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**OPJS UNIVERSITY, CHURU**

# **SYLLABUS**

**SCHEME OF EXAMINATION AND  
COURSE OF STUDY**

**NEP - 2020**

**B.Sc. B.Ed**

**FACULTY OF EDUCATION**

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

**Session 2020-2024**

The OPJS. University, Churu hereby institutes the following ordinances under the scheme governing admission, course of study, examination and other matters relating to the degree of B.Sc.B.Ed programme under the Faculty of Education.

**I. Eligibility**

1. The course of study shall extend over a period of four years as an integrated course in Science, Education, Work Experience, General Hindi/General English and Environmental Education and Sustainable Development leading to the composite degree of B.Sc. B.Ed.
2. Candidates who have passed Senior Secondary 10 +2 examination or any other examination recognized as equivalent thereto by the OPJS University, Churu with at least 50% marks in the aggregate are eligible for admission to the course.
3. The reservation and relaxation in marks for SC/ST/OBC/PWD and other category shall be as per the rules of the Central Government/State Government whichever is applicable.
4. The Institute will regulate admission through selection on the basis of marks in the qualifying examination and/or in the entrance examination or any other selection process as per the policy of the state or and the University and in accordance with the state quota as decided.
5. Candidate will be eligible for admission to Physical Science (PCM) Group if she/he has qualified qualifying examination with Physics, Chemistry and Mathematics or Statistics and for admission to Biological Science (CBZ) Group if she/he has qualified qualifying examination with Physics, Chemistry and Biology or Biotechnology.

**II. Scheme of Instructions and Examinations  
PROGRAMME STRUCTURE, & SCHEME OF EXAMINATION**

**B.Sc. B.Ed. Part I Examination (New Scheme)**

<b>Course/ Paper</b>	<b>Periods Per Week</b>	<b>Periods Per Year</b>	<b>Paper with External / Internal</b>	<b>Exam. Duration (hrs.)</b>	<b>Max. Mark</b>	<b>Min. for Pass</b>
<b>Group A: General Courses (GC)*</b>						
GC 1: Gen Hindi/ Gen English	4	124	External	3	100	36
GC 2: Environmental Education & Sustainable Development	2	62	External	2	50	18
<b>Group B: Core Courses (CC)</b>						
CC 1 : Physics	3	93	CC-1 (I) External Internal	3	40 10	36
	3	93	CC-1 (II) External Internal	3	40 10	
	4	124	Practical	5	50	18
CC 2: Chemistry	3	93	CC-2 (I) External Internal	3	40 10	36
	3	93	CC-2 (II) External Internal	3	40 10	
	4	124	Practical	5	50	18
CC 3: Zoology	3	93	CC-3 (I) External Internal	3	40 10	36
	3	93	CC-3 (II) External Internal	3	40 10	
	4	124	Practical	4	50	18
CC 4: Botany	3	93	CC-4 (I) External Internal	3	40 10	36
	3	93	CC-4 (II) External Internal	3	40 10	
	4	124	Practical	4	50	18
CC 5 : Mathematics	4	124	CC-5 (I) External Internal	3	60 15	54
	4	124	CC-5 (II) External Internal	3	60 15	
CC 6 Childhood and growing up	4	124	External Internal	3	60 15	27
<b>Group C : Developing Teacher Sensibilities</b>						
<b>Section I : Experiences for Teacher Enrichment</b>						
ETE 1 : Enriching Learning through Information and Communication Technology	2	62	Internal		50	18

ETE 2 : Yoga Health and Well being	2	62	Internal	-	50	18
Section II : Experiences for Social and Environmental Sensitivity (SES)						
SES 1 : Work Experience (Electricity and Electronics /Agriculture)	3	93	Internal	-	50	18
SES 2: Arts and Aesthetics	One Week Workshop		Internal		Grade	

**ETE and SES Internals are to be evaluated by a team of two members constituted by the Pincipal.**

**Distribution of Marks:**

**Total periods per week:**

General Courses	:	150*	PCM	45
Core (Science) Courses	:	450		
Education	:	225	CBZ	47
<b>Total Marks</b>		<b>825</b>		

Course/ Paper	Periods Per Week	Periods Per Year	Paper with External/Internal	Exam. Duration (hrs.)	Max. Mark	Min. for Pass
Group B: Core Courses (CC)						
CC 1 : Physics	3	90	CC-1 (I) External Internal	3	40 10	54
	3	90	CC-1 (II) External Internal	3	40 10	
	3	90	CC-1 (III) External Internal	3	40 10	
	4	120	Practical	5	50	18
CC 2: Chemistry	3	90	CC-2 (I) External Internal	3	40 10	54
	3	90	CC-2 (II) External Internal	3	40 10	
	3	90	CC-2 (III) External Internal	3	40 10	
	4	120	Practical	5	50	18
CC 3: Zoology	3	90	CC-3 (I) External Internal	3	40 10	54
	3	90	CC-3 (II) External Internal	3	40 10	
	3	90	CC-3 (III) External Internal	3	40 10	
	4	120	Practical	4	50	18
CC 4: Botany	3	90	CC-4 (I) External Internal	3	40 10	54
	3	90	CC-4 (II) External Internal	3	40 10	
	3	90	CC-4 (III) External Internal	3	40 10	
	4	120	Practical	4	50	18

**\* Marks will not be added to the aggregate for award of division B.Sc**

CC 5 : Mathematics	4	120		CC-5 (I) External Internal	3	60 13	72
	4	120		CC-5 (II) External Internal	3	50 13	
	4	120		CC-5 (III) External Internal	3	50 14	
CC 6:contemporary india and education	4	120		External Internal	3	60 15	27
<b>Group C : Developing Teacher Sensibilities</b>							
<b>Section II : Experiences for Social and Environmental Sensitivity (SES)</b>							
SES 1 : Work Experience (Electricity and Electronics / Agriculture)	3	90		Internal	-	50	18
SES3: Addressingspecial needs in Inclusive School	2	60		External Internal	2 -	40 10	18
SES4: Working with the Community	10 Days			Internal			Grade

**SES Internals are to be evaluated by a team of two members constituted by the Principal.**

<b>Distribution of Marks:</b>		<b>Total periods per week</b>	
Core (Science) Courses	: 600	PCM	47
Education	: 175	CBZ	48
<b>Total Marks</b>	<b>775</b>		

**B.Sc. B.Ed. Part III Examination (New Scheme)**

Course/ Paper	Periods Per Week	Periods Per Year		Paper with External/Internal	Exam. Duration (hrs.)	Max . Mark	Min . for Pass
<b>Group B: Core Courses (CC)</b>							
CC 1 : Physics	3	84		CC-1 (I) External Internal	3	40 10	36
	3	84		CC-1 (II) External Internal	3	40 10	
	4	112		Practical	5	50	18
CC 2: Chemistry	3	84		CC-2 (I) External Internal	3	40 10	36
	3	84		CC-2 (II) External Internal	3	40 10	
	4	112		Practical	5	50	18
CC 3: Zoology	3	84		CC-3 (I) External Internal	3	40 10	36
	3	84		CC-3 (II) External Internal	3	40 10	
	4	112		Practical	4	50	18

CC 4: Botany	3	84		CC-4 (I) External Internal	3	40 10	36
	3	84		CC-4 (II) External Internal	3	40 10	
	4	112		Practical	4	50	18
CC 5 : Mathematics	4	112		CC-5 (I) External Internal	3	60 15	54
	4	112		CC-5 (II) External Internal	3	60 15	
CC 6 Gender school and society	4	112		External Internal	3	60 15	27
Group C : Developing Teacher Sensibilities							
Section I : Experiences for Teacher Enrichment							
ETE 3 : Strengthening Professional Development	2	56		Internal		50	18
Group D: Pedagogical Courses							
PC 1: Pedagogy of Science (For PCM Group.) Pedagogy of Physical Science (For CBZ Group)	4	112		External Internal	3	60 15	27
PC 2: Pedagogy of Mathematics (For PCM Group) Pedagogy of Biological Sc. (For CBZ Gr.)	4	112		External Internal	3	60 15	27
PC 3: Learning to function as a Teacher	Four Weeks			Internal		50	18

**ETE Internals are to be evaluated by a team of two members constituted by the Principal.**

**Distribution of Marks:**

Core (Science) Courses	:	450
Education	:	325
<b>Total Marks</b>		<b>775</b>

**Total periods per week:**

PCM	42
CBZ	44

**B.Sc. B.Ed. Part IV Examination**

Course/ Paper	Periods Per Week	Periods Per Year	Paper with External/Internal	Exam. Duration (hrs.)	Max. Mark	Min. for Pass
Group B: Core Courses (CC)						
CC 1 : Physics	5	80	CC-1 (I) External Internal	3	80 20	36
	6	96	Practical	5	50	18
CC 2: Chemistry	5	80	CC-2 (I) External Internal	3	80 20	36
	6	96	Practical	5	50	18

CC 3: Zoology	5	80	CC-3 (I) External Internal	3	80 20	36
	6	96	Practical	5	50	18
CC 4: Botany	5	80	CC- 4 (I) External Internal	3	80 20	36
	6	96	Practical	5	50	18
CC 5 : Mathematics	5	80	CC-5 (I) External Internal	3	60 15	54
	5	80	CC-5 (II) External Internal	3	60 15	
CC 6: Assessment for Learning	5	80	External Internal	3	60 15	27
CC 7: Knowledge and curriculum	5	80	External Internal	3	60 15	27
Group D: Pedagogical Courses						
PC I: Learning to function as a Teacher	Sixteen Weeks		Internal External Internal	80 120* 100**	300	150

\* External examiners will be appointed by the University for award of external marks.

**\*\*For details of marks refer to syllabus.**

**Distribution of Marks:**

Core (Science) Courses : 450

Education : 450

**Total Marks 900**

**Total periods per week:**

PCM 42

CBZ 43

**Year wise marks of the four year B.Sc. B.Ed. course**

<u>Class</u>	<u>Marks</u>
I Year	825
II Year	775
III Year	775
IV year	900
<b>Total</b>	<b>3275</b>

Instructional time for all the four years of B.Sc. B.Ed is 32 weeks per Year. Instructional time of Part I of B.Sc.B.Ed includes one week workshop on Arts and

Aesthetics. So regular classroom instruction would be executed for 31 weeks. Instructional time of Part II of B.Sc.B.Ed includes two weeks for Working with Community. So regular classroom instruction would be executed for 30 weeks. Instructional time of Part III of B.Sc.B.Ed includes four weeks for Learning to Function as a Teacher (Pre-Internship). So, regular classroom instruction would be executed for 28 weeks. In B.Sc.B.Ed Part IV, Learning to Function as a Teacher (School Internship) of 16 weeks is included, so regular class room instruction would be for 16 weeks.

Note: For Pedagogy Courses in Science/Mathematics, combinations will be as follows:

(i) For PCM Group

(a) 1 Pedagogy Course : Pedagogy of Science

(Science comprises of Physics, Chemistry and an additional input of Biology)

(b) 2 Pedagogy Course: Pedagogy of Mathematics

(ii) For CBZ Group

- st
- (a) 1 Pedagogy Course: Pedagogy of Physical Science  
(Physical Science comprises of Physics and Chemistry)
  - (b) 2 Pedagogy Course: Pedagogy of Biological Science  
(Biological Science comprises Botany and Zoology )

### III 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 will be permitted to appear in the annual examination only if he/she has pursued a regular course of study and attended at least 80% of the classes for all the course work and practicum and 90% for school internship.
  3. 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 herein after.
  4. In order to qualify for B.Sc. B.Ed. degree a candidate should obtain a minimum of 36% marks in theory and practicals 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.
  5. In Part I, there will be two core subjects; Core subject **GC1** is General Hindi/ General English, Core Subject **GC2** is Environmental Education and Sustainable Development. In order to pass, a candidate must secure atleast **36%** marks in each core subject. However, the marks obtained in these papers will not be taken into account for awarding the division. In case a candidate fails in the core subject, s/he has to clear the same as per provision made in clause 12(ii).
  6. The minimum pass marks in the supplementary examination shall be the same as prescribed for the main examination.  
The candidate who has passed any year of B.Sc. B.Ed. programme after taking supplementary examination will be awarded minimum pass marks in the concerned subject irrespective of marks actually obtained in the supplementary examination.
- (i) A candidate who fails in one or two subjects (excluding General Hindi/General English / Environmental Education and Sustainable Development in the Part I) in any year of the programme will be eligible to take the supplementary examination in the subject(s) in which s/he fails. In case the candidate is not able to pass even in the supplementary examination s/he can appear only as an ex-student in all subjects again at the main examination of the subsequent year. s/he will not be required to appear in practical(s) if s/he has already cleared the same. A candidate shall be deemed to be an ex-student if s/he completed a regular course of study at the Institute and fulfilled the required attendance as specified in clause No. 2 and appeared in University examination but failed or did not take the examination.
  - (ii) A candidate who fails in the practical/theory/field work of a subject at the main examination shall be required to appear only in the corresponding practical/ theory of the supplementary examination.
  - (iii) A candidate who does not appear in the supplementary examination will have to appear in the subsequent main examination in all subjects including practical, only as an ex-student.

A candidate who appears for the supplementary examination may take provisional admission to the next higher class at his/her own risk. Such a candidate will, however, be allowed to appear in the University examination of the next higher class subject to his/her passing the supplementary examination,



fulfilling the attendance requirement as a regular candidate and completion of courses of study as per scheme of examination. If a candidate getting supplementary does not take provisional admission to the next higher class by the notified last date of admission and passes the supplementary examination at a later stage, s/he will not be admitted to the next higher class. However, such a candidate may take admission to the next higher class in the next academic session. (iv) A candidate who fails in more than two subjects (except General Hindi/General English/ Environmental Education and Sustainable Development) in any year of the course shall be declared failed and will not be promoted to the next class. Such a candidate will be permitted to appear at the main examination of the subsequent year in all the subjects only as an ex-student.

(v) However, in the case of General Hindi/General English, and Environmental Education and Sustainable Development, if a candidate fails in Part I he/she 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.

(vi) candidate who fails in more than two subjects but passes in practical he/she 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 he/she does not pass the examination even thereafter, s/he will not be eligible for readmission to any year of the programme.
8. Pedagogical course – Learning to function as a teacher will be conducted in two phases. Phase I (Pre internship) of 50 marks and phase II (Internship in Teaching) of 300 marks will be conducted in B.Sc., B.Ed. Programme in Part III and IV respectively. If a candidate fails in the Learning to function as a teacher (Pre-Intern - ship/Internship in Teaching) or is unable to complete Pre-Internship/Internship in teaching but passes in all other subjects he/she 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 Sustainable Development.

#### **Scheme of examination**

#### **Paper divided into three sections**

##### **Section-A**

Answer All ten questions .Answer limit 50 words. Each Questions carries two marks  
(10x2=20 marks)

##### **Section –B**

Answer All Five Questions. Answer limit 200 words. Each question has internal choice.  
Each question carries 6 Marks (6x5=30 Marks)

##### **Section-C**

Answer any three questions out of five. Answer Limit 500 words. Each questions Ten Marks.  
(3x10=30 Marks)

#### **IV. Evaluation Rules & Regulations Question papers:**

- i) Each question paper of 80 marks will be divided into five units. Each unit will have two questions one essay type and two short answer type with 2 to 3 parts having 16 marks in total. Candidate will be required to answer 5 questions one question from each unit.
- ii) Each question paper of 60 marks will be divided into five units. Each unit will have two questions one essay type and two short answer type with 2 to 3 parts having 12 marks in total. Candidate will be required to answer 5 questions one question from each unit.
- iii) Each question paper of 50 marks will be divided into five units. Each unit will have

two questions one essay type and two short answer type with 2 to 3 parts having 10 marks in total. Candidate will be required to answer 5 questions one question from each unit.

- iv) Each question paper of 40 marks will be divided into five units. Each unit will have two questions one essay type and two short answer type with 2 to 3 parts having 08 marks in total. Candidate will be required to answer 5 questions one question from each unit. Short answer type questions should aim at testing knowledge of concepts, facts, defining, laws, principles, generalization etc. and also testing of understanding of principles and concepts. The answer to such question should not exceed 150 words.
- v) Essay type questions are to aim at testing ability of critical thinking and application of principles etc. taught in theory. The answer to such question should not exceed 400 words.
- vi) The overall question paper will be set keeping the following difficulty levels. Easy: 30% Average:40% Difficult:30%.
- vii) For SES and EPC mode of internal assessment is given with the paper concerned.

#### **V Award of Division**

1. Successful candidates will be awarded division on the basis of the aggregate marks of all the Core Courses, Pedagogy Courses and Courses on Developing Teacher Sensibilities as per the following:

- i. First Division 60% or more
- ii. Second Division 48% or more (but less than 60%)
- iii. Third Division 36% or more (but less than 48%)

2 Candidates can apply for Re-evaluation in any of the theory courses as per rules stipulated by the University for B.Sc. B.Ed. degree. Changes in Statutes/ Ordinances/ Rules/ Regulations/ Syllabi and books may from time to time be made by amendment or remaking and a candidate shall, except in so far as the University determines otherwise, comply with any change that applies to years she/he has not completed at the time of change.

#### **Notes:**

- i. A course/ paper means any General Courses (GC), Core Courses (CC), Pedagogy Courses (PC) and Courses on Developing Teacher Sensibilities (i.e. ETE and SES) inclusive of Practical/Practicum, as the case maybe.
- ii. Marks of that part of the course/ paper in which the candidate passes will be carried over.

**B.Sc. B.Ed. Part -I**  
**Group A : General Courses (GC)**  
**GC-1**

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 2- nk ifjp;kRed i'u ikB; iLrdk ||

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%25\$25 ¼ 50 vd%  
 %10\$10 ¼ 20 vd%  
 %15\$15 ¼ 30 vd%

%c Hkx%  
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 2- okD; 'kf} & 5 vd  
 3- ikfjHkkf'kd 'kOnkoyh %vx%t'h 'kOnk d fgnh %ekukFkd 'kOn% & 5 vd  
 4- %k% & 5 vd  
 5- iYyou & 5 vd  
 6- okD;k\*k d fy, ,d %kFkd 'kOn & 5 vd  
 7- ik =lk %ikFkuk i=] fufonk] ifji=] vf/k%lpu] Kk%u] foKk%u% & 5 vd  
 8- 'kOn ;Xe & vFk Hkn & 5 vd  
 9- fuc/k & 10 vd

ikB; iLrd

- 1- x| ikk] iknd Mk- uoy fd'kkj] idk'ku % ip'khy idk'ku] fQYe dkykuh pKk jkLrk t; ij eY; : i; 15@&  
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**GC-1GENERAL ENGLISH**

**Contact Hours: 4 periods per Week**

**Maximum Marks: 100**

**Duration: 3 Hours**

**Minimum for Pass: 36**

**Objectives:** This is essentially a language-based course. It aims at making students read English prose with a view to enhancing their comprehension of the language and encouraging them to develop reading habits. It also aims at developing basic skills in grammar, enriching their vocabulary and enabling them to write simple and correct English.

**Scheme of Examination**

**1. Comprehension and Vocabulary**

- a. Questions based on content from the prescribed text 10 Marks  
 b. Questions based on a passage from the prescribed text to test the candidate's comprehension and vocabulary 20 Marks  
 c. Questions based on an unseen passage to test the candidate's comprehension and vocabulary 10 Marks (There will be a text of essays and short stories between 100 and 200 pages in length.)

**2. Composition**

- a. Letter/Application writing 10 Marks  
 b. Paragraph writing/Précis writing 10 Marks  
 c. Report Writing 10 Marks

**4. Grammar and Usage**

The Questions in this exercise will be set with the purpose of testing the candidate's knowledge of grammar and familiarity with correct usage.

- A. Elements of sentence 5 Marks

B.	Transformation of Sentences	5Marks
C.	Active and Passive Voice	5Marks
D.	Modals	5 Marks
E.	Determiners	5 Marks
F.	Common Errors in English	5 Marks

**The following chapters are prescribed for study:**

1. M.K.Gandhi : Training: Literary and Spiritual
2. Kamla Devi Chattopadhyay : Indian Women and the Salt Satyagraha
3. Uma Rao : A Special Child
4. Neelam Saran Gour : Personal Friend
5. Vandana Shiva : Women in the Food Chain
6. Boman Desai : Between the Mosque and the Temple

**Recommended Books:**

1. A.J.Thomson & A.V.Martinet : A Practical English Grammar (OP)
2. S.Pit Corder : Intermediate English Practice Book (O.L.)
3. Bhaskaran and Horsburgh : Strengthen your English (OUP 1973)
4. F.T.Wood : A Remedial English Grammar for Foreign Students (Macmillan 1965)
5. T.L.H.Smith-Pearse : The English Errors of Indian students. OUP

**Book Prescribed**

Dr. Jasbir Jain (Edt.): **The Many Worlds of Literature**, Macmillan India Ltd.

**GC-2 Environmental Education and Sustainable Development**

**Instructional Time: 2 periods/week**

**Max. Marks: 50**

**Exam. Duration: 2 Hours**

**External:**

**50**

**Objectives of the Course:**

The Course 'Environmental Education and Sustainable Development' aims to orient student-teachers to analyze and understand environment concerns through the process of inquiry, critical analysis, intellectual discourse and essential projects.

**Course Outline:**

**Unit I: Importance and Scope of Environment**

Importance need and scope of Environmental Conservation and Regeneration, Structure and functions of different ecosystems, India as a mega biodiversity nation, Role of individual in conservation of natural resources: water, energy and food, Equitable uses of resources for sustainable livelihoods, Environmental legislation: awareness and issues involved in enforcement.

**Unit II: Natural Resources and Environment management**

Community participation in natural resource management- water, forests etc, Deforestation in the context of tribal life, Sustainable land use management, Traditional knowledge and biodiversity conservation. Consumerism and waste generation and its management, Environmental degradation and its impact on the health of people, water resource management, Biomedical waste management.

**Unit III: Sustainable Environment in Global World**

Environmental conservation in the globalised world, Alternative sources of energy, Impact of natural disaster/man-made disaster on environment, Biological control for sustainable agriculture, Heat production and green house gas emission, Impact of industry/mining/transport on environment, Sustainable use of forest produces.

**Modes of Learning Engagement:**

∑ Case studies and success stories (involve local material).

∑ Problem solving and enquiry methods

- Σ Small assignments which may include observation of important relevant days, preparation of bulletin board material, games, crossword puzzles, worksheet etc.
- Σ Setting up of Eco-clubs.
- Σ Conducting a seminar and developing a seminar document
- Σ Project work and writing of project report
- Σ Discussion of activities pertaining to two different classes and subjects.
- Σ Activities on infusion of appropriate concerns

**Practicum:**

1. The students on completion of each topic of Unit-I-III will submit a small assignment in the form of an activity. This may include observation of importance of relevant season, preparation of bulletin board material, wall games, crossword puzzles, worksheet etc.
2. The class can also form an environment club. The activity has to be on some local specific issue pertaining to the native place of the students.
3. From the wide range of topics suggested in Units the student will be assigned one topic. The student will develop a seminar document, which will be submitted after the seminar.

**Suggested Readings:**

1. NCERT (1981) Environmental Education at School Level. New Delhi. NCERT.
2. Odum, E.P (1971). Fundamental Ecolog. London. W.B. Saunders Company.
3. Palmer, Joy A. (1998). Environmental education in the 21 Century. London. Routledge.
4. Sharma R. C and Tan, Marle C (Eds.) (1990). Resource Book in Environmental education for secondary school lectures. Bangkok. UNSECO.
5. Sharma, R.C. (1981). 'Environmental Education. New Delhi. Metropolitan Publishers.
6. UNESCO (1990). Sourcebook in Environmental Education for Secondary School Teachers. Bangkok.
7. CEE (1995). Joy of learning. Handbook of Environmental Education Activities. Vol.I-3 to 5.—Ahmedabad. Centre for Environment Education,
8. CEE (1996) Joy of learning. Handbook of environmental education activities. Vol.II-6 to 8.-- Ahmedabad: Centre for Environment Education
9. Pandya (1999). Mamata Guide to green material: experiences and learnings in developing effective environmental education material. Ahmedbad. Centre for Environment Education,
10. Sharma, R. C. (1981). Environmental Education. Delhi. Metropolitan.
11. Reddy, K. Purushotham. (2007). Environmental education. New Delhi. Neelkamal Publications Pvt. Ltd.
12. NCERT (2009). Project book in Environmental Education for class VII, VII, IX and X. New Delhi. NCERT.
13. NCERT (2011). Teachers' Handbook on Environmental Education for the higher secondary stage. New Delhi. NCERT.
14. NCERT (2013). Project book in Environmental Education for the higher secondary stage. New Delhi. NCERT.

