peer group.

## UNIT –II

### **Communication**

Meaning, nature, types; factors influencing communication: psychological, social, organisational. Mass Communication: its impact on personality development and classroom learning. Effective listening and its role in the classroom, Characteristics of effective communication (body language, listening behaviour, responding strategies), Mastering Effective Communication.

Workshop of Pupil Teachers to restructure personality through:

- (a) Analysis of one's strengths and weaknesses, professional commitment.
- (b) Developing effective listening and observation skills. Student teachers are required to develop in the workshop their personal strategies to enrich inner self as a teacher and stipulate its impact on their students.

### UNIT –III

#### Philosophy and use of Yoga

Philosophy of Yoga and its role in well being, use of yoga in different contexts; importance of Meditation; contribution to development of self.

- (a) Practice of Yoga Exercises and Meditation

#### SESSIONAL WORK

1. Reports of the practicums of the above units.

NOTE: In this paper there will be no external examination. Internally college will conduct a written examination carrying a weightage of 10 marks and a practical examination carrying a weightage of 20 marks, Viva Voce carrying a weightage of 10 marks and 10 marks will be awarded for sessional work.

#### College will conduct Internally

Total Marks : 50	Internal Assessment : 50
Written Examination	10 Marks
Practical Examination	20 Marks
Viva –Voce	10 Marks
Practicum / Sessional work	10 Marks

#### REFERENCES

1. Besant, A.(2005) An Introduction to Yoga. Cosmo. New Delhi.
2. Bhatnagar, Nitin (2012) Effective Communication and soft Skills. Pearson Education India

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5. Eriikson, E.H. (1963) Childhood and Society.(Second Edit.)Norton. New York
6. Gilmer,B.Von Haller (1970)Psychology. Harper and Row Publishers, New York, Chapter 9
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8. Kamla Ganesh & Usha Thakkar(edit.) (2005).Culture and Making of Identity in India. Sage Publications, New Delhi
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17. Woolfolk,A.(2007)Educational Psychology (10ThEd).Allyn & Bacon ,Boston
- Yadav, Y.P & yadav, R.(2003). Art of Yoga. New Delhi: Friends

## **PEC- 10 UNDERSTANDING OF ICT AND ITS APPLICATION IN EDUCATION**

**Marks :100  
External :50  
Internal :50**

### **Objectives**

**On completion of the course the students will be able to:**

- **Appreciate the historical, current and future trends in ICT and its implications to education**
- **Explain the meaning of ICT and its application in Education**
- **Demonstrate an understanding of the computer hardware and software fundamentals**
- **Use various digital hardware and software for creating resources and providing learning experiences**
- **Use a word processor, spread sheet, drawing and presentation software skillfully and intelligently to produce various teaching learning resources for educational use**
- **Use internet technologies efficiently to access remote information, communicate and collaborate with others**
- **Model collaborative knowledge construction using various web 2.0 tools and technologies**
- **Design and develop technology integrated learning experiences using ICT tools**
- **Develop skills in using various e-learning and e-content tools and technologies**
- **Plan, develop, and use multimedia based learning content using open source authoring software**
- **Use ICT for designing learning experiences using innovative pedagogical approaches**
- **Explain the role of ICT in authentic and alternative assessment**
- **Understand the social, economic, security and ethical issues associated with the use of ICT**
- **Appreciate the scope of ICT for improving the personal productivity and professional competencies**
- **Appreciate the use ICT in improving educational administration**
- **Explain the emerging trends in information and communication technology**

## **COURSE CONTENT**

### **Unit I**

#### **ICT and Education**

**Information and Communication Technology: meaning and nature. Learning theories and its implications for ICT integration in education. National ICT policy, curriculum and schemes Historical account of the development of various educational media (audio, print, video, storage, display, projection)**

**Role of technology in emerging pedagogical practices. Visual literacy, media literacy, and new media literacy**

**Computer hardware fundamentals, computer network-LAN, WAN and Internet. Software – meaning and types: proprietary software and open source software, System software and application software**

**Emerging Trends in ICT and its educational applications: Augmented reality, e-books and rhizomatic learning, learning analytics, ubiquitous computing and mobile learning, Game based learning, cloud computing and software as service, 3D printing, and marker space**