**Group B :CORE COURSES (CC) CC –  
1 PHYSICS**

Scheme	Exam Duration	Max. Marks	Min.Pass Marks
Paper I	3hrs.	40	36
Internal		10	
Paper II	3hrs.	40	
Internal		10	
Practical	5hrs.	50	18

**Note :** There will be two experiments. The distribution of marks will be as follows: Two experiments (one from each section)

Each of 15 marks	30 marks
Viva voce	10 marks
Record	10 marks
Total	50 marks

### CC – 1 (I) - PAPER I- RELAVITY, MECHANICS, OSCILLATIONS AND WAVES

**Duration- 3 hours**

**Max.Marks :40**

**Note :-** The paper is divided in five independent units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit. MKSA system of units is to be used. The question paper shall have at least 30 percent weightage of problems and numerical.

#### UNIT – I

**Relativity:** Reference systems, inertial and non-inertial frames, Galilean transformation, Galilean invariance and conservation laws, propagation of light, Michelson – Morley experiment. Postulates of the special theory of relativity, Lorentz transformations, length contraction, time dilation, velocity addition theorem, variation of mass with velocity, mass-energy equivalence, particle with a zero rest mass.

#### Unit-II

**Mechanics:** Motion under central force, Kepler’s laws, Gravitational law and field, Potential due to a spherical body, Gauss and Poisson equations for gravitational potential, gravitational self-energy.

Rigid body motion, Rotational motion, Moment of inertia and their products, principal moments and axes, Euler’s equations.

System of particles, centre of mass, equation of motion, single stage and multistage rocket, energy and momentum conservation, concepts of elastic and inelastic collisions.

#### Unit-III

**Oscillations:** Potential well and periodic oscillations, cases of harmonic oscillations, different equations and its solutions, Kinetic and potential energy, Simple Harmonic oacillations in – Spring and mass system, Simple and compound pendulum, Torsional pendulum, Bifilar oscillations, Helmholtz resonator, LC circuits, Vibration of a magnet, Oscillation of two masses connected by a spring, Superposition of two simple harmonic motions of same frequency along the same line, Interference, Superposition of two mutually perpendicular simple harmonic vibrations of same frequency, Lissajou’s figures, Cases of different frequency.

#### Unit –IV

**Coupled Oscillations:** Two coupled oscillators, normal modes, N-coupled oscillators, damped harmonic oscillators, Power dissipation, Quality factor, Driven harmonic oscillator, Transient and steady state, Power absorption, Resonance in system with many degrees of freedom.

#### Unit V

##### Waves

**Waves in Media:** Speed of transverse waves on a uniform string, speed of Longitudinal waves in a fluid, energy density and energy transmission in waves, waves over liquid surfaces, gravity waves and ripples, Group velocity and Phase velocity, Superposition of waves, linear homogeneous equations and the superposition principle, nonlinear superposition and consequences.

**Acoustics:** Noise and Music, The human ear and its responses, limits of human audibility, intensity and loudness, bel and decibel, the musical scale, temperament and musical instruments, Production and detection of ultrasonic and infrasonic waves and applications,

Transducers and their characteristics, Recording and reproduction of sounds, various systems, Measurements of frequency, waveform, intensity and velocity, The acoustics of halls, reverberation period, Sabine's formula.

#### **Textbooks and References**

- Robert Resnick, Introduction to special relativity (Wiley India Pvt. Ltd., 2005) Charles Kittel, Berkeley Physics Course vol.-1, Mechanics (Mc Graw-Hill, 1965)
- R.P Feynman, R.B. Ligton and M.Sands, The Feynman Lectures on Physics, vol-1 (Narosa Publishing House)
- N. K. Bajaj, The Physics of Waves and Oscillations (Tata McGraw-Hill Pub. Com. Ltd., 2006)
- R.S. Gambir, Mechanics (CBS Publishers and Distributions, New Delhi)
- S. Garg, C. K. Ghosh, S.Gupta, Oscillations and Waves (PHI Learning Pvt. Ltd., 2009)
- R.K Ghosh, The Mathematics of Waves and Vibrations, (Mc Milan, 1975)
- Frank S. Crawford Jr., Berkely Physics Course: Vol.3, Waves (McGraw Hill book company, 1968)
- I G Main, Vibrations and Waves (Cambridge University Press, 1984)
- H J Pain, The Physics of Vibrations and Waves (John Wiley & Sons Ltd., 2005)

### **CC – 1 (II) - PAPER –II** **MATHEMATICAL BACKGROUND, PROPERTIES OF MATTER AND** **ELECTROMAGNETIC WAVES**

**Duration- 3 hours**

**Max. Marks:40**

**Note:-** The paper is divided in five independent units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit. MKSA system of units is to be used. The question paper shall have at least 30 per cent weightage of problems and numerical.

#### **Unit-I**

**Scalars and Vectors:** dot products, triple vector product, gradient of scalar field and its geometrical interpretation, divergence and curl of a vector field, line, surface and volume integral, Flux of a vector field, Gauss divergence theorem, Green's theorem and Stokes theorem. Functions of two and three variables, Partial derivatives, geometrical interpretation of total differential of a function of two and three variables, Higher order derivatives and their applications.

#### **Unit –II**

Elasticity, Small deformations, Young's modulus, bulk modulus and modulus of rigidity for an isotropic solid, Poisson's ratio, relation among elastic constants, Theory of bending of beams and cantilever, Torsion of a cylinder, Bending moments and Shearing forces.

#### **Unit –III**

Kinematics of moving fluids, Equation of continuity, Euler's equation, Bernoulli's principle, viscous fluids, Streamline and turbulent flow, Poiseuille's law, Capillary tube flow, Reynold's number, Stokes' law, Surface tension and surface energy, molecular interpretation of surface tension, Pressure on a curved liquid surface, wetting.

#### **Unit-IV**

Electromagnetic induction, Faraday's law (its integral and differential form), Lenz's law, Mutual and Self-inductance, Transformers, Energy in a static magnetic field, Measurement of self-inductance by Rayleigh's method, Maxwell's displacement current, Maxwell's equations, Electromagnetic field and Energy density.

#### **Unit –V**

Plane electromagnetic wave in vacuum, Wave equation for E and B of linearly, Circularly

and elliptically polarized electromagnetic waves, Poynting vector, Reflection and Refraction at a plane boundary of dielectrics, Polarization by Reflection and total internal Reflection, Faraday effect, Wave in conducting medium, Reflection and Refraction by the ionosphere. Textbooks and References

Berkeley Physics Course, Vol. II Electricity and Magnetism, Ed, EM.Procell (Mc Graw Hill)  
Haliday and Resnik, Physics-VI Ed.

D.J Griffith —Introduction to electrodynamicsII, (Prentice Hall of India AM parties, Electomagnetic field.

V. V Sarvate, Electromagnetic field and Waves , (Wiley Eastern Ltd., NewDelhi)

S.N Ghosh, Electromagnetic theory and wave propagation, (Narosa Publishing House.)

Kakani and Hemrajani, Electromagnetism theory and Problems, (CBS Publishers and Distributors, New Delhi)

**Duration : 5 hours Max. Marks: 50 Min.Pass Marks : 18 Any 12 of the following experiments are to be done. Few more experiments may be set at the institutional level.**

#### **Section A**

1. Study of conservation of momentum in two dimensional oscillations.
2. Study of a compound pendulum.
3. Study of damping of a bar pendulum under various mechanics.
4. Study of oscillations of a mass under different combinations of springs.
5. Study of bending of a cantilever or a beam
6. Study of torsion of a wire (static and dynamic methods.)
7. Study of flow of liquids through capillaries.
8. Determination of surface tension of a liquid by different methods.
9. Study of viscosity of a fluid by different methods.
10. To study the random decay and determine the decay constant by statistical method.
11. To determine Poisson's ratio of rubber tube.

#### **Section B**

1. Study of magnetic field due to a current
2. Measurement of low resistance by Carey-Foster bridge.
3. Measurement of inductance using impedance at different frequencies.
4. Measurement of capacitance using impedance at different frequencies.
5. Study of decay of currents in LR and RC circuits.
6. Response curve for LCR circuit and resonance frequency and quality factor.
7. To determine the frequency of A.C mains
8. To study the characteristics of semi conductor junction diode and to determine forward and reverse resistance.
9. Conversion of galvanometer into an ammeter
10. Conversion of galvanometer into voltmeter.
11. To determine the internal resistance of laclanche cell using potentiometer.

#### **Laboratory Tutorials**

Elementary Fortran programs, flowcharts and their interpretation. To print out all natural even/odd numbers between given limits. To find maximum, minimum and range of a given set of numbers.

To compile a frequency distribution and evaluate moments such as mean, standard deviation etc.

To find the product of two matrices.

To find a set of prime numbers and Fibonacci series.

Motion of a projectile using computer simulation



Numerical solution of equation of motion. Motion of particle in a central force field. To find the roots of a quadratic equations.

#### CC-2 CHEMISTRY

Scheme	Exam Duration	Max. Marks	Min. Pass Marks
Paper I	3hrs.	40	36
Internal		10	
Paper II	3hrs.	40	
Internal		10	
Practical	5hrs.	50	18

**Note:** There will be three experiments. The distribution of marks will be as follows: Three experiments (one from each group)

Experiments (3)	40 marks
Viva Voce	05 marks
Record	05 marks
<b>Total</b>	<b>50 marks</b>

#### CC 2 (I) - PAPER I- INORGANIC CHEMISTRY

**Duration- 3 hours**

**Max. Marks: 40**

**Note :** The paper is divided in five independent units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit.

##### Unit I Atomic Structure and Bonding

- (A) **Atomic Structure:** Idea of de-Broglie matter waves, Heisenberg uncertainty principle, atomic orbitals, Schrödinger wave equation, significance of  $\Psi$  and  $\Psi^2$ , quantum numbers, radial and angular wave functions and probability distribution curves, shapes of s, p, d, orbitals.
- (B) **Structure and Bonding:** 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 shall electron pair repulsion (VSEPR) theory to  $\text{NH}_3$ ,  $\text{H}_3\text{O}^+$ ,  $\text{SF}_4$ ,  $\text{ClF}_3$ ,  $\text{ICl}_2^-$  and  $\text{H}_2\text{O}$ , MO theory, homonuclear and heteronuclear (CO and NO) diatomic molecules, multicenter bonding in electron deficient molecules, bond strength and bond energy, percentage ionic character from dipole moment and electro- negativity difference.

##### Unit II Chemistry of main group elements

- (A) **s-Block Elements:** Comparative study, diagonal relationship, salient features of hydrides, solvation and complexation tendencies including their function in bio-systems, an introduction to alkyls and aryls.
- (B) **p-Block Elements:** Comparative study (including diagonal relationship) of groups 13-17 elements, compounds like hydrides, oxides, oxy acids and halides of group 13-16, hydrides of boron-diborane and higher boranes, borazine, borohydrides, fullerenes, carbides, fluorocarbons, silicates (structural principle), tetrasulphur tetra nitride, basic properties of halogens, interhalogens and polyhalides.
- (C) **Chemistry of Noble Gasses:** Chemical properties of the noble gases, chemistry of xenon, structure and bonding in xenon compounds.

##### Unit III Ionic compounds: Bonding and Structure

- (A) **Ionic solids** – Ionic structures, radius ratio effect and coordination number, limitation of radius ratio rule, lattice defects, semiconductors, lattice energy

and Born-Haber cycle, solvation energy and solubility of ionic solids, polarizing power and polarisability of ions, Fajan's rule, Metallic bond-free electron, valence bond and band theories.

- (B) **Structure of Ionic solids:** Definition of space lattice, unit cell; Laws of crystallography – (i) Law of constancy of interfacial angles, (ii) Law of rationality of indices (iii) Law of symmetry, Symmetry elements in 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).
- (C) **Weak Interactions-** Hydrogen bonding, van der Waals forces.

#### **Unit IV Acids and Bases**

- (A) **Theories of Acids and Bases:** Arrhenius, Bronsted-Lowry, the Lux-Flood, solvent system and Lewis concept of acids and bases. Solvent system of acid and bases with special reference to liquid Ammonia, liquid BrF<sub>3</sub>
- (B) **Concept of 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.
- (C) **Solvent Systems:** Physical properties of a solvent, types of solvents and their general characteristics reactions in non-aqueous solvents with reference to liquid NH<sub>3</sub> and liquid SO<sub>2</sub>.

#### **Unit-V Chemistry of Transition Elements**

- (A) **Chemistry of Elements of First Transition Series:** Characteristic properties of d block elements, properties of the elements of the first transition series, their binary compounds (hydrides, carbides and oxides) and complexes with respect to relative stability of their oxidation states, coordination number and geometry.
- (B) **Chemistry of Elements of Second and Third Transition Series:** General characteristics, comparative treatment of Zr/Hf, Nb/Ta, Mo/W in respect of ionic radii, oxidation states, magnetic behaviour, spectral properties and stereochemistry.

#### **Textbooks and References**

1. Lee, J.D. Concise Inorganic Chemistry, ELBS.
2. Douglas, B.E. and Mc Daniel, D.H., Concepts & Models of Inorganic Chemistry
3. Day, M.C. and Selbin, J. Theoretical Inorganic Chemistry, ACS Publications.
4. Shriver and Atkins Inorganic Chemistry, W. H. Freeman and Company
5. James Huheey, Inorganic chemistry: Principles of Structure and Reactivity, Pearson Education India
6. B.N. Figgis, J.E Huheey, P.W. Atkins Inorganic Chemistry, Pearson Education
7. Duward Shriver, Inorganic Chemistry, W. H. Freeman
8. Gary Wulfsberg, Inorganic Chemistry, University Science Books
9. A. R. West, Solid State Chemistry and its Applications, Wiley

## CC 2 (II) - Paper II PHYSICAL CHEMISTRY

**Duration- 3 hours. Max. Marks:40 Note :** The paper is divided in five independent units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit.

### Unit- I Mathematical Concepts and Nuclear Chemistry

- (A) **Mathematical Concepts:** Logarithmic relations, curve sketching, linear graphs and calculation of slopes, differentiation of functions like  $K_x$ ,  $\sin x$ , maxima and minima, partial differentiation and reciprocity relations, Integration of some useful/relevant functions; permutations and combinations, Factorials, Probability.
- (B) **Nuclear Chemistry:** Radioactive decay – decay law, disintegration constant, half-life and average life, alpha and beta disintegration reactions, group displacement law, nuclear reactions fission, fusion, artificial radioactivity, applications of radioactivity, nuclear power, carbon dating, biological effects of various types of radiations, nuclear chemistry for peace, Nuclear chemistry in Medicine and diagnostic techniques.

### Unit –II Behaviour of gases

- (A) **Gaseous States:** Postulates of kinetic theory of gases, deviation from ideal behaviour, Vander Waals equation of state;
- (B) **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.
- (C) **Molecular velocities:** Root mean square, average and most probable velocities, Qualitative discussion of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter, Liquefaction of gases (based on Joule – Thomson effect).

### Unit III Liquid and Colloidal States

- (A) **Liquid State:** Intermolecular forces, structure of liquids (a qualitative description). Structural differences between solids, liquids and gases, Liquid crystals: Difference between liquid crystal, solid and liquid, Classification, structure of nematic and cholesteric phases, Thermography and seven segment cells.
- (B) **Colloidal States:** Definition of colloids, classification of colloids, Solids in liquids (sols): properties – kinetic, optical and electrical; stability of colloids, protective action, Hardy-Schulze law, gold number. Liquids in liquids (emulsions): types of emulsions, preparation, Emulsifier, Liquids in solids (gels): classification, preparation and properties, inhibition, general application of colloids, colloidal electrolytes.

### Unit IV Solutions, Dilute Solutions and Colligative Properties

- (A) Ideal and non-ideal solutions, methods of expressing concentrations of solutions, activity and coefficient.
- (B) Dilute solutions, 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.

### Unit V Concept of Equilibrium

- (A) **Chemical Equilibrium:** Equilibrium constant and free energy. Thermodynamic derivation of law of mass action. Le Chatelier's principle. Reaction isotherm and reaction isochore – Clapeyron equation and Clausius – Clapeyron equation, applications.
- (B) **Phase Equilibrium:** statement and meaning of the terms – phase, component and

degree of freedom, derivation of Gibbs phase rule, phase equilibria of one component system-water, CO<sub>2</sub> and S systems. Phase equilibria of two component system – solid – liquid equilibria, simple eutectic-Bi-Cd, Pb-Ag systems, desilverisation 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) system. 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. Nernst distribution law- thermodynamic derivation, applications.

#### Textbooks and References

1. Engel, Physical Chemistry, Pearson Publications.
2. Mary Anne White, Physical Properties of Materials, Taylor & Francis second edition.
3. D N Bajpai, Advanced Physical Chemistry, S. Chand Publishing
4. S Lewis and D Gladstone, Elements of Physical Chemistry, Macmillan.
5. Peter Atkins Julio de Paula, Atkins' Physical Chemistry Oxford University Press.

#### PRACTICAL

**Duration: 5 Hours**

**Max. Marks: 50**

**Min. Pass Marks : 18**

#### (A) Inorganic Chemistry

Semi micro analysis: Detection of the presence of three cations and three anions (including interfering) in a given mixture qualitatively.

#### (B) Organic Chemistry:

##### Laboratory techniques

##### 1. Calibration of Thermometer

Naphthalene (80-82°C), Acetanilide (113.5-114°C), Urea (132.5-133°C), Distilled Water (100°C)

##### 2. Distillation

- a. Simple distillation of ethanol-water mixture using water condenser
- b. Distillation of nitrobenzene and aniline using air condenser

##### 3. Crystallization

- a. Concept of induction of crystallization
- b. Phthalic acid from hot water (using fluted filter paper and stem less funnel)
- c. Acetanilide from boiling water
- d. Naphthalene from ethanol
- e. Benzoic acid from water

##### 4. Decolourisation and crystallization using charcoal

- a. Decolourisation of brown sugar (sucrose) with animal charcoal using gravity filtration.
- b. Crystallization and decolorisation of impure naphthalene (100g of naphthalene mixed with 0.3g of Congo Red using 1g decolorizing carbon) using ethanol.

##### 5. Sublimation (simple and Vacuum)

Camphor, Naphthalene, phthalic acid and Succinic acid.

##### 6. Determination of melting point/ boiling points

- a. **Determination of melting point:** Naphthalene, Benzoic acid, Urea, Succinic acid, Cinnamic acid, Salicylic acid, Acetanilide, m-Dinitrobenzene p- Dichlorobenzene, Aspirin.

- b. **Determination of boiling points:** Ethanol, Cyclohexane, Toluene, Aniline and Nitrobenzene.

**(C) Physical Chemistry**

**1. Chemical Kinetics**

- To determine the specific reaction rate of the hydrolysis of methyl acetate/ethyl acetate catalyzed by hydrogen ions at room temperature.
- To study the effect of acid strength on the hydrolysis of an ester.
- To compare the strength of HCl and H<sub>2</sub>SO<sub>4</sub> by studying the kinetics of hydrolysis of ethyl acetate.
- To study kinetically the reaction rate of decomposition of iodide by H<sub>2</sub>O<sub>2</sub>

**2. Colloids.**

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

**3. Viscosity**

- To determine the percentage composition of a given mixture (non interacting systems) by viscosity method.
- To determine the percentage composition of a given binary mixture by viscosity method (acetone & ethyl methyl ketone)

**4. Surface Tension**

- To determine the surface tension of amyl alcohol in water at different concentrations and calculate the excess of these solutions.
- To determine the percentage composition of a given surface tension binary mixture by surface tension method (acetone & ethyl methyl ketone).

**CC-3 ZOOLOGY**

Scheme	Exam Duration	Max.Marks	Min. Pass Marks.
Paper I	3 hours 40 (External)	10 (Internal)	36
Paper II	3 hours	40 (External) 10 (Internal)	
Practical	4 hours	50 (External)	

**Duration : 3 Hrs.**

**Objectives : CC – 3 (I) -PAPER I : NON CHORDATA**

To enable students to understand the organizational hierarchies and complexities, the evolutionary trends in external morphology and internal structure; identification and classification with examples, to enable them to understand various modes of adaptations in animals.

**Note :** The paper is divided in five independent units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit.

**Unit I**

- General principles of taxonomy and classification. Outline classification of Protozoa up to order.
- General Structural organization of *Amoeba*, *Englena* and *Plasmodium*.
- Habit and habitat, structure, nutrition, osmoregulation and reproduction of *Paramecium*
- Locomotion in Protozoans- pseudopodial, ciliary and flagellar.
- Nutrition in Protozoa
- Reproduction in Protozoa.

**Unit – II**

- Outline classification of Porifera and Coelenterata up to order.
- Habit, habitat, morphology, internal structure, reproduction of *Sycon*

- c) Canal system and skeleton in Sponges
- d) Habit, habitat, morphology, internal structure, nutrition and reproduction of *Obelia*
- e) Polymorphism in coelenterates, coral reefs

#### Unit - III

- a) Outline classification of Platyhelminthes and Nematheminthes up to order.
- b) Habit and habitat, morphology, internal structure, reproduction and life – cycle of *Fasciola*, and *Ascaris*
- c) Parasitic adaptations in Helminthes

#### Unit – IV

- a) Outline classification of Annelida and Arthropoda up to order.
- b) Habit and habitat, structure, nutrition, respiration, circulation, excretion, nervous system and reproduction of
  - (i) *Hirudinaria*
  - (ii) *Palaemon*
- c) *Peripatus* : structure and affinities
- d) Mouth parts and feeding habits of Insects.

#### Unit – V

Outline classification of Mollusca and Echinodermata up to order

- a) Habit and habitat, structure, nutrition, respiration, blood vascular system, excretion, nervous system and reproduction of *Pila*
- b) Torsion in Gastropoda
- c) Habit and habitat, structure, nutrition, respiration, blood vascular system, excretion, nervous system and reproduction of *Asterias*
- d) Larval forms of Echinoderms.

#### Textbooks References: -

- 1 Modern Textbook of Zoology Invertebrates by R.L. Kotpal –(Rastogi<sup>th</sup> Publication, Meerut 10<sup>th</sup> Revised Edition)
- 2 Invertebrate Zoology series (Protozoa of Echinodermata) by R.L. Kotpal – (Rastogi Publication, Meerut)
- 3 Invertebrate Zoology by E.L. Jordan and P.S. Verma – S. Chand & Co., Delhi
- 4 Invertebrate Zoology by J.K. Dhama and P.S. Dhama – S. Chand & Co., Delhi
- 5 A textbook of Invertebrate Zoology by S.N. Prasad – (Kitab Mahal, Allahabad)
- 6 Life of Invertebrate Zoology by Russel and Hunter – (Macmillan)
- 7 Invertebrate Zoology by R.D. Barnes :- (W.B. Saunders, Philadelphia)
- 8 A manual of Zoology Vol. I by Ekamernatha Ayyar (Vishwnathan, Madras)
- 9 The invertebrate series of L.H. Hyman – (McGraw Hill)
- 0 A student's textbook of Zoology by Adma Sedgwick VoI .I, II & III ( Central Book Depot, Allahabad)
- 1 A textbook of Zoology VoI. I by Parkar and Haswell – (Macmillan)
- 2 Lower non chordate, Dr VS Pawar, Hindi Edition, College book centre, Chaura Rasta, Jaipur
- 3 Higher non Chordate, Dr VS Pawar, Hindi Edition, College book centre, Chaura Rasta, Jaipur
- 4 Animal taxonomy and evolution, Dr VS Pawar, Hindi Edition, College book centre, Chaura Rasta, Jaipur

#### CC – 3 (II) -PAPER II : ANIMAL CELL BIOLOGY AND GENETICS

Duration : 3hrs. Max. Marks : 40 Objectives :

To enable students to comprehend the modern concepts and applied aspects of Cell Biology and modern concepts of Genetics and to create awareness regarding

inheritance.

**Note:** The paper is divided into five independent units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit.

#### Unit – I

Introduction to cell : Discovery, characteristics of prokaryotic (bacterial) and eukaryotic cells ( plant and animal cells), cell theory, viruses and viroids.

Cell membrane: Ultra structure, chemical composition , models, unit membrane concept, fluidity, glycocalyx and functions of cell membrane Modifications (specializations) of plasma membrane. Transport across cell membrane: Passive transport (osmosis, diffusion), facilitated ( mediated ) diffusion; active transport ( primary and secondary) and endocytosis and exocytosis.

Mitochondria : Morphology, ultra structure , chemical composition, functions , origin, electron transport chain and generation of ATP molecules.

#### Unit –II

Ultrastructure , types, chemical composition, origin and functions of

- (i) ER and Golgi-complex
- (ii) Lysosome, Ribosome,
- (iii) Centriole,
- (iv) Cilia and flagella

#### Unit III

a) Nucleus: occurrence, number, shape, size and structure (nuclear envelopes, nuclear matrix and nucleolus)

Chromosomes: Introduction, discovery morphology, structure (chromatids, primary and secondary constrictions, nucleolar organizer and telomeres) types. Chemical composition and functions. Chromosomal organizations : Euchromatin, heterochromatin, nucleosome concept.

b) Cell reproduction: Cell cycle, phases process and significances of mitosis and meiosis.

c) Chromosomal mutations-

- (i) Variation in chromosome number (aneuploidy and euploidy)
- (ii) Structural changes in chromosomes ( deletion, duplication, inversion and translocation).

#### Unit – IV

a) Mendelian principles of inheritance- monohybrid and dihybrid cross, back cross and test cross.

Deviation of Mendelism – incomplete dominance, codominance and lethal genes; modification of 3 : 1 and 9 : 3 : 3 : 1 with examples problems

- b) Gene interactions: Epistasis, complementary, supplementary, duplicate genes with cumulative effects and collaborator genes.
- a) Multiple alleles: Characters, examples pseudoalleles, inheritance of A, B, AB, O and Rh blood groups (antibody reactions)
  - a) Sex–determination–Genetic (sex chromosome, genic balance and haplo-diploidy mechanisms), hormonal and environmental control of sex determinations with examples.
  - b) Sex-linked inheritance- white eye color in *Drosophila*, colour blindness and hemophilia in man.
  - c) Linkage. Definition difference between linkage and independent assortment, different views, chromosomal theory of linkage , kinds , linkage groups and significances.
  - d) Crossing over- Definition, mechanism, theories , kinds , frequency , factors affecting crossing over and significances.

### Textbooks and References :

1. Molecular Cell Biology, H Lodish MP Scott et al 7<sup>th</sup> Ed, McMillan Pub 2013.
2. Biochemistry, Molecular Biology and Genetics 5<sup>th</sup> ED, Lippincott Williams and Wilkinson, 2013.
3. Cell Biology Gerald Karp, 7<sup>th</sup> ed, Wiley Pub 2014
4. Cell and Development Biology by Sastry, Singh & Tomar- (Rastogi Publications. 2008)
5. Essentials of Molecular Biology, 2<sup>nd</sup> ed, David Freifelder, Panima Publishing N Delhi 1996
6. Biochemistry and Molecular Biology, K Wilson & J Walker, 7<sup>th</sup> Cambridge 2010.
7. Cell and Molecular Biology by P.K Gupta – (Rastogi Publications 2008)
8. Cell Biology by C.B Power – (Himalaya publishing House, Bombay)
9. Cell Biology by de Robertis et al. (W.B Saunders, Philadelphia)
10. A text book of Cytology by R.C Dalela & S.R. Verma – (Jaiprashnath & Co. Meerut)
11. Cell Biology by J.D. Burke – (Scientific Book Agency, Calcutta)
12. Cell Biology: A molecular approach by R.D Dyson- Allyn & Bacon, Boston)
13. Cell Biology by R.M. Dowben – (Harper & Row, New York)
14. Cell function by L. L Langley – (Affiliated East West Press, New Delhi)
15. Cytology by C.D. Darlington
16. Cell and Molecular Biology by de Robertis EDP & de Robertis EMI Jr. (1996). Holt WB Saunders International
17. Genetics- P.S. Verma & V.K. Agarwal, S. Chand & Co. Delhi
18. Principles of Genetics Gardner, Ed 7<sup>th</sup> Wiley Eastern Pvt Ltd 2013
19. Genetic – Winchester, Oxford IBH Publications
20. Genetic – Stickberger, Macmillan Publications.
21. Immunology, Kuby 7<sup>th</sup> ed, Owen Punt Stanford McMillan, 2013

### PRACTICAL

**Duration : 4 Hrs.**

**Min. Pass Marks : 18**

#### Objectives:

To understand internal organization and skills- of staining and mounting of materials. (temporary and permanent), of dissection, display and labeling, of Preparation of cultures of invertebrates by using common culture methods; laboratory observation of animal cell division.

#### Course Content

1. Study of museum specimens with respect to levels and patterns of organization biosystematics, biodiversity, adaptations, development stages, population dynamics, ecological implications etc: *Porifera* – *Sycon*, *Spongilla*, *Euplectella*, *Leucosolnia*, *Hylonema*, *Hypospongia*, *Euspongia*; *Coelelerata* – *Hydra*, *Tubularia*, *Millepora*, *Physalia*, *Porpita*, *Vellela*, *Aurelia*, *Tubipora*, *Alcyonium*, *Metridium*, *Pennatula*, *Grantia*, *Fungia*, *Gorgonia*.  
*Helminthes* : *Fasciola*, *Taenia solium*, *Planaria*, *Ascaris*, *Ancylostoma* *Annelida* : *Nereis* *Heteroneresis*, *Aphrodite*, *Chaetoptreus*. *Arenicola*, *Pheretima*, *Hirudinarid* *Arthropoda* : *Palaemong*, *Eupagurus*, *Scolopendra*, *Apis Peripatus*.  
*Mollusca* : *Chiton*, *Pila*, *Aplysia*, *Helix*, *Denalium*, *Mytilus*, *Pinctda*, *Unio*, *Sepia*, *Loligo* *Octopus*:  
*Echinodermata*: *Autedon*, *Holothuria*, *Cucumaria*, *Astropecten*, *Asterias*, *Echinus*
2. Microscope: Simple and compound microscope, working mechanism and maintenance
3. Study of Permanent slides



*Paramecium*, *Paramecium* in Conjugation, paramecium binary fission, Euglena, Vorticella, Sycon L.S., Sycon T.S., Hydra L.S., Hydra T.S, Cercaria larva, Metacercaria, Miracidium larva, Sporocyst larva, Redialarva, Ascaris male and female T.S., T.S. thorough, pharynx region, Gizzard and intestinal region of Earthworm, T.S. through buccal cavity of *Hirudinaria*, Zoea, Metazoea, Nauplius, Mysis, T.S. of gill of Unio. T.S. of the shell & mantle of Unio. Glochidium larva of Unio,

4. Dissections and/or its demonstration through Charts/Models/Video/CD/digital alternative etc and/or preparation of working models of the different systems of the following animals.
  1. Earthworm: Alimentary canal Nervous system, Reproductive system
  2. Leech Alimentary canal
  3. Cockroach: Mouthparts Digestive system, nervous system
  4. prawn: Nervous system
  5. pila: Nervous system
5. Microscopic preparation or their observation of the following.
 

*Paramecium*, *Euglena*, *Sponge*, spicules, gemmules, *Obelia*, *Hydra*, parapodium of Nereis, statocyst of Prawn, mouthparts of *Cockroach*, radula of Pila, gill of Unio.
6. Culture of *Paramecium*, *Euglena* and *Amoeba*.
7. Study of bacterial and eukaryotic cell.
8. Slides of sub cellular components (Cell organelles)
9. Erythrocyte plasma membrane permeability.
10. Study of Karyotype and Idiogram of man.
11. Study of Barr Bodies in human buccal epithelial cells.
12. *Drosophila* culture and lifecycle.
13. Sexual Dimorphism in *Drosophila*, Identification of wild or mutant varieties.
14. Study of salivary gland chromosomes of *Drosophila*
15. Problems on pedigree analysis.
16. Meiotic studies of testes of cockroach.

**Note :**

1. Use of animals for dissection is subject to the conditions that these are not banned under the Wildlife Protection Act or any other legislation.
2. Students are required to submit the following during examination.
  - a. One assignment on the instrument/ technique about its principle, working, precautions and applications; and/or reagents/ solutions preparation.
  - b. Report on study of animals from their natural habitat from their local surroundings. Vermicompost etc.

**Guidelines/ Instructions for Practical Examination**

**Max. Marks : 50 Time allowed : 3 Hrs. Min. Pass Marks : 18**

S. No.	Exercise	Marks
1.	Dissection* (Exposition, labeled diagram)	8
2.	Temporary mounting – one ( Staining, identification, sketch)	4
3.	Museum specimens – 4 or 6 ( identification and classification)	12
4.	Ecological note – one Specimen	2
5.	Permanent slides – two ( Identification with reasons)	3
6.	Preparation of chromosome slide (root tip/grasshopper testis)	2
7.	<i>Drosophila</i> spotting / pedigree	2
8.	Practical record and assignment	5
9.	Viva	4
10.	Project report and assignment	8

\*as per UGC guidelines

<b>CC – 4 BOTANY</b>			
<b>Scheme</b>	<b>Exam. Duration</b>	<b>Max. Marks</b>	<b>Min. Pass Marks</b>
Paper I	3 hrs.	40(External) 10(Internal)	} 36
Paper II	3 hrs.	40(External) 10(Internal)	
Practical	4 hrs.	50	18

**CC-4(I) Paper I: Diversity of Microbes and Lower Plants**

**Duration: 3hrs**

**Max. Marks: 40**

**Unit I**

**Viruses and Bacteria:** Structure, Multiplication, transmission and disease symptoms of viruses; Structure and economic importance of mycoplasma; Bacteria – structure, nutrition, reproduction and economic importance, Gram’s staining;

General account and economic importance of Cyanobacteria.

**Unit II**

**Algae:** General characters, occurrence, classification (Fritsch, 1935), Pigment constitution, fine structure of algal plastids, life-cycles, Origin and evolution of sex and thallus in algae.

Cyanophyceae: Life Cycle of *Nostoc*, *Anabaena* and *Oscillatoria*

**Unit III**

**Structure, reproduction and evolutionary significance of following genera:**

Chlorophyceae: *Chlamydomonas*, *Volvox*, *Oedogonium* and *Coleochaete*

Xanthophyceae: *Vaucheria*, Phaeophyceae: *Ectocarpus*, *Sargassum*

Rhodophyceae: *Polysiphonia*

**Unit IV**

**Fungi:** General characters, occurrence, classification (Alexopolus and Mims, 1979; G. C. Ainsworth, 1986), Types of mycelia, structure of fungal cell, fungal flagella, Nutrition and economic importance of fungi. Host-parasite interaction, Control of plant diseases.

#### **Unit V**

##### **Structure reproduction and life history of**

Mastigomycotina - *Synchytrium* & *Phytophthora*

Ascomycotina – *Saccharomyces*, *Eurotium*, *Peziza*

Basidiomycotina – *Puccinia*, *Agaricus*, *Ustilago*

Deuteromycotina – *Alternaria*, *Cercospora*,

*Colletotrichum*, General account and economic importance of Lichens

##### **Suggested Readings:**

- ∑ Smith, GM. 1971. Cryptogamic Botany. Vol. 1 Algae & Fungi. Tata McGraw Hill Publishing Co, New Delhi.
- ∑ Sharma, O.P. 1992. Text Book of Thallophytes. McGraw Hill Pub. Co.
- ∑ Sharma. P.D. 1991. The Fungi. Rastogi & Co. Meerut.
- ∑ Dube. H.C. 1990. An Introduction to Fungi. Vikas Pub. House Pvt. Ltd. Delhi.
- ∑ Clifton A. 1985. Introduction of the Bacteria. McGraw Hill & Co. New York.

#### **CC–4(II) Paper II: Diversity of Cryptogams (Bryophytes & Pteridophytes)**

**Duration: 3 hrs. Max. Marks: 40**

##### **Unit I**

General characters, distribution, origin of the land habit in plants, classification, Evolutionary trends in thallus and sporophyte development; Alternation of generations; classification; and Economic importance of Bryophytes.

##### **Unit II**

Structure, reproduction, and evolutionary significance of following genera:

Hepaticopsida – *Riccia* *Marchantia*

Anthocerotopsida – *Anthoceros*

Bryopsida - *Funaria*

##### **Unit III**

General characters, distribution, classification, stelar evolution, heterospory and origin of seed habit, and life cycles in pteridophytes.

Structure, reproduction and evolutionary significance of the following genera:

*Psilotum*; *Lycopodium*

##### **Unit IV**

Structure, reproduction and evolutionary significance of the following genera:

*Selaginella*; *Equisetum*; *Pteris* and *Marsilea*.

##### **Unit V**

Geological time scale, fossils and fossilization processes, significance of fossils.

Study of the following form genera of fossils

(a) *Rhynia*

(b) *Calamites*

(c) *Glossopteris*

##### **Suggested Readings:**

- ∑ Smith, GM. 1971. Cryptogamic Botany. Vol. 1 Algae & Fungi. Tata McGraw Hill Publishing Co, New Delhi.
- ∑ Sharma, O.P. 1992. Text Book of Thallophytes. McGraw Hill Pub. Co.
- ∑ Smith, GM. 1971. Cryptogamic Botany. Vol-II Bryophytes and Pterido-

phytes. Tata McGraw Hill Pub. Co. New Delhi.  
 Σ Puri, P. 1980. Bryophyta. Atma Ram & Sons Delhi.

### PRACTICALS

**Duration: 4 hours Max. Marks: 50 Min.Pass Marks : 18 Course Content:**

Study of the genera included in Theory syllabus of Algae and Fungi by making temporary micro preparations and observation of permanent slides.

Observation of disease symptoms in host infected by Fungi, Bacteria, Viruses and Mycoplasma. Section cutting of diseased material and identification of the pathogens as per the theory syllabus.

Study of morphology, anatomy and reproductive structures of genera included in Bryophytes and Pteridophytes by making temporary micro preparations and observation of permanent slides.

Gram staining of bacteria.

Study of crustose, foliose & fruticose Lichens.

Maintenance & submission of a record of all the Laboratory activities.

#### CC-5 Mathematics

Scheme	Exam Duration	Max. Marks	Min. Pass marks
Paper-I	3 hours	60 (External) 15 (Internal)	54
Paper-II	3 hours	60 (External) 15 (Internal)	

#### CC-5 (I) Paper I : Calculus

**Duration: 3Hrs**

**Max.Marks:60**

##### Unit-1

Tangents and Normal's, sub tangent and subnormal (Cartesian and polar forms), Derivative of an arc (Cartesian and polar), pedal equations, curvature.

##### Unit-2

Partial differentiation with Euler's theorem and its applications, total derivative, change of variables (polar to Cartesian and vice-versa), concept of tangent plane and normal to a surface, maxima and minima of two variables including method of undetermined multipliers.

##### Unit-3

Asymptotes, multiple points, curve tracing (Cartesian, parametric and polar). Envelops and Evolutes.

##### Unit-4

Reduction formulae, double and triple integrals, change of order of integration double integrals, change of variables in multiple integration.

##### Unit-5

Quadrature, ractification, volume and surface of solids formed by revolution.

#### Textbooks and References:

- Advanced Engineering Mathematics: E. Kreyszig, 9<sup>th</sup> ed., Wiley Eastern, 2011.
- Engineering Mathematics: Ram Babu, Pearson, India, 2010.
- Calculus Vol. 1 and 2: T.M. Apostol (2007) Wiley
- Calculus: M. Spivak (2006) Cambridge
- Calculus: J. Stewart (2012) Cengage Learning
- Calculus and Analytic Geometry: G.B. Thomas, R. Finney (1995) Addison-Wesley

#### CC-5 (II) Paper-II : Vector Geometry and Linear Algebra

**Duration: 3Hrs Max.Marks:60**

##### Unit-1

Continuity and differentiability of vector functions, unit tangent vector. gradient, directional derivatives, tangent plane and normal line. divergence and curl of a vector field.

#### **Unit-2**

Integration of vectors, theorems of Stock, Green and Gauss (statement and verification only). application to area

#### **Unit-3**

General equation of second degree, tracing of conics, polar equation of a conic. sphere, cone and cylinder.

#### **Unit-4**

Matrices, system of linear equations, Gauss elimination method, Elementary matrices, invertible matrices Gauss-Jordan method for finding inverse of a matrix. determinants, basic properties of determinants. Cofactor expansion, determinant method for finding inverse of a matrix, Cramer's rule. Vector space, subspace, Examples.

#### **Unit-5**

Linear span, linear independence and dependence, Examples Basis, dimension, extension of a basis of a subspace, intersection and sum of two subspaces, examples. Linear transformation, kernel and range of a linear map, rank-nullity theorem. Rank of a matrix, row and column spaces, solvability of system of linear equations, some applications. Inner product on  $\mathbb{R}^n$ , Cauchy-Schwarz inequality, orthogonal Gram-Schmidt orthogonalization process. Eigen values, Eigen vectors.

#### **Textbooks and References:**

1. Calculus Vol. 2: T.M. Apostol (2007) Wiley
2. Calculus: J. Stewart (2012) Cengage Learning
3. Calculus and Analytic Geometry: G.B. Thomas, R. Finney (1995) Addison-Wesley
4. Linear Algebra: K. Hoffman and R. Kunze (2009) Prentice-Hall
5. Finite Dimensional Vector Spaces: P. Halmos. (2012) Martino Fine Books
6. Introduction to Linear Algebra: G. Strang (2009) Wellesley Cambridge Press
7. Linear Algebra done right: S. Axler (2014) Springer
8. Linear Algebra with applications: Bretscher (2012) Pearson

between mind and matter.

∑ Secularism, democracy, equality, egalitarianism, culture, social institutions, social grouping, social behaviours, social and moral values, quality of life, social justice and their educational implications.

∑ Salient features of Emerging Indian Society- our cultural heritage, its compositeness, unity in diversity, our philosophical tradition, central teachings of Indian Philosophies: Contribution of Indian philosophical thinkers in curriculum development and teaching.

∑ Indian Social system and the place of social therein. Types of schools and their pattern of relationship with social system.

### **CC6 : CHILDHOOD AND GROWING UP**

Instructional Time: 4 periods/week

Max. Marks: 75

Exam. Duration: 3 Hours

Internal: 15

External: 60

#### **.Course Objectives:**

1. To develop an understanding of the basic concepts, methods and principles of Psychology and of Educational Psychology with reference to learning and teaching.
2. To develop an understanding of growth and development in various stages.
3. To develop an understanding about the various factors that affect learner like personality, intelligence, creativity and motivation.
4. To develop an understanding of the impact of social and psychological factors responsible

- for a balance development of personality of the learners.
5. To develop effective teaching skills in the teacher in the making.

### **Course Content**

#### **Unit - 1**

- (a) Educational Psychology: its meaning, methods, scope, functions and applications.
- (b) Psychology of adolescents: Growth and Development of the Learner: Growth and Development - Meaning, Principles (Physical, social, mental and Emotional Development) and their Implications for learning.
- (c) Heredity and Environment:

#### **Unit - 2**

- (a) Personality: meaning, types, factors responsible for shaping it, objective and Projective techniques of personality assessment.
- (b) Intelligence: meaning, Theories, measurement and role in learning.
- (c) Creativity: meaning, process, development and measurement.

#### **Unit - 3**

- (a) Concept of adjustment, adjustment as achievement, adjustment as process.
- (b) Frustration and conflict. Causes of maladjustment, role of teacher in minimizing maladjustment of learner.
- (c) Adjustment Mechanism: some common adjustment Mechanism,

#### **Unit - 4**

- (a) Individual differences: meaning, causes and their educational implications.
- (b) Education for exceptional children: Gifted children, delinquent children, socially deprived children.
- (c) Remedial measure and Learning material used for exceptional children.

#### **Unit - 5**

- (a) Mental hygiene: mental hygiene concept and characteristics, factor effecting mental health.
- (b) Methods of development of good mental health. How to improve mental health of teacher?
- (c) Psychotherapy: aims of psychotherapy, types of psychotherapy.

#### **Reference Books:**

1. Agarwal, J.C. Essentials of Educational Psychology Vikas Publishing House, Pvt. Ltd. 1995.
2. Bhatnagar, R.P. Educational Psychology, Meenakshi Publication, Kanpur
3. Chauhan, S.S. (2002), Advanced Educational Psychology, New Delhi: Vikas Publishing House. (Hindi & English)
4. Kakkar, S.B. (2001), Educational Psychology, New Delhi, Prentice Hall of India.
5. Lindgren, H.C. Educational Psychology in the classroom Macmillan, N.Y. 1956
6. Mangal, S.K. (2002), Advanced Educational Psychology, New Delhi : Prentice Hall of India. (Hindi & English)
7. Sharma, R.A. Fundamentals of Educational Psychology Lal Book Depot, Meerut, 1996
8. Skinner, B.F. Essentials of Educational Psychology Asia Publishing House, Bombay 1960 (Hindi & English)
9. Uday Shander, Advanced Educational Psychology, Sterling Publishers Pvt. Ltd. New Delhi. 1984

#### **Modes of Internal Assessment**

##### **Written tests**

#### **Marks**

**10**

##### **Any two Projects & Assignments from Practicum from the following**

**05**

1. Analysis of a learning situation and case study, using theoretical perspectives
2. Administration of any one standardized tests (Intelligence/aptitude/ attitude/ creativity) and preparation of psychological assessment report.
3. Prepare a critical report on implications of any one theory of learning – Piaget, Erickson and Bandura.

Select a child with learning problem and carry out academic assessment in any one subject, identify the remedial measures and prepare a report.

**Group C: Developing Teacher Sensibilities Section I: Experiences for Teacher Enrichment**

**ETE 1: Enriching Learning through Information and Communication Technology**

**Instructional Time: 2 periods/week**

**Max. Marks: 50 Internal: 50**

**Objectives of the Course:**

On the completion of the Course, the student teacher will be able to

- recognise, understand and appreciate ICT as an effective learning tool for learners and as an enormous functional support to teachers.

**Course Outline:**

**Unit I: Relevance of ICT in education (Radio, Television, Computers)**

- Role of information technology in construction of knowledge
- Possible uses of audio-visual media, computers, internet, subject specific software.
- Technological Pedagogical Content Knowledge (TPCK)

**Unit II: Visualising Learning situation using Multimedia**

- Use of radio and audio media: Script writing, storytelling, songs, etc.
- Using appropriate software (single and multiple media animations and simulation)
- Exploring ICT for teaching-learning, curriculum analysis to determine methods of transacting
- Classroom organisation for ICT infused lessons ( Teacher led instruction, Self-learning and group activities)

**Unit III: Visualising technology-supported Learning Situations**

- Preparation of learning
- Schemes. Interactive use of
- Digital content.
- Focusing on enhancing learning-appropriate technology.
- Developing PPT slide show for classroom use.
- Use of available software or CDs with LCD projection, smart board for subject learning interactions.
- Generating subject- related demonstration using computer software.