### **Unit II**

#### **E-content and e-resources**

**Educational applications of word processing, spreadsheet, presentation, and drawing tools – diagrams, concept maps, timelines, flow charts.**

**Reusable Learning Objects (RLO), e-content standards, authoring tools- open source and proprietary alternatives**

**Multimedia: meaning and types, multimedia tools-audio editing, video editing, screen casting, graphic editing, basics of animation, and creating interactive media. Evaluation of multimedia resources.**

**Open Educational Resources –Meaning and importance, various OER initiatives, creative common licensing**

**Locating internet resources –browsing, navigating, searching, selecting, evaluating, saving and bookmarking**

**Use of digital still and video camera, digital sound recorder, scanner, printer, interactive white board, visualizer, and multimedia projector for creating and using multimedia resources**

## Unit III

### ICT and Pedagogy

**Techno pedagogical content knowledge (TPCK). Approaches to integrating ICT in teaching and learning**

**Web 2.0 tools for creating, sharing, collaborating, and networking: Social networking, social book marking, blog, wiki, instant messaging, online forums/discussion groups and chats, and media streaming.**

**E-learning: concept, types, characteristics, e-learning tools and technologies, Learning Management Systems (LMS)**

**Subject specific ICT tools for creating and facilitating learning. Designing technology integrated authentic learning designs and experiences**

**ICI integrated Unit plan –Web 2.0 for creating constructivist learning environment  
Technology for pedagogical innovations: web quest, PBL, virtual tours, MOOC, flipped classroom**

**Assistive technology for special needs and inclusion: tools and processes, ICT and Universal design for Learning (UDL)**

## Unit IV

### ICT for Assessment, Management, and professional development

**ICT and Assessment: e-portfolio, electronic rubrics, online and offline assessment tools – rubrics, survey tools, puzzle makers, test generators, reflective journal, and question bank. Use of web 2.0 tools for assessment,**

**ICT for professional development - tools and opportunities: electronic teaching portfolio, web 2.0 technologies, technology and design based research, ICT for self-directed professional development, web conferencing, role of OER and MOOCs**

**ICT for personal management: email, task, events, diary, networking. ICT for educational administration: scheduling, record keeping, student information, electronic grade book, connecting with parents and community, school management systems.**

**Managing the ICT infrastructure: software installation, troubleshooting of hardware, seeking and providing help, storage and backup, updating and upgrading software**

**Computer security: privacy, hacking, virus, spy ware, misuse, abuse, antivirus, firewall, and safe practices, fare use and piracy**



## **Sessional Work**

- 1. Hands on experience in setting up a desktop PC and working with various input devices, output devices, storage devices, and display devices**
- 2. Using word processor, spread sheet, drawing and presentation software to produce various teaching learning resources and sharing it online**
- 3. Locating internet resources –navigating, searching, selecting, saving, evaluating(use standard internet evaluation criteria), and bookmarking using social bookmarking**
- 4. Creating digital concept maps, flow charts, timelines, and other graphics for a particular content**
- 5. Creating screen cast video and podcast of a lesson**
- 6. Shooting, editing, and sharing of videos segment on any educational topic**
- 7. Creating account in YouTube/slide share and sharing the video/presentation. View and comment on others contributions**
- 8. Creating account in wikispace/wikipedia/mediawiki and adding/editing content**
- 9. Developing an educational blog in [www.blogger.com](http://www.blogger.com), [www.wordpress.com](http://www.wordpress.com), or [www.edublog.com](http://www.edublog.com)**
- 10. LMS experience- hands on various features of LMS –the ICT course may be provided through LMS**

## PEC 11- DRAMA AND ART EDUCATION

Marks :50  
Internal :50

### Objectives :

The student teacher will be able to:

- Understand the efficacy of different art forms in education
- Understand the use of 'Drama' as a strategy
- Use 'Role play' technique in the teaching learning process.
- Understand the importance of dramatic way of presentation.
- Integrate singing method in teaching learning process.
- Understand various 'Dance forms' and their integration in educational practices.
- Use art of drawing and painting in teaching learning process.
- Develop creativity through different creative art forms.

### COURSE CONTENT

#### Unit I

##### Drama and its Fundamentals

**Creative writing –Drama writing, Drama as a tool of learning, Different Forms of Drama Role play and Simulation, Use of Drama for Educational and social change (Street play, Dramatization of a lesson), Use of Drama Techniques in the Classroom: voice and speech, mime and movements, improvisation, skills of observation, imitation and presentation**

#### Unit II

##### Folklore Music (Vocal & Instrumental)

***Sur, Taal and Laya (Sargam), Vocal - Folk songs, Poems, Prayers, Singing along with "Karaoke", Composition of Songs, Poems, Prayers, Integration of Vocal & Instrumental in Educational practices***

### Unit III

#### The Art of Dance

Various Dance Forms - Bharat Natyam, Kathakali, Kuchipudi, Yakshagana- Folk dance and various other dances; integrate movement and rhythm

Integration of Dance in educational practices (Action songs, *Nritya Natika* )

### Unit IV

#### Drawing and Painting

Colours, Strokes and Sketching- understanding of various means and perspectives, Different forms of painting- Worli art, Madhubani art, Glass painting, Fabric painting and various forms of painting, Use of Drawing and Painting in Education -Chart making, Poster making, match-stick drawing and other forms, Model making –Clay modeling, Origami, Puppet making, Decorative –Rangoli, Ekebana, Wall painting (Mural), Kalameshuthu or any other local art

#### Transactional Strategies

Lecture cum Discussion for each Unit (Unit 1 to 4) followed by simulated/ authentic practices, Workshop schedule, Slide / Film show, Project work, Demonstration, Simulation, Group work and field trips involving meetings with folk singers and other skilled practitioners will especially form part of the transaction scheme. In addition to the above any one or more of the following:

#### Practicum

#### Suggestive List:

- a) Developing a script of any lesson in any subject of your choice to perform a Play / Drama.
- b) Developing a script for the street play focusing on “Girl’s education and Women empowerment”.
- c) Preparing a pictorial monograph on “Various folk dance of South India.
- d) Preparing a pictorial monograph on “Various Classical Dance forms in India”.
- e) Preparing a calendar chart on “Various Musical Instruments in India”.
- f) Develop an Audio CD based on newly composed Poems of any Indian language.
- g) Preparing some useful, productive and decorative models out of the waste materials.
- h) Visit the Faculty of Performing Arts in your city and prepare a detailed report on its multifarious functioning.
- i) Development a Review of a theatre programme if possible

- j) Organize a competition on some Decorative / Performing Art forms in the school during your School Internship programme and prepare a report on it.**
- k) Organizing a workshop on some selected Creative Art forms in the school during your School Internship programme and prepare a report on it.**

**In addition, school and community based activities may be organized with provisions for visits to innovative centres of pedagogy and learning, innovative schools, educational resource centres, etc. Action research based on teaching learning and school and community could be conducted.**

### **Evaluation Strategies**

**Sessional, practicum, unit test project work related presentations.**

### **Suggested Readings**

- 1. Natyashastra by Bharathamuni**
- 2. Deva, B.C. (1981). An Introduction to Indian Music. Publication Division, Ministry of Information and Broadcasting, Government of India.**
- 3. NCERT (2006). Position Paper by National Focus Group on Arts, Music, Dance and Theatre**
- 4. Theory of Drama by A. Nicoll**
- 5. Folklore and School Education. Regional Institute of English Publication, 2007.**

## SIP : III SCHOOL INTERNSHIP (Phase : II)

Marks :150

### COURSES OBJECTIVES

School Internship/ Field Attachment aims at engaging the students-teachers with field based situation and work in upper primary, secondary or senior secondary government/recognized private school and to provide an opportunity for reflection and writing on the same. This is to provide first-hand experience of the different kinds of works related to school education. This is also to facilitate a bridge between what students learn in classroom and observe in the field.

### COURSE CONTENTS/ ACTIVITY

Internship work shall be carried out in an upper primary, secondary or senior secondary government/recognized private school for a minimum duration of **16** weeks.

For each student-teacher, internship should be conducted preferably in one school for the entire **16** weeks.