**Unit IV: Internet Based Tools**

- Web 2.0 Tools
- Engaging in professional self-development. Collaborative learning tasks.
- Interactive use of ICT: Participation in Google / Yahoo groups, creation of blogs, etc.
- Innovative usage of technology: some case Studies.
- Use of technology integration in resource-plenty as well as resources-scare situations.
- Critical issues in internet usage - authenticity of information, addiction, plagiarism, downsides of social networking group.

**Unit V: ICT for Evaluation**

- Evaluation and ICT for Evaluation-
- purposes Exploring software tools for evaluation
- Focusing on enhancing Learning-tracking and managing students. Exhibition and peer evaluation of project lessons. Portfolio submissions and evaluation.

### Modes of Learning Engagement:

- Providing opportunities for group activities.
- Group/Individual Presentation.
- Providing opportunity for sharing idea.
- Exploring to exemplar constructivist-learning situation.
- Designing and setting up learning models.
- Audio- Visual Presentation followed by its analysis and discussion.

### Practical:

- Functional knowledge of operating computers-on/off, word processing, use of PowerPoint, Excel.
- Computer as a learning tool
- Effective browsing of the internet for discerning and selecting relevant information.
- Survey of educational sites based in India.
- Downloading relevant material.
- Cross collating knowledge from varied sources.
- Competencies in developing original software.
- Practical exercise on windows and office package.
- Trouble shooting and seeking help.
- Installing hardware and software.
- Synchronous communication on the web.
- Project using Web 2.0 Tool.
- Use of Smart board / interactive board.
- 

### Modes of Internal Assessment

	Marks
Written tests	10
Presentation and Communication skills in subject specific matters	10
Designing innovative learning situations	10
Performance in-group activity	10
Reflective written Assignments	10

### Suggested Readings:

1. Imran R. Shaikh. Introduction to Educational Technology & ICT McGraw Hill Education (India) Private Limited (21<sup>st</sup> August, 2013).
2. Chris Abbott. ( 2001). ICT Changing Education. Psychology Press (2<sup>nd</sup> September, 2003).
3. Saxena. (2009). ICT in Professional Education. New Delhi. Aph Publishing Corp.
4. Gwen Solomon, Lynne Schrum. Web 2.0 New Tools, New Schools. International Society for Technology in Education (15<sup>th</sup> October, 2007).
5. Gwen Solomon, Lynne Schrum. Web 2.0 How-To for Educators. International Society for Technology in Education (15<sup>th</sup> October, 2010).
6. Debra Geoghan. Visualizing Technology, Introductory(3<sup>rd</sup> Edition). Prentice Hall(18<sup>th</sup> May, 2014).
7. Laxman Mohanty & Neharika Vohra. ICT Strategies for schools. New Delhi. SAGE Publication, (6<sup>th</sup> October, 2006).
8. Ed Bott, Carl Siechert, Craig Stinson. Windows 7 inside Out. New Delhi. PHI Learning Private Limited, (3<sup>rd</sup> October, 2009).
9. David J emberton & J Scott Hamlin. Flash 4 Magic. New Delhi. Techmedia, (11<sup>th</sup> January, 2000).
10. Andy Rathbone. Windows 8 for dummies. John Wiley & Sons (23<sup>rd</sup> November, 2012)
11. Beth Melton. ( 2013). Microsoft Office Professional step by step. Microsoft Press



- (14 June, 2013).
12. Douglrs E Corner. The Internet Book , Everything you need to About Computer Networking and Now the Internet works (4th Edition) Addison-We sky (29 August 2006)
  13. Preston Gralla. How the Internet Works ( 8<sup>th</sup> Edition) Que Publishing (1<sup>st</sup> December 2006)
  14. J. Michael, Stracz ynski. The Complete Book of scriptwriting. Writer Digest Books (1<sup>st</sup> July, 2002)

**Section I: Experiences for Teacher Enrichment ETE 2: Yoga, Health and Well being**

**Instructional time: 2 periods/ week**

**Max. Marks: 50**

**Internal:50**

**Objectives of the Course:**

On completion of the course, the student teacher will be able to:

- understand the importance of games, sports and yoga for development of holistic health.
- know the status, identify health problems and be informed of remedial measures.
- know about safety and first aid.
- acquire the skills for physical fitness.
- practice yogasanas, meditation and relaxation.
- understand various policies and programmes related to health, physical education and yoga.

**Course Outline:**

**Unit I: Yoga for holistic Health**

- Meaning and definition of Yoga- Need, importance and scope
- Yoga- A way of healthy and integrated living
- Yoga- A way of socio-moral upliftment of individual
- Ashtang yoga
- Characteristics of a Yoga practitioner and prerequisites of yoga practices

**Unit II: Health & Well being**

- Concept of health, importance, dimensions and determinants of health, health needs of children and adolescents including differently abled children.
- Understanding of the body system – skeleton, muscular, respiratory circulatory and digestive in relation to health.
- Effects of exercise on skeleton, muscular, respiratory circulatory and digestive systems.
- Common health problems and diseases- causes, prevention and cure, immunization and first aid with special reference to rapidly increase of diabetes and cardiac disorders.
- Food and nutrition, food habits, nutrients and their functions, control over obesity.

**Unit III: Athletics and Games**

- Athletics – general physical fitness exercises.
- Games – lead up games, relays and major games.
- Rhythmic activities, gymnastics and their impact on health.
- Olympic movement.
- Development of motor components, speed, strength, endurance, flexibility, agility and coordinative ability

**Modes of Learning Engagement:**

Interactive discussions, group work, sharing experiences, organizing activities, analysing topics on health related issues, demonstrations, observations, field visits,

preparing work books, maintaining diary, participating in school health check up, practical classes of first aid, projects and assignments. Playing games and sports and performing Asanas and Pranayamas

### **Practical –Games, Sports and Yoga**

Rules regulations related to games, sports and yoga, Playing Volleyball, Basketball, Badminton and recreation games. Performing Suryanamaskara and selected yogasanas, mudras and pranayamas.

- Standing Asanas- Konasana, Trikonasana, Vrikshasana, Tadasana
- ∑ Sitting Asanas – Vajrasana, Gumukhasana, Navasana, Veerasana
- ∑ Lying on the stomach – Bhujangasana, Dhanurasana
- ∑ Body twisting asanas – Ardha Matsyendrasana, Vakrasana
- ∑ Back bending – Ushtrasana
- ∑ Mudras – Arham, Ananda Mudra
- ∑ Pranayama – kapalbhati, Anuloma-viloma, Bhramari, udgeeth, sheetali and sheetkaali.

<b>Modes of Internal Assessment</b>	<b>Marks</b>
Written tests	10
Performance – Games, Sports and Yoga	40

### **Suggested Readings:**

1. Pande, P.K. (1988). Sports Medicine. Delhi. Khel Sahitya Kendra.
2. Larry G. Shaver. (1982). Essentials of Exercise Physiology. Delhi. Surjeet Publications.
3. Kanabur Vyjayanthi V. (2007). Sports Nutrition the Scientific Facts. New Delhi. Kanishka Publishers.
4. Dheer. S. Kamal Radhika (2002). Organization and Administration of Physical Education. Friends Publications.
5. Chandler Timothy, Mohin Mike, Vamphew Wary (2007). Sports and Physical Education. London. Routledge Taylor Francis Group.
6. Verma Veena (1999) Sports Psychology. Delhi. Sports Publication.
7. Prakash, Agam (1999) A Textbook of Health Education. Delhi. Sports Publication.
8. Uppla A.K. (1996). Physical Fitness. New Delhi. Friends Publication.
9. Thani Lokesh (2003) Rules of Games and Sports. New Delhi. Sports Publication.
10. Sonkar Sathish. (1998). Methods, Measurement and Evaluation in Physical Education. Jaipur. Book Enclave.
1. NCERT, Position Paper, FGR (2006). Health and Physical Education. New Delhi. NCERT.
12. Seetharam AR (1996) Yoga for Healthy Living. Mysore. Paramahansa Yogashrama.
13. Ganguly, S.K., Bera, T.K., Gharote, M.L. (2003) Yoga in relation to Health related physical fitness and academic achievement of school boys. In Position Paper, FGR (2006). Health and Physical Education. New Delhi. NCERT.
14. Gharote, M.L. (1976). Physical Fitness in relation to the practice of selected yogic exercises. In Position Paper, FGR (2006). Health and Physical Education. New Delhi. NCERT.
15. Kulkarni, D.D. (1997). Yoga and Neurophysiology. In Position Paper, FGR (2006). Health and Physical Education. New Delhi. NCERT.

## **Section II : Experiences for Social and Environmental Sensitivity SES 1 - Work Experience: Electricity and Electronics**

Instructional time: 1 period/week (Theory)	Max. Marks: 50
2 periods/ week (Practicum)	Min. Pass
Marks: 18 Exam. Duration: 3 Hours	(Internal Examination)

Objectives of the Course:

On completion of the course, the student teacher will be able

- to recognize and use different
- tools/materials/instruments. read the sketch/drawing of
- the job/project.
- develop the skills for making simple projects/models.
- acquire skill to assemble/prepare simple electric circuits.
- acquire skill to use electronic components.
- identify faults in electronic components.
- develop the ability in repairing simple instruments used at secondary level.
- inculcate healthy values related to work culture.\

Course

outline :

**Unit I**

Symbols, Tools and Soldering: Precautions used for making any electrical connection, Identification of conductors & insulators. Symbols for electrical components, knowledge of electrical accessories and their rating.

Tools used for making any electrical connection, their sizes and use.

Hand soldering, Soldering alloy, soldering flux and desoldering pump. Practice of hand soldering.

**Unit II**

Wires, Wirings and connections of lamps: Different types of wire, use of SWG, Different types of wiring such as: Batten wiring, CTS wiring, casing capping wiring, Cleat and conduit wiring. Their advantage and disadvantage on each other.

Series and parallel connections of lamps (up to four lamps). Staircase wiring of one, two and three lamps, Godown wiring, connection for fan.

**Unit III**

Switches and Measuring Devices :Selection of fuse wire and use of DP and TP Switches. Knowledge of power consumed in Different Electrical and electronics gadgets.

Testing of energy meter, connection of energy meter and checking of electrical bills. Construction of Multi meter and knowledge of measuring the current, voltage and resistance in any circuit by using multimeter.

**Unit IV**

Electrical Components and Appliances: Colour coding in resistor and Capacitor, use of resistor and capacitor in electrical appliances, Understanding the working of electrical appliances: Electric iron, room heater, Immersion heater, geyser, Electric bell, emergency light

## Unit V

Electronic Components and Their Use :Semiconductor materials, Semiconductor diode, Diode testing, Zener diode, LED, Photo diode, Solar cell, Rectification by diodes, Voltage multiplication by diodes.

Modes of Learning Engagement:

Constructivist Approach: Hands on Experiences, Activity based Learning, Experimentation, Interactive engagement. Group Work, Peer Learning, Project Work.

Practicum :

Preparation of Projects/Models based on the following (Only Suggestive) Clap

- switch
- IR Remote switch (fan, tube light)
- Remote operated musical bell Alarm
- for luggage security
- Mobile cell-phone charger using cell
- Power supply failure alarm
- Blown fuse indicator
- Rectifier
- Voltage Multiplier
- Transistor Amplifier

Modes of Internal Assessment	Marks
Written Tests	10
Exam. and Projects	40

Suggested Readings :

1. Electrician – I Year Trade Theory 2007, National Instructional Media Institute, Chennai
2. Electrician – II Year – Trade Theory, 2007 national Instructional Media Institute Chennai
3. P.S. Bhimbhara (2007) Electrical Machinery. Krishna Publisher Delhi.
4. N.N. Bhargava, DC Kulshrestha and SC Gupta, Basic Electronics and Liner Circuits. Tata Mc. Graw Hills Ltd. New Delhi (2000)
5. B.L. Theraja, Basic Electronics, S.Chand New Delhi, (2005)

## SES 1 - Work Experience - Agriculture (Practices)

Instructional time: 1 Period/Week (Theory) Max. Marks: 50

2 Periods/ Week (Practicum) Min. Pass Marks 18

Exam. Duration : 3 Hours (Internal Examination)

Objectives of the Course

On completion of the course, the student teacher will be able to

- understand the meaning and scope of agriculture. understand all
- about seeds, imported weed, manures etc.
- acquire skills to practices of seed sowing, planting materials etc.
- understand practices of different ornamental and horticulture crops.
- recognise different field practices like earthing, hoeing, weeding watering etc.
- inculcate healthy values related to work culture.

**Course Outline:**

### Unit I

Agriculture: Meaning, definition, scope, history, branches and objectives.

### Unit II

Soil Science: Definition of pedology, soil management, soil erosion, soil conservation practices; structure of soil, soil profile; soil fertility and productivity, essential plant nutrients. Fertilizers and manures including bio-fertilizers.

Identification of manures and fertilizers.

### **Unit III**

Irrigation: Definition, method of irrigation, systems of irrigation, drainage, irrigation pattern of India.

### **Unit IV**

Horticulture: Definition, branches of horticulture, layout of orchards, propagation by seeds and by vegetative means; Pot filling technique; Planning, planting and maintaining lawn; Practice related to landscaping.

### **Unit V**

Agricultural practices: Preparation of land, selection of seeds, watering, thinning, hoeing and weeding, harvesting of crop, identification of important agricultural tools, trees and crop plants. Minor project preparation on agriculture.

Modes of Learning Engagement: Hands on experiences, Activity based learning, Experimentation, Interactive engagement, Group work, Peer learning, Project work.

Practicum :

- (a) Identification of an agronomy of following crops:  
Wheat, Bajra, Maize, Rose etc.
- (b) Agricultural Processes:  
Irrigation, Training and Pruning, Hoeing and Weeding, Seed Bed preparation, Nursery Management.

Modes of Internal Assessment	:	Marks
Written test	:	10
Exam and project	:	40

### **Suggested Readings:**

1. Jitendra Singh, Basic Horticulture (Kalyani Publishers, New Delhi, 2012).
2. Dr. Jaiveer Sing, Plant Propagation & Nursery Husbandry (Rama Publishing House, Meerut, 2002).
3. Dr. Rajveer Singh & Dr. O.P. Rajput, Principles of Agronomy, Scientific Crop Production (Kushal Publications and Distributors, Varanasi, 2008).  
Dr. K.N. Dubey, Fruit Production in India (Rama Publishing

On completion of the course the student teacher will be able to:

- express freely their ideas and emotions about different aspects of life through different art forms.
- learn to appreciate different art forms and distinguish them.
- develop an insight towards sensibility and aesthetic appreciation and become more creative and conscious about the good and beautiful in their environment, including classroom, school, home and community through an integrated learning approach.
- integrate the knowledge of art with daily life through learning with different media and techniques by using creative expression and making objects of common use.
- make learners conscious of rich cultural heritage of their own region as well as that of the nation.
- get acquainted with the life and work of artists.

**Course Components:** This course as part of the four year B.Sc. B. Ed. programme will consist of theory, practical, project work and workshop. Also, the arts need to be applied in day to day life from designing classroom materials to notice board, cultural festivals, theme based celebrations, national days, festivals etc. These occasions will be a forum for students' activities wherein all the art forms will be integrated.

**Theory:**

- Concepts and forms of arts and aesthetics- an introduction: Meaning of arts and aesthetics, visual art forms and performing art forms.
- Significance of art in education: Importance of art forms in learning.
- Integrating arts and aesthetics in school curriculum as a pedagogical support/ resource: education through arts and aesthetics.
- Different ways/methods to integrate arts in education: during the curriculum transaction.
- NCF 2005 and position paper on Arts on Aesthetics.
- ∑ Knowing about local art forms: the diversity of India's arts its integration in the curriculum.

**Project:**

- The student-teacher can take a theme-based project from any of the curricular areas covering its social, economic, cultural and scientific aspects integrating various art and craft forms.
- They can do an analysis of textbooks - where they can find a scope either in the text or in the form of activities or exercises to integrate art forms.
- They can also document processes of an art or craft form from the pedagogical point of view; such as weaving or printing of textiles, making of musical instruments, folk performances in the community etc. - how the artists design their products, manage their resources including raw materials, market it, what problems do they face etc.
- A lived tradition of any artistic school devoted to traditional or folk arts can be studied by student-teachers available in their surrounding or locality.

**Workshop:**

A workshop for one week of working with artist or a group of artists (theatre, music, dance etc.) to learn basics of art forms and understand its pedagogical aspects is required for student-teacher in first year of the programme. The forms learnt during the course will help student-teachers in their profession, as a means of exploring different media and creative expressions such as drawing, painting, clay-work/pottery, collage-making, wood-work, toy-making, theatre, puppetry, dance, music etc. including regional and folk forms of arts, which will be helpful in imparting quality education among school children. The focus of the workshop will be on how art forms can be used as pedagogy for various subjects belonging to science/social science streams.

### **Modes of Learning Engagement:**

- Workshop environment will be interactive and discussions will take place wherein student-teachers can document their experiences as an artist and connoisseur both.
- Attending exhibitions and performances, interacting with artists and craft persons, watching and listening art related films, audio and video materials available on different performers, regional/ folk art forms etc. may also be shown from time to time.
- Projects and assignments may be given for individual learners as well as for group work.
- Workshop will be conducted in such environment wherein student teachers can get a firsthand experience of working with artists, handle different materials and media, learn about different aspects of art forms on how it relates to the society and community and can be used as pedagogical tool to transact.
- A small Resource centre may be a part of all RIE, where materials including books, CDs, audio, video cassettes, films, software, properties etc. are available.

### **Practicum:**

- Activities related to doing arts, including application of arts in the immediate environment small activities, which enhances the skills including the communication and presentation skills, brings in imagination, creativity and aesthetic sensibility among the student teachers.
- Application of aesthetic and design sensibility in the day to day life, in their profession and environment are some of the practical aspects, which needs to be taken care of. During the celebrations of festivals, functions, special days etc. this will be reflected.

### **Modes of Internal Assessment:**

The engagement of teacher-learners in the above set of experiences should be quantitatively and qualitatively evaluated, based on observations and submissions of projects and assignments that cover: a) submission of work b) participation c) creative potential displayed d) application of aesthetic and design sensibility in campus events or in other course work.

- Letter Grade	- Grade Point
- O (Outstanding)	- 100
- A+(Excellent)	- 90-99
- A(Very Good)	- 80-89
- B+(Good)	- 70-79
- B(Above Average)	- 60-69
- C(Average)	- 50-59
- P (Pass)	- 40-49
- F(Fail)	- Below 40
- Ab (Absent)	- 0

### **Suggested Readings:**

1. Arnold Berleant (2012). Aesthetics Beyond the Arts. New and Recent Essays. Ashgate Publishing.
2. Goldblatt D (2010). Aesthetics A Reader in Philosophy of the Arts. New Delhi. Pearson Education (singapore) pte.

3. Dennis Atkinson D Atkinson (2003). Art in Education: Identity and Practice. Springer.
4. Parul Dave-Mukherji (2015). Arts and Aesthetics in a Globalizing World. UK. Bloomsbury Publishing.
5. Perry Ellen (2005). The Aesthetics of Emulation in the Visual Arts of Ancient Rome. Cambridge University Press.
6. Saxena, S. K. (2010). Aesthetics. Approaches Concepts and Problems. D.K. Printworld (P) Ltd.
7. S. S. Barlingay. (2007). Modern Introduction of Indian Aesthetic Theory. D. K. Printworld.
8. Weitz Morris (2005). Philosophy of the Arts: An Introduction to Aesthetics. Routledge Chapman & Hall.



**B.Sc. B.Ed. Part II Group B : Core  
Course (CC)  
CC – 1 PHYSICS**

Scheme	Exam Duration	Max. Marks	Min. Pass Marks
Paper I	3hrs.	40	54
Internal		10	
Paper II	3hrs.	40	
Internal		10	
Paper III	3hrs.	40	18
Internal		10	
Practical	5hrs.	50	

**Note:** There will be two experiments. The distribution of marks will be as follows:

Two experiments (one from each group)	30 marks
Each of 15 marks	10 marks
Viva voce Record	10 marks
Total	50 marks

**CC – 1 (I) - PAPER I : ELECTRICITY  
AND MAGNETISM Duration- 3 hours Max. Marks: 40 .**

**Unit – I**

Coulomb's law, calculations of E for simple distributions of charges at rest, dipole and quadrupole fields, Work done on a charge in an electrostatic field, conservative nature of the electrostatic field, Electric potential, relation between electric field and electric potential, torque on a dipole in a uniform electric field and its energy, flux of the electric field, Gauss's law and its application for finding E for symmetric charge distributions, Gaussian pillbox, Fields at the surface of conductor, Screening of E field by a conductor, capacitors, electrostatic field energy, force per unit area of the surface of conductor in an electric field, conducting sphere in a uniform electric field, point charge in front of a grounded infinite conductor.

**Unit –II  
Dielectrics**

Parallel plate capacitor with a dielectric, dielectric constant, polarization and polarization vector, displacement vector D, molecular interpretation of Claussius – Mossotti equation, boundary conditions satisfied by E and D at the interface between two homogenous dielectrics: illustration through simple examples.

**Unit –III**

**Electric Currents (steady and alternating)**

Steady current, current density J, non-steady currents and continuity equation, Kirchoff's law and analysis of multiloop circuits, rise and decay of current in LR and

CR circuits, decay constants, transients in LCR circuits, AC circuits, complex numbers and its application in solving AC circuit problems, complex impedance and reactance, Measurement of capacitance using impedance at different frequencies, series and parallel resonance, Q factor, power consumed by an AC circuit, power factor, Y and — networks and transmission of electric power.

## Unit-IV

### Magnetostatics

Force on a moving charge: Lorentz force, equation and definition of B, force on a straight conductor carrying current in a uniform magnetic field, Torque on a current loop, magnetic dipole moment, angular momentum and gyromagnetic ratio. **Motion of charged particles in electric and magnetic fields.** Linear accelerator, E as deflecting field – CRO, sensitivity. Transverse B field, curvatures of tracks for energy determination of nuclear particles, principle of a cyclotron. Mutually perpendicular E and B fields- mass spectrograph, velocity selector, its resolution. Response curve for LCR circuit and resonance frequency, quality factor.

## Unit - V

### Magnetic Fields in Matter

Biot-Savart law, calculation of H in simple geometrical situations, Ampere's Law, the divergence and curl of B, field due to a magnetic dipole, magnetization current, magnetization vector, magnetic permeability (linear cases), interpretation of a bar magnet as a surface distribution of solenoidal current, the field of a magnetized object.

### Textbooks and references

Barkeley Physics Course; Electricity and Magnetism, Ed. E.M. Purcell (McGraw- Hill).

Halliday and Resnik; Physics, Vol 2.(Wiley Eastern)

D.J. Griffith; Introduction to Electrodynamics (Prentice-Hall of India). Reitz and Milford; Electricity and Magnetism (Addison-Wesley).

A.S.Mahajan and A A Rangwala; Electricity and Magnetism (Tata McGraw-Hill).

A.M. Portis; Electromagnetic Fields.

Pugh and Pugh; Principles of Electricity and Magnetism (Addison-Wesley). Panofsky and Phillips; Classical Electricity and Magnetism (India Book House). S.S.Atwood; Electricity and Magnetism (Dover).

## CC – 1 (II) - Paper II: KINETIC THEORY AND THERMODYNAMICS

**Duration- 3 hours Max. Marks:40**

### Kinetic Theory of Matter

#### Unit - I

**Ideal Gas:** Kinetic model, deduction of Boyle's law, interpretation of temperature, estimation of rms speeds of molecules, Brownian motion, estimate of the Avogadro number, Equipartition of energy, specific heat of monoatomic gas, extension to di- and triatomic gases, Behaviour at low temperatures, Adiabatic expansion of an ideal gas, applications to atmospheric physics.

**Real Gas:** Van der Waals gas, equation of state, nature of Van der Waals forces, comparison with experimental P-V curves, The critical constants, gas and vapour, Joule expansion of ideal gas and of a Van der Waals gas, Joule coefficient, Joule- Thomson effect.

#### Unit - II

**Liquefaction of gases:** Boyle temperature and inversion temperature, Principle of regenerative cooling and of cascade cooling, liquefaction of hydrogen and helium, Refrigeration cycles, meaning of efficiency.

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

### Thermodynamics

#### 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, reversible and irreversible changes, Carnot cycle and its efficiency, Carnot theorem and the second law of thermodynamics, Different versions of the second law, practical cycles used in internal combustion engines, Entropy, principle of increase of entropy, The thermodynamic scale of temperature, its identity with the perfect gas scale, Impossibility of attaining the absolute zero temperature, third law of thermodynamics.

#### Unit - IV

**Thermodynamic relationships:** thermodynamic variables- extensive and intensive, Maxwell's general relationships, application to Joule – Thomson expansion and adiabatic cooling in a general system, Van der Waals gas, Clausius-Clapeyron heat equation, Thermodynamic potentials and equilibrium of thermodynamical systems, relation with thermodynamical variables, Cooling due to adiabatic demagnetization, production and measurement of very low temperatures.

#### Unit - V

**Blackbody radiation:** Pure temperature dependence, Stefan-Boltzmann law, pressure of radiation, Spectral distribution of blackbody radiation, Wein's displacement law, Rayleigh-jean's law, Planck's quantum postulates, Planck's law, complete fit with experiment, interpretation of behaviour of specific heats of gases at low temperature.

#### Textbooks and References

1. M.W.Zemansky Heat and Thermodynamics (Mcgraw-Hill Book Company)
2. M.N. Saha, B.N.Srivastava A Treatise on Heat (The Indian Press, (Publication) Pvt. Ltd. Allahabad)
3. M.N. Saha, B.N.Srivastava A Textbook of HeatA (Science Book Agency, Calcutta)
4. A. N. Matveev Molecular Physics (Mir Publishers, Moscow, 1985)
5. Joseph O. Hirschfelder et al Molecular Theory of Gases and Liquids (John Wiley & Sons, Newyork)
6. K.S. Pitzer, L. Brewer, Thermodynamics (Mc Graw Hill Book Company)
7. S.C.Garg, R.M. Bansal, C.K. Ghosh, Thermal Physics (Tata McGraw Hill Publishing Company Ltd.)
8. Samuel Glasston, Thermodynamics for Chemists (Affiliated East West Press Pvt. Ltd., New Delhi)
9. Yu. B. Rumer, M. Sh. Ryvkin Thermodynamics, Statistical Physics and Kinetics (Mir Publishers, Moscow)
10. S.S. Singhal, J.P. Agarwal, Satya Prakash, Heat and Thermodynamics (Pragati Prakashan, Meerut).

### CC – 1 (III) - Paper III: OPTICS AND LASERS

**Duration : 3 hours**

**Max. Marks : 40**

#### Optics

##### Unit I

**Aberration in images:** Chromatic aberrations, achromatic combination of lenses in contact and separated lenses, Monochromatic Aberration and corrections, aplanatic points of a spherically refracting surface and sphere, oil immersion objectives, meniscus lens.

**Optical instruments:** Entrance and exit pupils, Need for a multiple lens, eyepiece, common types of eyepieces.

##### Unit – II

**Interference of a light:** Division of wavefront and division of amplitude, The principle of superposition, two-slit interference, Fresnel biprism, thin film interference, Newton's rings, application of interference in determination of wavelength and precision measurements.

**Haidinger fringes:** fringes of equal inclination, Michelson interferometer, its application for precision determination of wavelength, wavelength difference and the width of spectral lines, Intensity distribution in multiple beam interference, Fabry- Perot interferometer.

##### Unit - III

**Fresnel diffraction:** Fresnel half-period zones, Types of zone plates, Circular aperture, Circular disc, Diffraction at a straight edge, Construction and working principle of Zone plate and its application as a lens. **Fraunhofer diffraction:** Phasor diagram, Diffraction at a single slit, double slits & N parallel slits and their intensity distribution, plane diffraction grating, reflection grating and blazed grating, Concave grating and different mountings, diffraction at a circular aperture. Rayleigh criterion of Resolution, Resolving power of Telescope, Microscope, Grating and Prism.

#### Unit IV

**Polarization and Optical Rotation:** Meaning and representation of Polarized light, Types of polarized light, Production of Polarized light, Brewster law, Malus law, double refraction, Phase retardation plates, Analysis of Polarized light as plane polarized, circularly polarized and Elliptically polarized light, Rotation of plane of polarization, Specific rotation and its experimental determination, Polarimeter (Laurent and Biquartz).

#### Unit – V

**Lasers:** Laser system, Radiative and Non-radiative Transition mechanisms, Basic necessity for a Lasing device, Purity of a spectral line, coherence length and coherence time, spatial coherence of a source, Einstein's A and B coefficients, Spontaneous and Induced emissions, conditions for laser action, population inversion. Construction, Working principle and Applications of Ruby laser, He-Ne Laser and Semiconductor lasers, spatial coherence and directionality, estimates of beam intensity, temporal coherence and spectral energy density.

Basic concepts of Holography, Construction of a Hologram and reconstruction of the image.

#### Textbooks and References

1. A. K. Ghatak, Physical Optics – Tata McGraw-Hill Publishing Co. Ltd, New Delhi.
2. D. P. Khandelwal, Optics and Atomic Physics (Himalaya Publishing House, Bombay, 1998).
3. F. Smith and J.. Thomson; Manchester Physics series; Optics (English Language book Society and John Wiley, 1977).
4. Bom and Wolf; Optics.
5. K. D. Moltev; Optics (Oxford University Press)
6. Sears; Optics.
7. Jenkins and White; Fundamental of Optics (McGraw-Hill)
8. Smith and Thomson; Optics (John Wiley and Sons).
9. A.K. Ghatak, Physical Optics
10. B.B. Laud; Lasers and Non-linear Optics (Wiley Eastern 1985)

#### PRACTICALS

##### B.Sc.B.Ed. Part-II

**Duration: 5 hours**

**Max. Marks: 50**

**Min. Pass Marks : 18**

Any twelve out of the following experiments are to be conducted. Few more experiments may be set at the institutional level.

1. Determination of wavelength of light using diffraction grating.
2. To find out the wavelength of a monochromatic source of light using Newton's rings and find the refractive index of liquid.
3. Find out the wavelength of a given monochromatic (Sodium light) source using Michelson's interferometer and determination of  $D_1$  &  $D_2$ .
4. Determination of wavelength using Biprism.
5. Determine the specific rotation of sugar solution by Polarimeter.
6. Study of polarization by reflection from a glass plate with the help of Nichol prism and Photo cell and verify Brewster's law.
7. Find out the melting point of a given substance using platinum resistance thermometer.
8. Determine thermal conductivity of a bad conductor by Lee's method.
9. Determine the thermodynamic constant  $\gamma = C_p/C_v$  using Clements's and Desormas method.
10. Study of variation of total thermal radiation with temperature.
11. Determination of Stefan's constant.
12. Study thermo emf versus temperature of a thermo couple. Find the neutral temperature and use it to find temperature of an unknown substance.
13. Study the magnetic field along the axis of a current carrying circular coil for different currents. Plot the observations on a graph and find out the radius of a circular coil.

14. Determination of band gap using a junction diode.
15. Determination of power factor ( $\cos \phi$ ) of a given coil using CRO.
16. Determination of velocity of sound in air by standing wave method using speaker microphone and CRO.
17. Measurement of inductance of a coil by Anderson's bridge.
18. Measurement of Capacitance and dielectric constant of a liquid by desauty bridge.
19. Determination of a small thickness by interference method.
20. Study the characteristics of a transistor and determine alpha and beta values.
21. Determination of Resolving Power of Telescope.

#### Laboratory tutorials

1. Calculation of days between two dates of a year
2. To check if triangle exists and the type of the triangle
3. To find the sum of the sine and cosine series and print out the curve
4. To solve simultaneous equations by elimination method.
5. To prepare a mark-list of polynomials.
6. Fitting a straight line or a simple curve a given data.
7. Convert a given integer into binary and octal systems and vice versa
8. Inverse of a matrix
9. Spiral array

#### CC 2 CHEMISTRY

Scheme	Exam Duration	Max. Marks	Min. Pass Marks
Paper I	3hrs.	40	36
Internal		10	
Paper II	3hrs.	40	36
Internal		10	
Practical	5hrs.	50	18

**Note :** There will be two experiments. The distribution of marks will be as follows: Three experiments (one from each group)

Experiments (3)	40 marks
Viva	05 marks
Record	05 marks
<b>Total</b>	<b>50 marks</b>

#### CC 2 (I) Paper-I INORGANIC CHEMISTRY

**Duration- 3 hrs.**

**Max. Marks:40**

##### Unit I Coordination Compounds

Werner's coordination theory and its experimental verification, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes. Limitations 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.

##### Unit II Chemistry of Lanthanide and Actinides

**(A) Chemistry of Lanthanide:** Occurrence and separation, Electronic structure, oxidation states and ionic radii and lanthanide contraction, spectral and magnetic properties, complex formation and applications.

**(B) Chemistry of Actinides:** Electronic configuration, oxidation states, actinide contraction, complex formation spectral and magnetic properties, applications. Chemistry of separation of Np, Pu and Am from Uranium, similarities between the later actinides and later lanthanides.

### Unit III Organometallic compounds

Definition, nomenclature and classification of organometallic compounds, Preparation, properties, bonding and applications of alkyls and aryls of Li, Al, Hg, Sn and Ti, a brief account of metal-ethylene complexes and homogenous hydrogenation.

### Unit IV Carbonyls and Nitrosyls

**(A) Metallic carbonyls:** Metallic carbonyls General methods of Preparation, general properties, structure and nature of Metal carbonyls, bonding in carbonyls, Effective atomic number (EAN) rules as applied to metallic carbonyls. 18-electron rules applied to metallic carbonyls. Preparation, properties and structure of nickel tetracarbonyl, iron penta carbonyls, chromium hexa carbonyls, dimanganese deca carbonyl, dicobalt octa carbonyl.

**(B) Metallic nitrosyls:** Some metallic nitrosyls: Metal nitrosyl carbonyls, metal nitrosyl halides, sodium nitroprusside (Preparation properties, structures and uses) structure and nature of M-N bonding in nitrosyl. Effective atomic number (EAN) rules as applied to metallic nitrosyls.

### Unit V Stability of Metal complexes and Oxidation Reduction (A) Thermodynamic and

#### **Kinetic Aspects of Metal Complexes:** A brief outline

of thermodynamics stability of metal complexes and factors affecting the stability, stability constants of complexes and their determination, substitution reactions of square planar complexes.

**(B) Oxidation 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.

### Textbooks and References

1. R. C. Mehrotra and A. Singh Organometallic Chemistry :A Unified Approach, Wiley
2. A. G. Sharp Inorganic Chemistry, Pearson
3. Bell and Lott Modern approach to Inorganic chemistry, Van Nostrand
4. Emelns and Anderson Principles of Inorganic Chemistry–
5. G. L. Miessler and D. A. Tarr Inorganic Chemistry, Prentice Hall
6. Cotton and Wilkinson, Advanced Inorganic Chemistry, 6th Edition, Wiley
7. Lee, J.D. Concise Inorganic Chemistry, ELBS.
8. Douglas, B.E. and Mc Daniel, D.H., Concepts & Models of Inorganic Chemistry
9. Day, M.C. and Selbin, J. Theoretical Inorganic Chemistry, ACS Publications
10. Shriver and Atkins Inorganic Chemistry, W. H. Freeman and Company
11. James Huheey, Inorganic chemistry: Principles of Structure and Reactivity, Pearson Education India
12. B.N. Figgis, J.E Huheey, P.W. Atkins Inorganic Chemistry, Pearson Education

### CC 2 (II) - Paper II ORGANIC CHEMISTRY

**Duration- 3 hours Max. Marks:40**

### Unit I Fundamentals of Organic Chemistry

**(A) Structure and Bonding:** Hybridization, bond lengths and bond angles, bond energy, localized and delocalized chemical bonding, van der Waals interactions, inclusion compounds, clathrates, charge transfer complexes, resonance, hyperconjugation, aromaticity, inductive and field effects, hydrogen bonding.

**(A) Mechanism of Organic Reactions:** Curved arrow notation, drawing electron movements with arrows, half-headed and double-headed arrows, homolytic and heterolytic bond breaking, Types of reagents – electrophiles and nucleophiles, Types of organic reactions, Energy considerations. Reactive intermediates – Carbocations, carbanions, free radicals, carbenes, arynes and nitrenes (with examples). Assigning formal charges on intermediates and other ionic species. 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 center, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centers, diastereomers, threo and erythro diastereomers, meso compounds, resolution of enantiomer, inversion, retention and racemisation.

Relative and absolute configuration, sequence rules, D & L and R & S systems of nomenclature.

Geometric isomerism – determination of configuration of geometric isomers, E & 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, Cycloalkanes and Alkenes

(A) **Alkanes:** IUPAC nomenclature of branched and unbranched alkanes, the alkyl group, classification of carbon atom in alkanes, Isomerism in alkanes, sources, methods of formation (with special reference to Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acids), physical properties and chemical reactions of alkanes, Mechanism of free radical halogenation of alkanes: orientation, reactivity and selectivity.

(B) **Cycloalkanes:** Nomenclature, methods of formation, chemical reactions Baeyer's strain theory and its limitations. Ring strain in small rings (cyclopropane and cyclobutane), theory of strainless rings. The case of cyclopropane ring, banana bonds.

(C) **Alkenes:** Nomenclature of alkenes, methods of formation, mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, regionselectivity in alcohol dehydration, The Saytzeff's rule, Hofmann elimination, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes – mechanism 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.

## Unit IV Cycloalkenes, Dienes, Alkynes

(A) **Cycloalkenes:** Methods of formation, conformation and chemical reactions of cycloalkenes; Nomenclature and classification of dienes: isolated, conjugate and cumulated dienes, Structure of allenes and butadiene, methods of formation, polymerization, chemical reaction – 1, 2 and 1, 4 additions, Diels- Alder reaction.

(B) **Alkynes:** Nomenclature, structure and bonding in alkynes, Methods of formation, Chemical reactions of alkynes, acidity of alkynes, Mechanism of electrophilic and nucleophilic addition reactions, hydroboration-oxidation, metal-ammonia reductions, oxidation and polymerization.

(C) **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, MO picture.

**Aromaticity:** The Huckle rule, aromatic ions.

## Unit V Concept of Electrophilic substitution reaction

(A) **Aromatic electrophilic substitution** – general pattern of the mechanism, role of  $\sigma$ - and  $\pi$ - complexes, Mechanism of nitration, halogenation, sulphonation, mercuration and Friedel-Crafts 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 alkynylbenzenes and biphenyl, naphthalene and Anthracene.

(B) **Alkyl and Aryl Halides:** Nomenclature and classes of alkyl halides, methods

of formation, chemical reactions; Mechanisms of nucleophilic substitution reactions of alkyl halides,  $S_N$  and  $S_N$  reactions with energy profile diagrams; Polyhalogen compounds : Chloroform, carbon tetrachloride. Methods of formation of aryl halides, nuclear and side chain reactions; The addition-elimination and the elimination-addition mechanisms of nucleophilic aromatic substitution reactions; Relative reactivities of alkyl halides vs allyl, vinyl and aryl halides, synthesis and uses of DDT and BHC.

#### Textbooks and References

1. Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
4. Eliel, E. L. & Wilen, S. H. Stereochemistry of Organic Compounds; Wiley: London, 1994.
5. March's Advanced Organic Chemistry: Reactions, Mechanisms, and Structure, Sixth Edition
6. Peter Sykes, A Guidebook to Mechanism in Organic Chemistry Paperback – 2003.
7. Harkishan Singh and V. K. Kapoor. Medicinal and Pharmaceutical Chemistry. Vallabh Prakashan Publishers, Delhi. 1996.
8. R L Madan Chemistry for Degree Students B.Sc. 2Nd Year S. Chand Publishing.
9. Hashmat ali, Reaction Mechanism in Organic Chemistry S. Chand publishing.
10. John Leonard, Barry Lygo, Garry Procter Advanced Practical Organic Chemistry, Third Edition

### CC 2 (III) - Paper III PHYSICAL CHEMISTRY

**Duration- 3 hours. Max. Marks:40**

#### Unit I Thermodynamics-I

- (A) **Thermodynamics:** Definition of thermodynamic terms: system, surroundings etc. Types of systems, intensive and extensive properties, State and path functions and their differentials. Thermodynamic 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  $w$ ,  $q$ ,  $dU$ , &  $dH$  for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process.
- (B) **Thermo chemistry:** standard state, standard enthalpy of formation – Hess's Law of heat summation and its applications. Heat of reaction at constant volume. Enthalpy of neutralization. Bond dissociation energy and its calculation from thermochemical data, temperature dependence of enthalpy, Kirchhoff's equation.

#### Unit II Thermodynamics – II

- (A) **Thermodynamics:** Second law of thermodynamics: need for the law, different statements of the law. Carnot cycle and its efficiency, Carnot theorem. Thermodynamic scale of temperature.
- Concept of entropy: entropy as a state function, entropy as a function of  $V$  &  $T$ , entropy as a function of  $P$  &  $T$ , entropy change in physical change, Clausius inequality, entropy as a 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 functions; 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  $G$  with  $A$  with  $P$ ,  $V$  and  $T$ .

#### Unit III Electrochemistry-I



Electrical transport-conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance, measurement of equivalent conductance, variation of equivalent and specific conductance with dilution.

Migration of ions and Kohlrausch law, Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law its uses and limitations.

Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only). Transport number, definition and determination by Hittorf method and moving boundary method.

Applications of conductivity measurements;: determination of degree of dissociation, determination of  $K_a$  of acids, determination of solubility product of a sparingly soluble salt, conductometric titrations.

#### Unit IV Electrochemistry –II

Types of reversible electrodes-gas-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 and without, liquid junction potential, application of concentration cells, valency of ions, solubility product and activity coefficient, potentiometric titrations.

Definition of pH and  $pK_a$  determination of pH using hydrogen, quinhydrone and glass electrodes, by potentiometric methods.

Buffers-mechanism of buffer action, Handerson-hazel equation. Hydrolysis of salts. Corrosion-types, theories and methods of combating it.

#### Unit V Chemical Kinetics and Catalysis

- (A) **Chemical Kinetics:** Chemical kinetics and its scope, rate of a reaction, factors influencing the rate of a reaction – concentration, temperature, pressure, solvent, light catalyst, concentration dependence of rates, mathematical characteristics of simple chemical reactions – zero order, first order, second order, pseudo order, half-life and mean life, Determination of the order of reaction – differential method, method of integration, method of half-life period and isolation method.

Radioactive decay as a first order phenomenon; Experimental methods of chemical kinetics: conductometric, potentiometric, optical methods, polarimetry and spectrophotometer. Theories of chemical kinetics: effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy. Simple collision theory based on hard sphere model, transition state theory (equilibrium hypothesis), Expression for the rate constant based on equilibrium constant and thermodynamic aspects.

- (B) **Catalysis:** characteristics of catalysed reactions, classification of catalysis homogeneous and heterogeneous catalysis, enzyme catalysis, miscellaneous examples.

#### Textbooks and References

1. S Lewis and D Gladstone, Elements of Physical Chemistry, Macmillan.
2. Moudgil, H. K. Textbook of physical chemistry second edition, PHI
3. B S Bahl , G D Tuli & Arun Bahl, Guide to Essentials of Physical Chemistry S. Chand Publishing.
4. Alberty & Bawendi Silbey, Physical Chemistry 4th Economy Edition, Wiley.
5. Christopher M. A. Brett, Ana Maria Oliveira Brett, Electrochemistry: Principles, Methods, and Applications, Oxford sciencepublications
6. Keith J. Laidler, Chemical Kinetics (3rd Edition) 3rd Edition, Prentice Hall

7. Michael J. Pilling, Paul W. Seakins, Reaction Kinetics 2nd Edition, Oxford Science Publications.

### PRACTICALS

**Duration: 5 Hours**

**Max. Marks: 50**

**Min. Pass Marks : 18**

#### (A) Inorganic Chemistry

##### Quantitative Analysis: Volumetric Analysis

- 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 by permanganometry.
- Estimation of ferrous and ferric by dichromate method.
- Estimation of copper using thiosulphate.

#### (B) Organic Chemistry

##### Qualitative Analysis

Detection of extra elements (N, S and halogens), solubility behaviour and functional groups (Alcoholic, phenolic, carboxylic, carbonyl, esters, carbohydrates, amines, amides, nitro and anilide) in simple organic compounds.

Identification of an organic compound through the functional group analysis and preparation of suitable derivatives.

#### (C) Physical Chemistry

- Determination of the **transition temperature** of the given substance by thermometric/dialometric method (e.g.  $\text{MnCl}_2 \cdot 4\text{H}_2\text{O}/\text{SrBr}_2 \cdot 2\text{H}_2\text{O}$ ).

#### 2 Phase Equilibrium

- Study of 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.
- Construction of the phase diagram of two component (e.g. diphenylamine, benzophenone) system by cooling curve method.

#### 3 Thermo chemistry

- Determination of the solubility of benzoic acid at different temperatures and to determine  $\Delta H$  of the dissolution process.
- Determination of the enthalpy of neutralization of a weak acid/weak base versus strong base/strong acid and determine the enthalpy of ionization of the weak acid/weak base.
- Determination of the enthalpy of solution of solid calcium chloride and calculate the lattice energy of calcium chloride from its enthalpy data using Born Haber cycle.

#### 4 Distribution Law

- Determination of the distribution coefficient for the distribution of iodine between water and  $\text{CCl}_4$ .
- Study the distribution of benzoic acid between benzene and water.

### CC – 3 ZOOLOGY

Scheme	Exam Duration	Max.Marks	Min.Pass Marks.
Paper I	3 hours	40 (External) 10 (Internal)	54
Paper II	3 hours	40 (External) 10 (Internal)	
Paper III	3 hours	40 (External) 10 (Internal)	
Practical	4 hours	50 (External)	18

## CC – 3 (I) -PAPER I : CHORDATA

**Duration : 3 Hrs.**

**Max Marks : 40**

### **Objectives :**

To enable students to understand in respect of vertebrates – their organizational hierarchies and complexities, the evolutionary trends in external morphology and comparative studies of internal structures; identification and classification with examples; to enable them to understand various modes of adaptations in animals.

### **UNIT – I**

- a) An outline classification of chordates up to orders but up to subclasses only in case of protochordate groups and mammals.
- b) Comparative anatomy of vertebrates from an evolutionary point of view of the following:-
  - (i) Integument including structure and development of placoid scales, feathers and hair.
  - (ii) Heart and aortic arches.
  - (iii) Kidney and associated urinogenital ducts

### **Unit- II**

Habit and habitat, structure, reproduction (excluding development) and affinities to following types:-

- a) Hemichordate: *Balanoglossus*
- b) Urochordata: *Herdmania*, ascidian tadpole larva and its metamorphosis.
- c) Cephalochordata: *Amphioxus*

### **Unit-III**

Habit, habitat, structure (morphology, digestive system, respiratory system, blood vascular system, urinogenital system nervous system (central and peripheral ) of the following types:-

- a) Agnatha: *Petromyzon* (including its affinities)
- b) Pisces: *Scoliodon* (including sense organs)
- c) Scales and fins of fishes.

### **Unit- IV**

Habit, habitat, structure (morphology, digestive system, respiratory system, blood vascular system, nervous system (central and peripheral) and urinogenital system of the following types:-

- a) *Amphibia : Hoplobatrach tigrina*
- b) *Reptilia: Sara hardwicki*
- c) Poisonous and non-poisonous snakes, poison apparatus and biting mechanism. First aid of snake bite.
- d) Parental care in Amphibia.