The Principal/Head of the Institution shall assign a Supervisor to each student for Internship work. Internship should not be reduced to the ‘\_delivery’ of a certain number of lesson plans, but should aim for meaningful and holistic engagement with learners and the school. During the Internship a student-teacher shall work as a regular teacher and participate in all the school activities, including Practice Teaching, and participation in all the school activities, including planning, teaching and assessment, interacting with school teachers, community members and children under the direct guidance of his/her supervisor and shall submit a report manifesting his/her experiences concerning all the dimensions as well as his/her understanding of the school in totality, its philosophy and aims, organization and management; the life of a teacher; needs of the physical, mental, emotional development of children; aspects of curriculum and its transaction; quality, transaction, and assessment of teaching-learning, in two typed copies, within the time specified by the College/Department, which shall in no case be later than the first date announced for start of the Second Year Examination, along with a certificate duly signed by the supervisor that the work has been carried out under his/ her personal supervision and that it is not a copy of an earlier work of the same nature. The Internship Report should be typed in Times New Roman/Walkman Chanakya font with letter size **12** and line spacing **1.5**. The word limit for the Internship Report shall ideally be between 12,000 (nearly 60 pages) to 14,000 words (nearly 70 pages).

□ The candidate shall also submit separately the —Records of the Lessons taught at school (At least **60** Lesson Plans in the Pedagogical subject)||, —Record of Preparing Teaching-Learning Materials|| (**20** for school subject), and the ‘\_Records of the Observation of Peer Interns’ Lesson (at least **20** lessons of Peer Interns’ are to be observed).

Student-teachers are to be actively engaged in teaching at two levels, namely, upper primary and secondary. They should be provided opportunities to teach in schools with systematic supervisory support and feedback from faculty.

During Internship student-teacher has to organize different activities in the school such as co-curricular activities and do case studies on infrastructural facilities available or on any other issue of importance.

<b>ACTIVITIES OF INTERNSHIP &amp; THEIR WEIGHTAGE IN ASSESSMENT SL. NO.</b>	<b>ACTIVITIES/DIMENSIONS</b>	<b>MARKS</b>
<b>1</b>	Internship Report	<b>10</b>
<b>2</b>	Records of the Lessons taught at school (At least <b>60</b> Lesson Plans in the Pedagogical subject)	<b>70</b>
<b>3</b>	Records of the Observation of Peer Interns' Lesson (at least <b>20</b> lessons of Peer Interns' are to be observed)	<b>10</b>
<b>4</b>	Record of Preparing Teaching-Learning Materials ( <b>20</b> for school subject)	<b>05</b>
<b>5</b>	Development of Achievement Test in the subject concerned, its application on the relevant class and preparation of result	<b>05</b>
<b>6</b>	Preparation of School Time Table	<b>05</b>
<b>7</b>	Preparation of Cumulative Records of 5 students	<b>05</b>
<b>8</b>	Case study: Meeting with parents of at least 2 students for total growth & development of their wards and preparation of report	<b>05</b>
<b>9</b>	Organization of 5 co-curricular activities and preparation of report	<b>10</b>
<b>10</b>	Maintenance of School records (related to Office)	<b>10</b>
<b>11</b>	Maintenance School Laboratories /Maintenance School Library	<b>5</b>
<b>12</b>	Organization of Sports/Games & preparing Reports	<b>5</b>
<b>13</b>	Regularity and Behaviour	<b>5</b>
<b>TOTAL</b>	<b>150</b>	

# SIP IV -External Assessment

[IV YEAR]

**Marks :100**

The weightage of external evaluation (Viva-voce for 2<sup>nd</sup> phase) of internship will be 100 marks.

During the Viva voce, student will present all the records of the work done during the internshi (2<sup>nd</sup> phase) programme viz. teaching in school, individual and group activities.

Power point presentation (Including Videos of various activities) of the work done by the students during the second phase of internship is desirable at the time of viva-voce.

## External Evaluation

**Total Marks - 100**

Viva-Voce for Internship Programme	
Written test based on internship	20
Presentaion of work (Power point presentation and documentation of internship)	40
Practical examination of internship work	20
Group Discussion	10
Viva-Voce	10

### The Board of examiners for Viva-voce will consist of:

- The Principal of the college concerned.
- One senior member of the college. (Preferably Internship Incharge)
- ONE external members appointed by the university.

# SIP V -External Assessment

[IV YEAR]

Marks :100

SIP VI	Final Lesson OF Second Pedgogy Subject (Final Practical Exam)	100
	TOTAL	100

**The Board of examiners for Viva-voce will consist of:**

The Principal of the college concerned.

One senior member of the college.

TWO external members appointed by the university.