### **Unit- V**

Habit, habitat, structure, morphology, digestive system, respiratory system, blood vascular system, nervous system (central and peripheral) and urinogenital system of the following types:-

- a) Aves: *Columba*
- b) Mammalia: *Rabbit*.
- c) Origin of birds, migration & flight adaptation of birds.

### **Textbooks and References:**

1. Modern Textbook of Zoology: Vertebrate by R.L. Kotpal – Rastogi Publication, Merrut, 3<sup>rd</sup> Edition, 2008
2. A Textbook of Zoology Vol. II by Parkar and Hasswel – (MacMillan)
3. A Textbook of Zoology Vol. II by R.D. Vidyarthi – (S. Chand & Co. Delhi)
4. Life of Vertebrates by J. Z. Young – (Oxford University Press)
5. The Vertebrates by A.S. Romer – (vakils, Ferrer & Simons, Bombay)

- 6 Elements of Chordate Anatomy by Weichert – (McGrawHill)<sup>th</sup>
- 7 The Birds by R.L. Kotpal (4<sup>th</sup> Edition) – Rastogi Publications, 2008
- 8 Bird Migration by D.R. Griffin – (Doubleday, Garden city, USA)
- 9 The Book of Indian birds by salim Ali.
10. Fish and Fisheries by K. Pandey and J.P. Shukla (2<sup>nd</sup> Edition) (Rastogi Publication, 2008)
11. Indian Fishes by Qureshi – (Brij Brothers., Bhopal)
12. Comparative anatomy of the vertebrates by George C Kent- 3<sup>rd</sup> Saint Louis: The C.V. Mosby Co 1973
13. Animal taxonomy and evolution, Dr VS Pawar, Hindi Edition, College book centre, Chaura Rasta jaipur.

### **CC – 3 (II) -PAPER II: ANIMAL PHYSIOLOGY AND ENDOCRINOLOGY**

**Duration: 3 Hrs. Max. Marks: 40 \**

**Objective:**

To enable students to comprehend the modern concepts of physiological aspects on various organs and systems of animals and human being to comprehend chemical nature, biological molecules and physiological roles.

**Note :** The paper is divided in five independent units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit.

**Unit-I**

- a) Physiology of digestion: Chemical nature of food stuff (including micronutrients), various types of digestive enzymes and their digestive action in the alimentary canal, role of GI hormones in digestion, mechanism of absorption of digested food.
- b) Physiology of respiration: Mechanism and control of breathing, exchange of gases transport of respiratory gases (oxygen and carbon dioxide)

**Unit-II**

- a) Physiology of blood circulation
- b) Composition and function of blood.
- c) Blood groups (ABO and Rh)
- d) Blood coagulation – factors, mechanism, theories and anticoagulants.
- e) Origin, conduction and regulation of heart beat in mammals.
- f) Cardiac cycle, ECG

**Unit-III**

- a) Nerve physiology: structure and types of neuron, origin and conduction of nerve impulse,
- b) Synapse-structure, types, properties and signal transmission through synapses.
- c) Muscle physiology: Ultra-structure and mechanism of contraction of skeletal muscle, summation and fatigue.

**Unit-IV**

- a) Physiology of Excretion: Nitrogenous wastes, anatomy of mammalian kidney, structure of nephron, mechanism of urea and urine formation (including hormonal regulation)
- b) osmoregulation
- c) Physiology of Reproduction:
  - (i) hormonal control of male and female reproduction, implantation, parturition and lactation in mammals
  - (ii) Reproductive cycles

## Unit-V

### Endocrinology

- a) Hormones: Classification, properties of hormones.
- b) Mechanism of hormone action (peptide and steroid hormones)
- c) Endocrine glands:
  - (i) Pituitary gland: Location, anatomy and functions of hormones with hypothalamic regulation
  - (ii) Thyroid gland: Location, anatomy, synthesis and function of T3 & T4
  - (iii) Adrenal gland, Islets of Langerhans, Testes and Ovaries

### Textbooks and References:

1. A text book of Medical physiology, Guyton and hall, Elsevier Pub (South Asia) 2013.
2. Animal Physiology, K Schmidt – Nielson, 5 ed, Cambridge Pub 2013.
3. Biochemistry D Voet & JG Voet, Wiley 2011
4. Animal Physiology by A. maria Kutikan & n. Arumugam – (Saras Publication, Nagercoil, Tamil Nadu).
5. Animal Physiology and biochemistry by K.V. Sastry – (Rastogi Publications, 2008).
6. Regulatory mechanism in Vertebrates by kamleshwar pandey and J.P. Shukla- (Rastogi Publications, 2008)
7. Animal Physiology by K.A. Goyal and K.V. Sastry –( Rastogi Publication 2008)
8. Endocrinology and Reproductive Biology by K.V. Sastry - ( Rastogi Publication 2008)
9. Animal Physiology by Arora M.P. ( 1989)- Himalaya Publications House.
10. Textbook of medical Physiology by Guyton A.C. & Hall J.E (1996)- (W.B. Saunders & Co.)
11. General and Comparative Physiology by Hoar W.S. (1983) – Prentice Hall Publication)
12. A textbook of Animal Physiology by Hurlkar P.C. & Mathur P.N. ( 1976) – S Chand & Co.
13. General Endocrinology by Turner C.D. & Gangara J.T. ( 1971)- W.B. Saunders & Co.
14. Animal Physiology , Biochemistry and Immunology , Dr KC Soni Hindi Edition , College book centre, Chaura Rasta , Jaipur
15. Animal Physiology and Immunology , Dr KC Soni Hindi Edition, College book centre , Chaura Rasta, Jaipur
16. Mammalian Endocrinology and Animal Behavior , Dr VS Pawar, Hindi Edition , College book centre, Chaura Rasta, Jaipur

## CC – 3 (III) -Paper III EVOLUTION AND PALEONTOLOGY

**Duration : 3 hours Max.Marks: 40**

### Objectives :

To enable students to understand and comprehend origin of life and theories of evolution ; to understand the evolution from the evidences.

**Note :** The paper is divided in five independent units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit.

### Unit –I

- a) Origin of life ( Abiogenesis and biogenesis)

- a. Evidence in favor of evolution: Evidences from morphology and comparative anatomy, Embryology and Paleontology.
- b) Molecular basis of evolution

#### **Unit – II**

Theories of evolution :

- a) Lamarckism, inheritance of acquired characters and Neo-Lamarckism.
- b) Darwinism, theory of natural selection and NeoDarwinism.
- c) Mutation theory of Hugo de Vries.
- d) Weismann theory of germplasm
- e) Recapitulation theory

#### **Unit –III**

- a) Variation : Kinds , sources of variation, origin of new mutations.
- b) Isolation : Definition , mechanism and role of isolation in evolution.
- c) Adaptation : Introduction , kinds ( structural, physiological and protective ) of animal associations, divergent evolution , convergent evolution, evolutionary significances of adaption.

#### **Unit –IV**

- a) Origin of species: Concept of species/subspecies/sibling. Specie, Factors causing genetic divergence in the population of species, genetic drifts, Bottle Neck effect founder's effect.
- b) Mimicry and protective coloration : Definition, kinds , condition necessary for mimicry, significance.
- c) Zoogeographical distribution of animals, geological time scale, eras origin and evolution of amphibian, reptiles, birds and mammals.

#### **Unit –V**

- a) Introduction , formation , kinds, determination of age of fossil and its significance.
- b) Dinosaurs, fossil evidence & reasons for extinction of dinosaurs.
- c) Evolution of man: Time of origin, compelling causes, ancestor of man, evolution from apes and evolutionary trends.

#### **Textbooks and References:**

1. Evolutionary Biology by B.S. Tomar & S.P. Singh – ( Rastogi Publications, 2008)
2. The origin of life by K. John –( Reinhold Publishing Corpn)
3. The evolution of Man by G.W. Lasker – ( Holt,Rinehart &Winston)
4. Organic Evolution by R.S. Lull – (MacMillan)
5. Organic evolution – V.B. Rastogi
6. Animal Taxonomy and Evolution , Dr VS Pawar Hindi Edition , College book centre, Chaura Rasta, Jaipur
7. Mammalian Endrocrinology and Animal Behavior , Dr VS Pawar, Hindi Edition, College book centre, Chaura Rasta Jaipur

**Duration : 4 hrs.**

#### **PRACTICALS**

**Max. Marks : 50**

**Min. Pass Marks: 18**

#### **Objectives:**

To develop in the student the skills of staining and mounting of materials (temporary and permanent) and of dissection, display and labeling as per UGC guidelines; Cadaver or otherwise collection, preservation, mounting, identification and labeling of specimens as per UGC guidelines: Field observation of animals. To enable students to develop the skills of hematology and endocrinology.

## Course Content

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

**Note :**

1. Use of animals or materials for dissection or otherwise is subject to the condition that these are not banned under the Wildlife Protection Act.
2. Report on study of animals from their natural habitat from their local surroundings or as assigned.

**Guidelines/Instructions for Practical Examination****Max. Marks : 50****Time allowed : 4 Hrs.****Min. Pass Marks 18**

S. No.	Exercise	Marks
1.	Dissection* ( Exposition, labeled diagram)	6
2.	Temporary mounting –one ( Staining, identification, Sketch	3
3.	Museum specimens – four or six (identification and Classification	12
4.	Ecological note –one specimen	2
5.	Permanent slides – two ( Identification with reasons)	2
6.	Osteology	3
7.	Physiological exercise	5
8.	Practical record and slides	5
9.	Viva	4
10.	Project report assignment	8

\* as per UGC guidelines

**CC-4 BOTANY**

<b>Scheme</b>	<b>Duration</b>	<b>Max. Marks</b>	<b>Min.Pass Marks</b>
Paper I	3 hrs.	40 (External) 10 (Internal)	54
Paper II	3 hrs.	40 (External) 10 (Internal)	
Paper III	3 hrs.	40 (External) 10 (Internal)	
Practical	4 hrs.	50	18

**CC-4(I) PAPER –1: Diversity of Seed Plants****Duration: 3 hours****Max. Mark 40****Unit I**

Characteristics of seed plants; evolution of the seed habit; seed plants with fruits (angiosperms) and without fruits (gymnosperms); fossil and living seed plants; fossil gymnosperms.

**Unit II**

Angiosperms: Origin and evolution; primitive angiosperms. diversity in plant forms- annuals, biennials and perennials; convergence of evolution of tree habit in



gymnosperms, monocotyledons and di-cotyledons, trees-largest and longest lived seed plants.

#### **Unit –III**

General features of gymnosperms, distribution and their classification; morphology and anatomy of vegetative and reproductive parts and life cycle of *Cycas*.

#### **Unit – IV**

Morphology and anatomy of vegetative and reproductive parts and life cycle of *Pinus* and *Ephedra*, Economic importance of gymnosperms

#### **Unit – V**

Significance of seed – suspended animation; ecological adaptation; unit of genetic recombination and replenishment; dispersal strategies. Vegetative propagation- Natural and Artificial

#### **Suggested Readings**

Bhatnagar, A.P. and Moitra, A. 1996. Gymnosperms. New Age International Limited, New Delhi.

Gifford, E.M. and Foster, A.S. 1988. Morphology and Evolution of Vascular Plants. W. H. Freeman & Company, New York.

Sporne, K.R. 1965. The Morphology of Gymnosperms. Hutchinson & Co. (Publishers) Ltd., London. Stewart, W. M. 1983. Paleobotany and the Evolution of Plants. Cambridge University Press. Cambridge.

### **CC–4 (II) PAPER – II: Systematics of Angiosperms**

**Duration : 3 hours.**

**Max. Marks : 40**

#### **Unit – I**

Angiosperm taxonomy: Brief history, aims and fundamental concepts of artificial, natural and phylogenetic system of classification, Bentham & Hooker, Engler & Prantle and Hutchinson, system of classification.

Herbarium; Tools and techniques, important herbaria and botanical gardens of India and their importance.

#### **Unit – II**

Botanical Nomenclature: Principles and rules of ICBN, type of concept, taxonomical categories, principle of priority, identification keys, floras.

#### **Unit – III**

Diversity of flowering plants as illustrated by members of the families – Brassicaceae, Malvaceae, Rutaceae, Fabaceae (Lotoideae, Caesalpinoidae, Mimosoidae) Apiaceae.

#### **Unit – IV**

Diversity of Flowering plants as illustrated by members of the families – Acanthaceae, Apocynaceae, Asclepiadaceae, Asteraceae, Solanaceae, Lamiaceae. **Unit–V**

Diversity of flowering plants as illustrated by members of the families – Annonaceae, Amaranthaceae, Cucurbitaceae, Euphorbiaceae, Liliaceae, Poaceae. **Suggested Readings**

Davis, P.H. and Heywood, V.H. 1963. Principles of Angiosperm Taxonomy. Oliver and Boyd, London.

Heywood, V.H. and Moore, D.M. (eds) 1984. Current Concepts in Plant Taxonomy. Academic Press. London.

Jaffrey, C, 1982. an Introduction to Plant Taxonomy, Cambridge University Press, Cambridge, London.

Jones, S.B., Jr. and Luchsinger, A.E. 1986. Plant Systematics (2<sup>nd</sup> edition). Mc Graw-Hill Book Co., New York.

Maheshwari, J.K. 1963. Flora of Delhi, CSIR, New Delhi.

Radrord, A.E. 1986. Fundamentals of Plant Systematics. Harper and Row, New York.

Singh, F. 1999. Plant Systematics: theory and Practice. Oxford and IBH Pvt. Ltd.,

New Delhi.

State, C.A. 1989. Plant Taxonomy and Biosystematics

**CC-4(III) PAPER – III: Plant Cell Biology and Genetics**

**Duration : 3 hours. Max. Marks : 40**

**Unit – I**

Ultrastructure of cell and cell organelles; Cell wall, Plasma membrane, Golgi Complex, endoplasmic reticulum, Lysosomes, Ribosomes, peroxisomes, vacuoles, mitochondria, chloroplast, nucleus.

**Unit – II**

Chromosome organization; Structure/Morphology, centromere and telomere; chromosome aberrations – deletions, duplication, inversions and translocations; Variations in chromosome number – aneuploidy, euploidy, sex chromosomes.

Cell division; Cell cycle and Mitosis and meiosis.

**Unit – III**

Nuclear and extra nuclear genetic material: DNA structure; replication; DNA protein interaction; nucleosome model; genetic code; satellite and repetitive DNA; mitochondrial and plastid DNA; plasmid; gene mapping

**Unit – IV**

Gene expression: Structure of gene; transfer of genetic information; proteins. structure and classification; transcription; translation; regulation of gene expression in prokaryotes and eukaryotes.

**Unit – V**

Genetic inheritance: Mendelism, Mendal’s law of inheritance, Linkage and crossing over; allelic and non-allelic interactions.

Genetic variations: Mutations - spontaneous and induced; transposable genetic elements; DNA damage and repair.

**Suggested readings**

Alberts, B., Bray, D., J., Raff, M., Roberts, K and Watson, I. D. 2001. Molecular Biology of Cell Garland, publishing Co. Inc., New York, USA.

Atherly.,G., Girton, J. R. and McDonald, J. F. 1999. The Science of Genetics Saunders College Publishing, Fort Worth, USA.

Gupta, P.K. 1999. A Textbook of Cell and Molecular Biology. Rastogi Publications, Meerut.

Kleinsmith, L. J. and Kish. V.M. 1995, Principles of Cell and Molecular Biology (3rd edition). Harper Collins College Publishers, New York, USA.

Lodish, H., Berk, A., Aipursky, S.L., Matsudaira, P., Baltimore, D. and Darnell, J. 2000. Molecular Cell Biology. W.H. Freeman & Co. New York, USA. Russel,

P. J. 1998. enetics. The Benjamin/Cummings Publishing Co. Inc., USA.

Snustad, D.P. and Simmons, M. J. 2000. Principles of Genetics. John Wiley & Sons, Inc., USA.

Stent, G.S. 1986. Molecular Genetics. CBS Publications, Delhi.

Wolfe, S.L. 1993. Molecular and Cell Biology. Wodsworth Publishing Co., California, USA.

**PRACTICALS**

**Duration: 4 hours**

**Max. Marks: 50**

**Min. Pass Marks: 18**

**Gymnosperms:**

**1. Cycas**

Habit, armour of leaf bases on the stem, very young leaf (circinate veneration) and old foliage leaves, scale leaf, bulbils, male cone, microsporophyll, megasporophyll, and mature seed. Study through temporary micro preparations or permanent slides – normal root, coralloid root, stem, rachis, leaflet, microsporophyll, pollen grains, and ovule.

**2. Pinus**

Habit, long and dwarf shoot showing cataphylls and scale leaves, T.S. wood showing growth rings, male cones, female cones, and winged seeds.

Study through temporary micro preparations and/or permanent slides – stem (young and old), needle, pollen grains, root, female cone, ovule, embryo (W.M.) showing polycotyledonous condition.

### 3. Ephedra

Habit and structure of whole male and female cones.

Temporary micro preparations and/or permanent slides of node, internode, macerated stem to see vessel structure; epidermal peel mount of vegetative parts to study stomata, male cone, female cone, and pollen grains.

### 4. Angiosperms

Familiarity with the terms used in technical description of plants. Study of representative plants of families included in the syllabus.

### 5. Cyto-genetics

1. Study of cell structure from onion leaf peels; demonstration of staining and mounting methods.
2. Comparative study of cell structure in onion cells, *Hydrilla* and *Spirogyra*. Study of cyclosis in *Tradescantia*, staminal hairs.
3. Study of plastids to examine pigment distribution in plants (e.g., *Cassia*, *Lycopersicon* and *Capsicum*).
4. Examination of electron micrographs of eukaryotic cells with special reference to organelles.
5. Study of electron micrographs of viruses, bacteria, cyanobacteria and eukaryotic cells for comparative cellular organization.
6. Examination of various stages of mitosis and meiosis using appropriate plant material (e.g. onion root tips, onion flower buds),.
7. Preparation of karyotypes from dividing root tip cells and pollen grains.
8. Cytological examination of special types of chromosomes: bar body, lamp brush and polytene chromosomes.
9. Working out the laws of inheritance using seed mixtures.
10. Working out the mode of inheritance of linked genes from test cross and or F2 data.

### Suggested Readings

- Fukui, K. and Nakayama, S. 1996. Plant Chromosomes: Laboratory Methods. CRC Press, Boca Ratin, Florida.
- Gunning, B.E.S. and Steer, M. W. 1996. Plant Cell Biology: Structure and Function. Jones and Barlett Publishers. Boston Massachusetts.
- Harris, N. and Oparka, K. J. 1996. Plant Biology: A Practical Approach. IRL Press at Oxford University Press. Oxford, UK.
- Sharma A.K. and Sharma A. 1999, Plant Chromosomes: Analysis, Manipulation and Engineering. Harwood. Academic Publishers Australia.

### CC-5 Mathematics

Scheme	Exam Duration	Max. Marks	Min. Pass Marks
Paper-I	3 hours	60 (External)	72
	13 (Internal)		
Paper-II	3 hours	50 (External)	
		13 (Internal)	
Paper-II	3 hours	50 (External)	
	14 (Internal)		

### CC-5 (I) Paper-I: Abstract Algebra

**Duration: 3Hrs**

**Max.Marks:60**

#### Unit-1

Set, Relations, functions and binary operations, binary operations in contrast to unary and ternary operations. Group: Definition, examples and simple properties of group and subgroup

### Unit-2

Permutation group, cyclic group, cosets, Lagrange theorem, homomorphism and isomorphism of group, Cayley's theorem.

### Unit-3

Normal subgroup and Quotient group. theorem. Fundamental theorem of homomorphism of group.

### Unit-4

Rings: Definition and example. Residue classes ring, Special classes of ring, integral domain, division ring (ring, field) simple properties & ring, sub ring, sub field, ring homomorphism and ring isomorphism.

### Unit-5

Ideal, principal ideal, principal ideal ring, quotient ring, prime ideal, maximal ideal, Euclidean ring and its properties, polynomial ring.

### Textbooks and References:

1. Topics in Algebra: I.N. Herstein, Wiley Eastern, New Delhi, 2<sup>nd</sup> ed. 1975.
2. A Course in Abstract Algebra: V.K. Khanna and S.K. Bhambri, Vikas Pub. House, New Delhi, 2<sup>nd</sup> rev. ed. 1998.
3. Modern Algebra: A.R. Vashistha, Krishna Prakashan Mandir, Meerut, 2<sup>nd</sup> rev. ed., 1971.
4. Algebra: M. Artin (1991) Prentice Hall

### CC-5 (II) Paper-II: Real Analysis

Duration: 3Hrs

Max.Marks:50

#### Unit- 1

Real Numbers system: completeness axiom, densities of rational/irrational, properties of real numbers, least upper bound axiom of a function, Basic properties of the limits Continuous functions and classification of discontinuities, properties of continuous functions Boundedness of a continuous function on a closed interval [a,b] existence of a maximum of a continuous function on [a,b], uniform continuity,

#### Unit-2

Differentiability, chain rule of differentiability, Mean value theorems and their geometrical interpretations, Darboux's intermediate value theorem for derivatives, Taylor's theorem with various forms of remainders,

#### Unit-3

Riemann integral, Integrability of continuous and monotonic functions, The fundamental theorem of integral calculus, Mean value theorems of integral calculus. **Unit-4**

Real sequence, Definition, Theorems on limits of sequences, Bounded and monotonic sequences, Sequential Continuity, Cauchy's convergence criterion, Infinite series of non negative terms, comparison tests, Cauchy's integral test, Ratio tests, Raabe's logarithmic, De Morgan and Bertrand's tests, Alternating series, Leibniz's theorem, Absolute and conditional convergence.

#### Unit-5

Uniform convergence of series of function, Weierstrass M-Test Abel's and Dirichlet's test for uniform convergence. Improper integrals and their convergence, Comparison tests, Abel's and Dirichlet's tests,

### Textbooks and References:

1. Mathematical Analysis: S.C. Malik, New Age International, New Delhi, 2004.
2. Real Analysis: T.M. Apostol, Narosa Publishing House, New Delhi 1985.
3. Real Analysis: H.L. Royden, Macmillan, 4<sup>th</sup> edition 1993.
4. Principles of Mathematical Analysis: W. Rudin, McGraw Hill, 3<sup>rd</sup> edition 1976.

### CC-5 (III) Paper-III: Differential Equations

Duration: 3Hrs

Max.Marks:50

#### Unit-1

Linear equations and equations reducible to linear form. Exact differential equations,

integrating factors, first order and higher degree equations solvable, for x, y, p. Clairaut's form and singular solutions, Geometric. meaning of a differential equation, orthogonal trajectories linear differential equations with constant coefficients, homogeneous linear ordinary differential equations.

#### Unit-2

Ordinary simultaneous differential equations, total differential equations. Linear differential equations of second order, transformation of the equation by changing dependent independent variable, method of variation of parameters.

#### Unit-3

Series solution of differential equations, power series method, besel, legendre and hypergeometric equations, bersel, legendre and hypergeometric functions and their elementary properties.

#### Unit-4

Partial differential equations of the first order, lagranges solution, some special type of equations which can be solved easily by methods other than the general method, Charpit's general method of solution.

#### Unit-5

Partial differential equations of second order and higher orders, classification of linear partial differential equations of second order, homogeneous and non-homogeneous equations with constant coefficients partial, differential equations reducible to equations with constant coefficients, Monges method.

#### Textbooks and References:

1. Differential Equations Vol I: J.L. Bansal and H.S. Dhami, JPH, 2004.
2. Ordinary and Partial Differential Equations: M.D. Raisinghania and R.S. Aggarwal, S. Chand & Company, New Delhi, 2<sup>nd</sup> edition 1983.
3. Theory and problems of Differential equations: Frank Ayres, McGraw-Hill Book Company, Singapore, 1<sup>st</sup> edition 1972.
4. An Introduction to Ordinary Differential Equations, Dover Books on Mathematics: E. Coddington (1990) Dover
5. Differential Equations and Dynamical Systems: L. Perko (2010) Springer
6. Theory of Ordinary Differential Equations: Coddington and Levinson (1987) Tata Mc GrawHill

### CC 6: Contemporary India and Education

**Instructional Time: 4 periods/week**

**Max. Marks: 75**

**Exam. Duration: 3 Hours**

**Internal: 15**

**External: 60**

#### Course Objectives:

To enable student Teacher to -

1. Acquire knowledge of the concept of Educational Administration and Management.
2. Understand the role of center, state and local agencies in managing education.
3. Acquire knowledge of administration and supervision of education in Rajasthan.
4. Develop an understanding of the principles and practices of school organization.
5. Develop an understanding of the main issues related to Indian educational system.

#### Unit 1

- (a) Concept, need, characteristics, principles of Educational Administration and Educational management.
- (b) Concept of authority, delegation of power, centralization and decentralization, direction, communication, unity of command, TQM.
- (c) Constitutional provision of education, Fundamental rights and duties,

#### Unit 2

- (a) Universalization of education.
- (b) Equality of opportunities in education.
- (c) directive principals of State Policies.

- (d) Relationship between education and democracy.
- (e) Role of education in developing Socialistic patterns and national integration.

### Unit 3

- (a) Education as a sub system:
  - (b) Education as an agent of social change, social change influencing the trend of education and social disparities
- (c) Social Mobility, Cultural Lag, Gender Disparities
- (d) Regional disparities.
- (e) The role of educational institution for creating new social orders.

### Unit - 4

A brief survey of growth and development of education in India.

- (a) Pre - Independence era -
  - i Education during vedic, Buddhist and Medieval period.
  - ii Development during British period - Macaulay's minutes, woods dispatch 1854.
  - iii Naye Taleem
- (b) Post independence era.
  - i Salient features of secondary education commission 1952-53, ii Education Commission 1964 (Major recommendations)
  - iii National Policy on Education 1986 (NEP 1986 for educational administration)
  - iv Mid day meal to insure nutrition and public space ( irrespective of caste, religion, class and gender)
  - v RTE-2009

### Unit - 5

- (a) Role of central and state agencies of education.  
MHRD, NCTE, NCERT, CBSE, CAGE (Central Advisory Board of Education), NIEPA State Dept. of Education, RBSE, SIERT, IASE, CTE, DIET

Practicum

#### Any one of the followings

- i Preparing a project report concerning any aspect of school Management.
- ii Construction of time-table and maintenance of attendance register.
- iii Preparation of an outline of an institutional planning on any aspect of school organization.
- iv A case study of a secondary school with reference to the leadership role of school Headmaster.

#### Books Suggested:

- 1- Agarwal J. C. (1972): School Administration, Arya Book Depot Karol Bagh, New Delhi
- 2- Baquer, A. & Sharma, A. (1997) Disability: Challenges Vs. responses. Can Publishing
- 3- Dash, B.N., School Organisation Administration & Management, Neel Kamal Publications Pvt. Ltd., 1996.
- 4- Mathur, S.S. Educational Administration, Krishana Brothers Jullundur. 1969
- 5- Mathur, S.S., Educational Administration and Management, Ambala Cantt: The Indian Press, 1990
- 6- Sharma, R.A., School Management, Surya Publications, Meerut, 2005.
- 7- National Curriculum Framework, (2005) [www.ncert.nic.in](http://www.ncert.nic.in)
- 8- National Curriculum Framework for Teacher Education (2009)

Modes of Internal Assessment	Marks
Written tests	10
Any two of the Practicum:	05

**Group C : Developing Teacher Sensibilities**  
**Section II : Experiences for Social and environmental sensitivity**  
**SES 1 - WORK EXPERIENCE : ELECTRICITY AND ELECTRONICS**

**Instructional Periods : Theory 1 Period /week    Max Marks : 50**  
**Practium 2 periods/week                            Min. Pass Marks : 18**  
**Exam Duration : 3 hours                             (Internal Examination)**

**Objectives of Course:**

On completion of the course the student teacher will be able to:

- recognize and use different soldering methods.
- understand working of different lamps.
- acquire skill to assemble/prepare simple electrical appliances.
- develop the ability in repairing simple appliances used at secondary level.
- develop the skills for making simple projects/models.
- inculcate healthy values related to work culture.

**Course Outline:**

**UNIT I**

Knowledge of different soldering methods like wave soldering, dip soldering and ultra sonic soldering, Practice of soldering.

**UNIT II**

Understanding the working of CFL tubes, Incandescent lamp, arc lamp, sodium vapour lamp, neon lamp, fluorescent lamp, use of choke and starter

**UNIT III**

Construction of Transformers, recognition of primary and secondary winding, knowledge of step-up and step-down transformer, Use of transformers.

**UNIT IV**

Understanding the working of Electrical appliances such as Refrigerator, Air conditioners etc, making Resistance and Capacitance boxes, use of testing board and extension boards for laboratory.

**UNIT V**

Recognition of emitter, base and collector in a transistor, characteristics of transistor, transistor action, Amplification by transistor, Basic idea of integrated circuits, FET – recognition of drain, source and gate terminals, FET and its characteristics, testing of transistor and FET, LCD.

**Project (anyone) - Only suggestive**

Alarm for luggage security  
Mobile cell-phone charger using cell  
Power supply failure alarm  
Blown fuse indicator .

**Modes of Learning Engagement:**

Constructivist Approach : Hands on Experience, Activity used Learning ,  
Experimentation Interactive Engagement, Group work, Peer Learning , Project Work

**Modes of Internal Assessment : Marks**

Written Test	: 10
Exam and Project	: 40

**References:**

1. Electrician – I Year Trade Theory Published by National Instructional Media Institute, Chennai re-print 2007
2. Electrician – II Year – Trade Theory Published by national Instructional Media Institute Chennai re-print 2007
3. Electrical Machinery Published by Krishna Publisher Delhi Author P.S. Bhimbhara re-print 2007

**SES 1 - Work Experience - Agriculture  
(Practices)**

**Instructional time: 1 Period/Week (Theory)                      Max.Marks: 50**  
**2 Periods/ Week (Practicum)                                      Min. Pass Marks: 18 Exam.**

**Duration : 3 Hours (Internal Examination) Objectives of the Course**

On completion of the course, the student teacher will be able to

- ∑ identify seeds of common crops and vegetables.
- ∑ recognise manures and fertilizers used commonly.
- ∑ understand characteristics of seeds and seedling.
- ∑ identify different summer and winter flowers.
- ∑ Acquire skills to horticulture practices.
- ∑ Inculcate healthy values related to work culture.

**Course Outline:**

**Unit I: Identification**

- a) Seeds of common crops.
- b) Seeds of common vegetables.
- c) Important weeds.
- d) Manures commonly used.
- e) Fertilizers commonly used.

**Unit II : Seeds and Seedlings**

- a) Characteristics of a good seed for sowing.
- b) Calculation of germination percentage of seeds.
- c) Planting seeds and transplanting seedling.
- d) Raising seedlings in a nursery
- e) Study about green-house.

**Unit III**

**Ornamental gardening**

- a) Identification of different summer flowers.
- b) Identification of different winter flowers.
- c) Identification of common hedge and creeper plants.
- d) Preparation and maintenance of rockeries and borders.
- e) Preparation and maintenance of borders through hedge and flower plantation.

**Unit IV**

**Horticulture Practices**

- a) Agro forestry and related concepts
- b) Potting and repotting practices.
- c) Practices related to production of important flowering plants.
- d) Collection of different types of seeds.
- e) Preparation of a project.

**Unit V**

**General field practices**

- a) Earthing.
- b) Planting.
- c) Hoeing.
- d) Weeding.



- e) Watering of plants.

**Modes of Learning Engagement:**

Hands on experiences, Activity based learning, Experimentation, Interactive engagement, Group work, Peer learning, Project work.

**Practicum:**

- a) Identification of an agronomy of following crops:  
Wheat, Mustard, Gram, Rose etc.
- b) Agricultural Processes:  
Irrigation, Training and Pruning, Hoeing and Weeding, Seed Bed preparation, Nursery Management.

<b>Modes of Internal Assessment</b>	<b>:</b>	<b>Marks</b>
Written test	:	10
Exam and project	:	40

**Suggested Readings:**

1. Jitendra Singh, Basic Horticulture (Kalyani Publishers, New Delhi, 2012).
2. Dr. Jaiveer Sing, Plant Propagation & Nursery Husbandry (Rama Publishing House, Meerut, 2002).
3. Dr. Rajveer Singh & Dr. O.P. Rajput, Principles of Agronomy, Scientific Crop Production (Kushal Publications and Distributors, Varanasi, 2008).
4. Dr. K.N Dubey, Fruit Production in India (Rama Publishing House, Meerut, 2008).

**SES 2: Addressing Special Needs in Inclusive School**

**Instructional Time: 3 periods/week**

**Exam. Duration: 2 Hours**

**Max. Marks: 50**

**Internal: 20**

**External: 30**

**Objectives of the Course:**

On completion of the course, the student teacher will be able to:

- ∑ demonstrate knowledge on different perspectives in the area of education of children with disabilities;
- ∑ reformulate attitudes towards children with special needs;
- ∑ identify needs of children with diversities;
- ∑ plan need-based programmes for all children with varied abilities in the classroom;

- ∑ use human and material resources in the classroom;
- ∑ use specific strategies involving skills in teaching special needs children in inclusive school;
- ∑ plan and execute appropriate learner-friendly evaluation procedures;
- ∑ incorporate innovative practices to respond to education of children with special needs;
- ∑ contribute to the formulation of policy; and
- ∑ implement laws pertaining to education of children with special needs.

**Course Outline:**

**Unit I: Paradigms in Education of Children with Special Needs and Policy Perspectives**

- ∑ Historical perspectives and contemporary trends
- ∑ Defining Special Needs: ways of looking of Educational Difficulties - individual deficit view vs. curriculum view.
- ∑ Concept of special education, integrated education and inclusive education;
- ∑ Recommendations of the Salamanca Statement and Framework of Action, 1994; and Educational Provisions in the UNCRPD, 2006;
- ∑ Constitutional Provisions; Persons with Disabilities Act, 1995, (PWD Act); Rehabilitation Council of India Act, 1992, National Trust Act 1999 and RTE Act, 2009. National Institutes
- ∑ Education of Students with Disabilities in the National Policy on Education, 1986, POA 1992, Integrated Education for PW; IEDC, 1974 Scheme for Inclusive Education for PWD (IEDC, 2000) and Education of Special Focus Groups under the Sarva Shiksha Abhiyan (SSA, 2000); Scheme of Inclusive Education for PWD at Secondary School (IEDSS, 2009).

**UNIT II: Concept, characteristics, classification and curriculum adaptation in inclusive school for children with various disabilities**

- ∑ Visual impairment
- ∑ Hearing impairment
- ∑ Locomotor and Neuromuscular disorders
- ∑ Mental Retardation
- ∑ Specific learning disabilities
- ∑ Autism Spectrum Disorders

**UNIT III: Assessment and Teaching and development of appropriate Inclusive practices in schools**

- ∑ Identification and functional assessment of children with special needs.
- ∑ Implication of assessment for instructional planning and placement
- ∑ Peer tutoring, Cooperative learning, social learning, system approvals Multisensory teaching, reflective teaching.
- ∑ Developing lesson plan, IEP and TLM for children with special needs
- ∑ Duty of educational institutions, appropriate governments and School Management Committee to promote and facilitate inclusive education and towards creation of barrier-free environment for CWSN.
- ∑ Involving community resources as source of support to Inclusive school

**Modes of Learning Engagement:**

- ∑ The students should be exposed to good practices of dealing with special needs either through videos or through actual visits
- ∑ It is important to engage the participants in a lot of cooperative group work so that they start valuing alternative points of view and significance of collaboration
- ∑ The student trainees can also be asked to write their reflections on various topics.

- ∑ Presentation of case studies and discussion
- ∑ Interaction with children with disabilities studying in schools and spending quality time with them is of great help in changing attitudes and developing empathy.
- ∑ Projects on various topics can help the students to acquire in depth knowledge.
- ∑ Audio- Visual presentations and demonstrating various practices.

**Practicum:**

1. Critically review the New Indian Disability Act/ UNCRPD and examine how the new Act will satisfy the needs of PWD in an inclusive society.
2. Identify any one child with disability and prepare a case report.
3. Identify any one topic from the textbook and prepare write up as to how the given content can be adapted for children with sensory impairment and suggest teaching learning aids to be required by the teacher.
4. Conduct a survey in the local community and identify the possible changes to be brought in to remove physical, social and attitudinal barrier towards PWD.
5. Identify various types of schools available for children with disability and make a note on educational facility available for them.
6. Prepare any one of the topics from the five units for presentation in the class.

**Modes of Internal Assessment**

**Marks**

Written tests	10
Any two of the Practicum	10

**Suggested Readings:**

- 1 Banine, D (1988). Handicapped children in Developing countries: Assessment, Curriculum and Instruction - Edmonton (Alberta). University of Alberta.
- 2 Bala, M.J (2004). Methods of Teaching Exceptional Children,
- 3 Browning , R, E (2004): Teaching Students with Behaviour and Serve Emotional Problems, Jampala, M, B: Methods of Teaching Exceptional Children,
- 4 Farrell, M. (2004). Special Educational Needs: A Resource for Practitioners. New Delhi. Sage Publications.
- 5 Hegarty S. & Mithu Alur (2002). Education and children with Special need. New Delhi. Sage Publication.
- 6 Mani, M., N., G. (2001). Inclusive Education in Indian context. INRDC.
- 7 Moyes, R.A (2010). Building Sensory Friendly Classrooms to Support Children with Challenging Behaviors: Implementing Data Driven Strategies
- 8 NCERT and UNESCO (2004). Inclusive Education: An Orientation package for Teacher Educators. Department of Education of Groups with special needs. NCERT and UNESCO.
- 9 NCERT and UNESCO (2000). Assessment of Needs for Inclusive Education. Report of the First Regional Workshop. NCERT and UNESCO.
- 10 National institute for the Visually Handicapped.(2015). Information Booklet on Visual Impairment in India, Dehradun: Government of India.
- 11 Nerbonne, M. A. & Schow, R.L. (2013). Introduction to Audiologic Rehabilitation. 6th ed. Boston: Pearson Education.
- 12 Panda, K., C. (1990). Education of Exceptional Children. New Delhi. Vikas Publications.
- 13 Reddy G.L. & Rama, R (2000). Education of children with special needs, New Delhi - Discovery Pub.
- 14 Smith, D.D. (2002). Introduction to Special Education: Teaching in an age of challenge. Boston. Allyn and Bacon.
- 15 The Persons With Disability Act (1995). Ministry of Social Justice and Empowerment. Government of India, India, MSJE.
- 16 Smith, D.D (2003). Introduction to Special Education Teaching in an Age of opportunity, Allyn & Bacon,
- 17 Strichart, S., S (1993). Teaching Study Strategies to Students with Learning Disabilities, Allyn & Bacon, Boston,

- 18 Sataloff, R. T. & Sataloff, J. (2005). *Hearing Loss*. (4th Ed.) London: Taylor & Francis
- 19 Loreman, T, Deppeler, J & Harvey, D (2005). *Inclusive education - A practical guide to supporting diversity in the classroom*. (2<sup>nd</sup> Eds.). U.K. Routledge
- 20 UNESCO (1994). *The Salamanca Statement and Framework for Action on Special needs Education*. Paris. UNESCO
- 21 Wong, B, Y, L (1999). *The ABCs of Learning Disabilities*,

### **SES 3: Working with Community**

**Duration: 10 days/year**

**Evaluation: grade point scale**

**Objectives of the course:**

On completion of the course, the student teacher will be able to:

- acquaint themselves with the factors working in the society/community i.e. knowledge of social realities.
- develop the dignity of labour among them.
- arouse their interest in the social and economic reconstruction of the country.
- make themselves aware of the educational problems and needs of this society.
- enable themselves for preparing youth for sustainable development.
- develop their personality through community service.

**Methodology:** The students will spend 10 days at a stretch during the academic year in the identified village. Separate activities will be undertaken every year out of the following or given by the Institute.

**Suggested Activities:**

1. Shramdaan and beautification.
2. Study of educational scenario of a community. Reporting the profile of each Institution/NGO/social organisation, which are directly or indirectly concerned with educational /literacy programme.
3. Micro planning exercises for assessing the educational status of the community.
4. Organisation of "Nukad Natak" "Cultural Programmes", "Rallies" etc. for motivating parents for sending their wards to schools.
5. School mapping exercises for assessing the educational needs of the community.
6. Study of enrolment, stagnation and dropout problems.
7. Exploring the community resources and finding means and ways of using them for betterment of school.
8. Adopting a community and assessing its educational needs, social needs etc.
9. Conducting awareness programmes in the community- like Environment conservation, tree plantation, watershed management, health programmes like vaccination, polio drop etc. AIDS awareness, electoral awareness, road safety, human rights, women rights etc.
10. Organization of Literacy programmes in the community
11. Cleanliness drives in the community and awareness about their needs.
12. Character building programmes
13. Developing healthy food habits among the community
14. Conducting Vocational training programmes for selfemployment.
15. Promoting peace oriented values in the community.
16. Remedial teaching work for poor and needy in the community.
17. Action Research regarding local problems in consultation with the community.
18. Promoting peace oriented values in the community.

19. Conducting Adult Education programmes
20. Assistance and working with local community in actual relief work whenever needed.
21. Training of community in First Aid.
22. Helping the children with special needs.
23. Conducting Vocational training programmes for self employment.

**Modes of Learner Engagement:**

Proposed activities of the programme will be organized keeping in view the budgetary provision and the time of duration along with the required available facilities at the time of organization of the programme.

**Modes of Internal Assessment:**

- Σ Internal assessment of Punctuality, Regularity, Discipline, Cooperation and Performing Arts will be done through observation of the students and viva will be conducted on their experiences and written report prepared by the student teachers.

- Letter Grade	- Grade Point
- O (Outstanding)	- 100
- A+(Excellent)	- 90-99
- A(Very Good)	- 80-89
- B+(Good)	- 70-79
- B(Above Average)	- 60-69
- C(Average)	- 50-59
- P (Pass)	- 40-49
- F(Fail)	- Below 40
- Ab (Absent)	- 0

**B.Sc.B.Ed. Part-III**

**Group B : Core Courses**

**CC – 1 PHYSICS**

<b>Scheme</b>	<b>Exam Duration</b>	<b>Max. Marks</b>	<b>Min.Pass Marks</b>
Paper I	3hrs.	40	36
Internal		10	
Paper II	3hrs.	40	
Internal		10	
Practical	5hrs.	50	18

**Note:** There will be two experiments. The distribution of marks will be as follows: Two experiments

Each of 15 marks	30 marks
Viva voce	10 marks
Record	10 marks
Total	50 marks

**Note :-** The paper is divided in five independent units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit. MKSA system of units is to be used. The question paper shall have at least 30 percent weightage of problems and numericals.

**CC – 1 (I) Paper – I: SOLID STATE PHYSICS, SOLID STATE DEVICES AND ELECTRONICS**

**Duration- 3 hours**

**Max. Marks: 40**

**Solid State  
Physics Unit I**

**Overview:** Crystalline and glassy forms, liquid crystals, glass transition.

**Structure:** Crystal structure, periodicity, lattices and bases, fundamental translation vectors, unit cell, Wigner-seitz cell, allowed rotations, lattice types, lattice planes, common crystal structures.

Laue's theory of X-ray diffraction, Bragg's law, Laue patterns.

**Bonding:** Potential between a pair of atoms, Lennard-Jones potential, concept of cohesive energy, covalent, Van der Waals, ionic, and metallic crystals.

**Magnetism:** Atomic magnetic moment, magnetic susceptibility, Dia-, Para- and Ferromagnetism, Ferromagnetic domains, hysteresis.

**Unit-II**

**Thermal properties:** lattice vibrations, simple harmonic oscillator, second order expansion of Lennard-Jones potential about the minimum, vibrations of one dimensional monatomic chain under harmonic and nearest neighbour interaction approximation, concept of phonons, density of modes (1-D), Debye model; lattice specific heat, low temperature limit, extension (conceptual) to 3-D.

**Band structure:** Electrons in periodic potential, nearly free electron model (qualitative), energy bands, energy gap, metals, insulators, semiconductors.

**Motion of electrons:** Free electrons, conduction electrons, electron collisions, mean free path, conductivity and Ohm's law, Density of states, Fermi energy, Fermi velocity, Fermi-Dirac distribution.

**Unit III**

**Semiconductors:** Intrinsic semiconductors, electrons and holes, Fermi level, Temperature dependence of electron and hole concentrations, Doping, impurity

states, n and p type semiconductors, conductivity, mobility, Hall effect, Hall coefficient.

**Semiconductor devices:** metal-semiconductor junction, p-n junction, majority and minority carriers, diode, Zener and tunnel diodes, light emitting diode, transistor, solar cell.

**Advanced Materials:** Superconductors, fullerenes, carbon nanotubes, graphenes, nanomaterials.

## **Electronics**

### **Unit IV**

**Power supply:** Diode as a circuit element, load line concept, rectification, ripple factor, Zener diode, voltage stabilization, IC voltage regulation, characteristics of a transistor in CB, CE and CC mode, graphical analysis of the CE configuration, low frequency equivalent circuits, h-parameters, bias stability, thermal runaway.

**Field effect transistors:** I-V curves of JFET, biasing of JFET, operation of JFET, source follower, depletion and enhancement mode, MOSFET, biasing of MOSFET, FET as variable voltage resistor, digital MOSFET circuits, Tunnel diode, concept of negative resistance, characteristics and working of tunnel diode, UJT- its construction and working, UJT as relaxation oscillator.

### **Unit V**

**Small Signal Amplifiers:** General principles of operation, classification, distortion, RC coupled amplifier, gain, frequency response, input and output impedance, multistage amplifiers, transformer coupled amplifiers, Equivalent circuits at low, medium and high frequencies, emitter follower, low frequency common-source and common-drain amplifier, Noise in electronic circuits.

### **Textbooks and References**

1. C. Kittel; Introduction to Solid State Physics, V<sup>th</sup> Edition (John Wiley and Sons, New York, 1976)
2. S Blackmore; Solid state Physics, II<sup>nd</sup> Edition (Cambridge University press, Cambridge)
3. N W Ascroft and N D Mermin; Solid State Physics (Holt, Rinehart and Winston, New York, 1976) II
4. B G Streetman; Solid State Electronic devices, India, New Delhi, 1986) W D Stanley; Electronic Devices, Circuits and Applications, (Prentice-Hall, New Jersey, USA, 1988)
5. J D Ryder; Electronics Fundamentals and Applications, II<sup>nd</sup> Hall of India, New Delhi, 1986)
6. J Millman and A Grabel; Microelectronics, International Edition (McGraw- Hill Book Company, New York, 1988).
7. R. J. Singh, Solid State Physics (Pearson, 2012)
8. J. P. Srivastava, Elements of Solid State Physics (PHI, 2006)
9. Anke Krueger, Carbon Materials and Nanotechnology (Wiley-VCH, 2010)
10. C. N. R. Rao and A. K. Sood, Graphene synthesis, properties and phenomena (Wiley-VCH, 2010)

**CC – 1 (II) - Paper II : QUANTUM MECHANICS AND STATISTICAL PHYSICS**  
**Duration- 3 hours** **Max. Marks:40**

**Quantum Mechanics Unit-I**

Origin of the quantum theory- Failure of classical physics to explain the phenomena such as black-body spectrum, photoelectric effect, Ritz combination principle in spectra, stability of an atom, Planck's radiation law, Einstein's explanation of photoelectric effect, Bohr's quantization of angular momentum and its application to hydrogen atom, limitations of Bohr's theory.

**Unit II**

Wave-particle duality and uncertainty principle- Louis de Broglie's hypothesis for matter waves, the concept of wave and group velocities, evidence for diffraction and interference of 'particles', experimental demonstration of matter waves, Consequence of de Broglie's concepts, quantization in hydrogen atom, energies of a particle in a box, wave packets, Heisenberg's uncertainty relation for  $p$  and  $x$ , its extension to energy and time.

Consequence of the uncertainty relation: gamma ray microscope, diffraction at a slit, particle in a box, position of electron in a Bohr orbit.

**Quantum Mechanics:** Schrodinger's equation, Postulatory basis of quantum mechanics, operators, expectation values, transition probabilities.

**Unit III**

Applications of quantum mechanics to particle in a one dimensional and three dimensional box, harmonic oscillator, reflection at a step potential, transmission across a potential barrier.

Hydrogen atom: natural occurrence of  $n$ ,  $l$  and  $m$  quantum numbers, the related physical quantities, comparison with Bohr's theory, Wave functions, Probabilistic interpretation.

**Statistical Physics**

**Unit IV**

The statistical basis of thermodynamics: Probability and thermodynamic probability, principle of equal a-priori probabilities, probability distribution and its narrowing with increase in number of particles, The expressions for average properties, Constraints, accessible and inaccessible states, distribution of particles with a given total energy into a discrete set of energy states.

Some universal laws: The  $\mu$  space representation, division of  $\mu$  space into energy sheets and into phase cells of arbitrary size, application to one-dimensional harmonic oscillator and free particles, Equilibrium between two systems in thermal contact, bridge with macroscopic physics, Probability and entropy, Boltzmann entropy relation, Statistical interpretation of second law of thermodynamics, Boltzmann canonical distribution law and its applications, rigorous form of equipartition of energy. Partition function and its applications, Saha's ionization formula.

**Unit V**

Maxwellian distribution of speeds in an ideal gas, Distribution of speeds and of velocities, experimental verification, distinction between mean, rms and most probable speed values, Doppler broadening of spectral lines.

Transition to quantum statistics: ' $h$ ' as a natural constant and its implications, cases of particle in a one-dimensional box and one-dimensional harmonic oscillator, 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.

**Textbooks and References**

1. B B Laud, Introduction of Statistical Mechanics (Macmillan 1981).



- F Reif: Statistical Physics (Mcgraw-Hill, 1988).
- K Haug: Statistical Physics (Wiley Eastern, 1988).
- H.S. Mani and G.K. Mehta: Introduction to Modern Physics Affiliated East West Press Pvt. Ltd. New Delhi, 1998.
- A. K. Ghatak and S. Lokanathan: Quantum Mechanics- Theory and Application Macmillan India Lt. Delhi.
- Non-relativistic Quantum Mechanics, Landau and Liftshitz.

### PRACTICALS

**Duration: 5 hours                      Max. Marks: 50                      Min.Pass Marks: 18**

Any twelve of the following experiments are to be performed. Few more experiments may be set at the institutional level.

- (1) Study of a RC Transmission line at 50 Hz.
- (2) Study of a LC transmission line
  - (i) a fixed frequency (ii) at variable frequency
- (3) (i) Study the Recovery time as a function of frequency of operation and switching current.  
(ii) Recovery time of junction diode and point contact diode.
- (4) Design and study of a Zener/VR tube regulated power supply and study the regulation with various load.
- (5) Study the characteristics of a field effect transistor (FET) and design and study of amplifier of finite gain.
- (6) Study the characteristics of a unijunction transistor.
- (7) Study the frequency responses of a transistor amplifier (bipolar/FET) obtain the input and output impedance of the amplifier.
- (8) Design and study of an R-C phase shift oscillator and to measure output impedance (frequency response with change of component of value R & C).
- (9) To study the characteristics of a thermistor.
- (10) Direct measurement of magnetic field by PSSC Method.
- (11) To find the mass of electron by magic eye tube (PSSC) method).
- (12) Study of the Hybrid parameters of a transistor.
- (13) Study of negative feedback amplifier. (Frequency response & bandwidth to distortion)

#### Laboratory tutorials

1. Find roots of  $f(x) = 0$  by using Newton-Raphson method
2. Find roots of  $f(x) = 0$  by using secant method
3. Integration by Simpson rule
4. To find the value of y at a given value of x by Runge-Kutta Method
5. Eight Queens Problem
6. String manipulations
7. Towers of Hanoi (Nonrecursive)
8. Finding first four perfect numbers

### CC 2 CHEMISTRY

Scheme	Exam Duration	Max. Marks	Min. Pass Marks
Paper I	3hrs.	40	} 36
Internal		10	
Paper II	3hrs.	40	
Internal		10	
Practical	5hrs.	50	} 18

**Note :** There will be three experiments. The distribution of marks will be as follows: Three experiments (one from each group)

Experiments (3)	40 marks
Viva	05 marks
Record	05 marks
Total	50 marks

### CC 2 (I) – Paper I - Organic Chemistry

**Duration- 3 hrs.**

**Max. Marks:40**

#### Unit I Chemistry of hydroxy compounds

- (A) Alcohols classification and nomenclature. Monohydric alcohols-nomenclature, methods of formation by reduction of aldehydes, ketones, carboxylic acids and esters. Hydrogen bonding. Acidic nature. Reactions of alcohols.  
Dihydric alcohols-nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage [Pb(OAc)<sub>4</sub> and HIO<sub>4</sub>] and pinacol-pinacolone rearrangement.  
Trihydric alcohols- nomenclature and methods of formation, chemical reactions of glycerol.
- (B) **Phenols:** Nomenclature, structure and bonding. Preparation of phenols, physical properties and acidic character. Acidic strengths 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, Lederer-Manasse reaction and Reimer-Tiemann reaction.
- (C) **Ethers and Epoxides:** Nomenclature of ethers and methods of their formation, physical properties, Chemical reactions – cleavage and auto oxidation, Ziesel's method. Synthesis of epoxides. Acid and base-catalyzed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and Organolithium reagents with epoxides.

#### Unit II Carbonyl compounds

- (A) **Aldehydes and Ketones:** Nomenclature and structure of carbonyl group. Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, synthesis of aldehydes and ketones using 1, 3- dithianes, synthesis of ketones from nitriles and from carboxylic acid. Physical properties,  
Mechanism of nucleophilic additions to carbonyl group with particular emphasis on Benzoin, Aldol, Perkin and Knoevenagel condensations, Condensation with ammonia and its derivatives, Witting reaction, Mannich reaction.  
Use of acetals as protecting group, Oxidation of aldehydes, Baeyer-villiger oxidation of ketones, Cannizzaro reaction, MPV, Clemmensen, Wolff-kishner, LiAlH<sub>4</sub> and NaBH<sub>4</sub> reductions, Halogenation of enolizable ketones.
- (B) Introduction to  $\alpha$ ,  $\beta$  unsaturated aldehydes and ketones.

#### Unit III Carboxylic Acids and its derivatives

- (A) **Carboxylic Acids:** Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Preparation of carboxylic acids. Reactions of carboxylic acids. Hell-Volhard-Zelinsky reaction. Synthesis of acid chlorides, esters and amides. Reduction of carboxylic acids. Mechanism of decarboxylation.  
Methods of formation and chemical reactions of unsaturated monocarboxylic acids.  
Dicarboxylic acids: Methods of formation and effect of heat and dehydrating agents.
- (B) **Carboxylic Acid Derivatives:** Structure and nomenclature of acid chlorides, esters, amides and acid anhydrides. Relative stability of acyl derivatives. Physical properties, interconversion of acid derivatives by nucleophilic acyl substitution. Preparation of carboxylic acid derivatives, chemical reactions, mechanisms of esterification and hydrolysis (acidic and basic).

#### Unit IV Nitrogen containing compounds and Enolates

- (A) **Nitroalkanes and Nitroarenes:** Preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes.  
Mechanisms of nucleophilic substitution in nitroarenes and their reductions in acidic, neutral and alkaline media. Picric acid. Halonitroarenes: Reactivity.
- (B) **Amines:** Structure and nomenclature of amines, physical properties. Stereochemistry of amines, Separation of a mixture of primary, secondary and tertiary amines, Structural features effecting basicity of amines, Amines salts as phase-transfer catalysts, Preparation of alkyl and aryl amines (reduction of nitro compounds, nitriles), reductive amination of aldehydic and ketonic compounds, Gabriel-phthalimide reaction, Hofmann bromamide reaction. Reactions of amines: Electrophilic aromatic substitution in aryl amines, reaction of amines with nitrous acid. Synthetic transformation of aryl diazonium salts, azo coupling.
- (C) **Organic Synthesis via Enolates:** Acidity of  $\alpha$ -hydrogens. Synthesis of ethyl acetoacetate by Claisen condensation and Synthesis of diethylmalonate. Keto- enol tautomerism in ethyl acetoacetate. Synthetic applications of ethyl acetoacetate and diethylmalonate. Alkylation of 1,3-dithianes.

#### Unit V Electromagnetic Spectrum: Absorption Spectra

- (A) **Ultraviolet (UV) absorption spectroscopy** – absorption laws (Beer-Lambert law), molar absorptivity, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome. Bathochromic, hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated enes and enones. Woodward Fieser rules for calculation of absorption maxima in dienes and  $\alpha, \beta$  unsaturated carbonyl compounds.
- (B) **Infrared (IR) absorption spectroscopy** – molecular vibrations, Hooke's law, selection rules, intensity and position of IR bands, fingerprint region, characteristic absorption of various functional groups and interpretation of IR spectra of simple organic compounds.

#### Text Books and References

1. Bruckner, R. Advanced organic chemistry : reaction mechanisms Academic Press
2. Lowry, Thomas H. Mechanism and theory in organic chemistry Addison-Wesley
3. Kalsi P S Reaction Mechanism 6th Edition
4. Singh Mukherjee, Reaction Mechanism
5. Robert M. Silverstein, Spectrometric Identification of Organic Compounds, Wiley
6. Lowry, Thomas H. Mechanism and theory in organic chemistry Addison-Wesley
7. Francis A Carey Organic Chemistry fourth edition.
8. Bahl, Arun A textbook of organic chemistry S. Chand and Co. Ltd.

### CC 2 (II) - Paper-II PHYSICAL CHEMISTRY

Duration- 3 hrs.

Max. Marks:40

#### Unit I Elementary Quantum Mechanics

Black-body radiation, Planck's radiation law, photoelectric effect, heat capacity of solids, Bohr's model of hydrogen atom (no derivation) and its defects, Compton effect, De Broglie hypothesis, the Heisenberg's uncertainty principle, Sinusoidal wave equation, Hamiltonian operator, Schrodinger wave equation and its importance, physical interpretation of the wave function, postulates of quantum mechanics, particle in a 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 functions.

#### Unit II Molecular Orbital Theory

Basic ideas, criteria for forming M.O from A.O , construction of M.O's by

+

LCAO-H<sub>2</sub><sup>+</sup> ion, calculation of energy levels from wave functions, physical picture of bonding and ant bonding wave functions, concept of  $\sigma$ ,  $\sigma_2^*$ ,  $\sigma_3^*$ ,  $\pi$ ,  $\pi^*$  orbitals and their characteristics. Hybrid orbitals – sp, sp<sub>2</sub>, sp<sub>3</sub>, calculation of coefficients of A.O.'s used in these hybrid orbitals.

Introduction to valence bond model of H<sub>2</sub>, comparison of M.O. and V.B. models.

### Unit III Fundamentals of Spectroscopy-I

- (A) **Spectroscopy:** Introduction: electromagnetic radiation, regions of the spectrum, basic features of different spectrometers, statement of the Born- Oppenheimer approximation, degrees of freedom.
- (B) **Rotational Spectrum:** Diatomic molecules, Energy levels of a rigid rotor (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.
- (C) **Vibrational Spectrum:** Infrared spectrum: energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, 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.

### Unit IV Fundamentals of Spectroscopy-II

- (A) **Raman Spectrum:** Concept of polarisability, pure rotational and pure vibrational Raman spectra of diatomic molecules, selection rules.  $\sigma$ ,  $\pi$ - and n M.O., their energy levels and the respective transitions.
- (B) **Electronic Spectrum:** Concept of potential energy curves for bonding and antibonding molecular orbitals, qualitative description of selection rules and Frank-Condon principles. Qualitative description of  $\sigma$ ,  $\pi$ - and n M.O., their energy levels and the respective transitions.

### Unit V Photochemistry and physical properties of matter

- (B) **Photochemistry:** Interaction of radiation with matter, difference between thermal and photochemical processes. Law of photochemistry: Grothus- drapper law, Stark-Einstein law, Jablonski diagram depicting various processes occurring in the excited state, qualitative description of fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions – energy transfer processes (simple examples).
- (B) **Physical properties of matter:** Optical activity, polarization – (Clausius – Mossotti equation), orientation of dipoles in an electric field, dipole, moment, induced dipole moment, measurement of dipole moment temperature method and refractivity method, dipole moment and structure of molecules, magnetic properties- paramagnetism, diamagnetism and ferromagnetics.

### Text Books and References

1. Mahendra R Awode, Quantum Chemistry S. Chand Publishing.
2. A K Chandra, Introductory Quantum Chemistry, Tata McGraw-Hill Education
3. Peter Atkins Julio de Paula, Atkins' Physical Chemistry Oxford University Press.
4. Robert J. Silbey, Robert A. Alberty, Mounji G. Bawendi, Physical Chemistry 4th Edition, Wiley
5. Colin N. Banwell, Fundamentals of Molecular & Spectroscopy, Tata McGraw- Hill Education
6. Walter S. Struve, Fundamentals of Molecular Spectroscopy, Wiley

### PRACTICAL

**Duration: 5 Hours**

**Max. Marks: 50**

**Min.Pass Marks: 18**

**Note: The students should be given exposure of any research labs and instrumentation center/ reputed university lab/ industry/ government labs of northern region.**

#### A. Inorganic Chemistry

##### 1. Synthesis and analysis

- a. Preparation of sodiumtrioxalatoferrate(III), Na<sub>3</sub>[Fe(C<sub>2</sub>O<sub>4</sub>)<sub>3</sub>] and determination of its composition by permanganometry.
- b. Preparation of copperetraammine complex. [Cu(NH<sub>3</sub>)<sub>4</sub>]SO<sub>4</sub>.
- c. Preparation of Ni-DMG complex, [Ni(DMG)<sub>2</sub>].
- d. Preparation of cis- and trans – bisoxalatodiaqua chromate (III) ion.

## 2. Gravimetric Analysis

- a. Cu as Copper thiocyanate.
- b. Ni as Nickel dimethylglyoxime

## B. Organic Chemistry Synthesis

### of Organic Compounds

- a. Acetylation of salicylic acid, aniline, glucose and hydroquinone.
- b. Benzoylation of aniline and phenol.
- c. Aliphatic electrophilic substitution: Preparation of iodoform from ethanol/acetone  
Aromatic electrophilic substitution:
- d. Nitration: Preparation of *m*-dinitrobenzene and *p*-nitroacetanilide
- ẽ. Halogenation: Preparation of *p*-bromoacetanilide and 2,4,6-tribromophenol
- ÿ. Diazotization/coupling: Preparation of methyl orange and methyl red
- ÿ. Oxidation: Preparation of benzoic acid from toluene
- ÿ. Reduction: Preparation of aniline from nitrobenzene and *m*-nitroaniline from *m*-dinitrobenzene.

## C. Physical Chemistry

### 1. Electrochemistry

1. pH metric: Acid-Base Titration.
2. To determine the strength of the given acid conductometrically using standard alkali solution.
3. To determine the solubility and solubility product of a sparingly soluble product of a sparingly soluble electrolyte conductometrically.
4. To determine the ionization constant of a weak acid conductometrically.
5. To titrate potentiometrically the given ferrous ammonium sulphate solution using  $\text{KMnO}_4$  /  $\text{K}_2\text{Cr}_2\text{O}_7$  as titrant and calculate the redox potential of Fe<sup>2+</sup>/Fe<sup>3+</sup> system on the hydrogen scale.

### 2. Chemical Kinetics

To study the saponification of ethyl acetate kinetically.

<b>CC-ZOOLOGY</b>			
<b>Scheme I</b>	<b>Exam Duration</b>		<b>Max Marks</b>
<b>Paper – I</b>	3 hours	40 (External) 10 (Internal)	
<b>Paper II</b>	3 hours	40 (External) 10 (Internal)	36

### **CC – 3 (I) -PAPER I : DEVELOPMENTAL BIOLOGY**

**Max. Marks : 40**

Practical                      4 hours                      50 (External)                      18

**Duration : 3 hrs.**

**Objectives :**

To enable students to comprehend the modern concepts of Developmental Biology to understand the Developmental sequences in vertebrates ; to compare the Developmental of organs and systems.

**Unit – I**

- Concepts and scope of Developmental Biology
- Gametogenesis: i) Structure and types of spermatozoa, spermatogenesis.  
ii) Structure and types of eggs, oogenesis
- Fertilization: types mechanism and significance
- Cleavage : Types and patterns of cleavage , fate map.

**Unit –II**

- Gastrulation : Morphogenetic movements and significance.
- Development up to the end of neurulation
- Metamorphosis of tadpole larva, hormonal control of metamorphosis

**Unit –III**

- Development of frog up to formation of advanced tadpole, normal table of development
- Embryogenesis of chick: Development up to neurulation, tabulation.
- Development of chick according to the hours of incubation – 18 hours, 21 hours, 24 hours, 33 hours, 48 hours, 56 hours, 72 hours, and 96 hours.
- Extra embryonic membranes of chick – development and functions.

**Unit-IV**

- Placenta and placentation in mammals.
- Parthenogenesis: natural and artificial
- Regeneration mechanism in animals , steps of limb regeneration in amphibians.

**Unit –V**

- Elementary idea of the following developmental process
  - Embryonic induction'
  - Organizer concept
  - Differentiation
- Teratogenesis : Genetic and environmental teratogenesis
- Aging and senescence.

**Textbooks and References:**

- Development Biology by S.F. Gilbert, 10<sup>th</sup>, (Sinauer Associate, 2014)
- Development Biology by K.V. Sastry & Vinita Shukla – (Rastogi Publications 2008)
- Introduction to Embryology by B.I. Balinsky – (W.B. Saunders, Philadelphia, 1976)
- Foundations of Embryology by B.M. Paten and B.M. Carison.
- Foundations of Animal Development by A.F. Hopper and N.H. Hart (Oxford University press, New York, 1980)
- Vertebrate Embryology by R. S. McEwen (Oxford & I. B. M Publishing Co., New Delhi)

7. Development Biology by J.W. Brookbank.
8. Patterns and principles of Animal Development by J.W. Saunders Jr
9. Embryology by Barth IG (1966) – Holt Rinehart & Winston
10. Embryology by Berril N & Karp G (1960) -Holt Rinehart & Winston
11. Fundamentals of Comparative Embryology of Vertebrates by Huettner AF (1967) – McMillan Co.
12. Chordate Embryology by Mohan Arora (1985) – Atma Ram & Sons
13. Laboratory manual of Vertebrate Embryology by Rugh R -Allied Pacific Pvt. Lt.d
14. Chordate Embryology by Verma PS & Agarwal VK – Chand & Co.
15. Modern Development Biology, Dr KC Soni Hindi Edition, College bookcentre, Chaura Rasta Jaipur, Dr KC Soni Hindi Edition, College bookcentre, Chaura Rasta, Jaipur

**CC-3 (II) - PAPER II : ENVIRONMENTAL STUDIES, ETHOLOGY AND ECONOMIC ZOOLOGY**

**Duration : 3 hrs.**

**Max. Marks : 40**

**Objectives :**

To enable students to understand the energy sources, flow of energy and conservation; to understand the recycling of minerals and nutrients in ecosystem; to understand the dynamics of population; to understand causes of pollution; to comprehend origin of life, animal behavior and economic importance of animals with wild life protection.

**Unit –I**

- a) Environment : - Atmosphere, lithosphere and hydrosphere as habitats and ecological factors.
- b) Abiotic factors : - Light and Temperature as ecological factors, limiting factors, Liebig's law of minimum and Shelford Law of tolerance
- c) Ecosystem : Types, structure, functions and example, Dynamics of Ecosystem, Ecological Pyramids, energy in ecosystem, productivity,
- d) biochemical cycle- water, nitrogen and sulphur cycles regarding of organic nutrients.
- e) Population : - Definition and attributes – density – natality, vital index, age distribution, growth patterns, migration, dispersal, dispersions, Environmental resistance, carrying – Definition Structure, Species.
- f) Biotic Community – Definition Structure, Species, Ecotone, edge effects, niche, community stability Ecological succession, Intra and Interspecific interaction. All types of animal association.
- g) Elementary statistics : central tendency, test of significance.

**Unit-II**

Pollution Types and Causes

- a) Air pollution: sources, acid rain, photochemical smog, prevention and control
- b) Water pollution, sources, prevention and control, eutrophication.
- c) Noise pollution; sources, prevention and control.
- d) Soil pollution; sources, prevention and control
- e) Thermal pollution.

**Unit – III**

- a) Green house effect and global warming
- b) Depletion of ozone layer.
- c) Natural Disaster – Earthquake, Tsunami
- d) Natural Resources and conservation – Non Renewable and Renewable
- e) Biomagnification

**Unit –IV**

- b) Introduction and history of Ethology.
- c) Behavior :- Innate (tropism, Texas, reflex instincts) and Acquired (learning and



- reasoning)
- d) Motion : Classification of directional movements:- kinesis, tropism & taxes
  - e) Communication :- Definition ,types of signal ( touch, sound, Chemical, and visual), metacomunication) phenomenon
  - f) Societies: characteristics and advantage with special reference to honey bee, and monkey

#### Unit –V

- a) Economic Importance of Invertebrates (Apiculture, Aquaculture, Sericulture).
- b) Insects as pests and their management
- c) Economic Importance of vertebrates ( Fish culture and Poultry culture.)
- d) Wild life of India causes of depletion , wild life, modes of wild life conservation, Red data book. Environmental legislations (Wildlife Protection Act, Environment act. Bio divergent act). Wild life scenario in and around central foot hills of the Arawali and the thar.

#### Textbooks and References

1. Environmental Biology , M Calver , Cambridge Pub 2009.
2. Fundamentals of Ecology of E.P. Odum – W.B. Saunders, Philadelphia)
3. Fundamentals of Ecology of Gene P Odum & Gray W Barrett 5<sup>th</sup> ed., Cengage Learning 2011
4. Environmental studies by S.V.S Rana – Rastogi Publication, 2008
5. Animal Ecology by S.P. Singh 6<sup>th</sup> Revised Edition – Rastogi Publications ,2008
6. Basic Ecology by E.P. Odum (Holt, Rinehart & Winston , New York)
7. Ecology by S.K. Charles – (Prentice Hall of India, New Delhi)
8. Ecology : Principle and Applications by Chapman E ( 1988) – Cambridge University Press
9. Modern concept of ecology by Kumar HD ( 1986) Vikas Publication House.
10. Ecology and Environment by Sharma PD (1991) – Rastogi Publication
11. Environmental Biology by Trivedi PR & Gurudeep Raj (1992)
12. Animal Ecology and Biostatistics. Dr KC Soni Hindi Edition college book centre, Chaura Rasta, Jaipur
13. Mammalian Endocrinology and Animal Behavior , Dr VS Pawar, Hindi Edition, College book centre, Chaura Rasta Jaipur

#### PRACTICAL

**Duration : 4 hours**

**Max .Marks : 50**

#### Objectives:

To develop the skills of staining and mounting of embryos of chick/frog/insect as per UGC guidelines: to understand the development patterns of chick and frog. To enable students to analyse the physico-chemical and biological factors of water and soil sample ; to identify and estimate quantitatively the aquatic organism and their adaptation; to observe the population growth patterns.

Practical work based of Paper I and II

Course content:

1. Study of types of sperm smears preparation.
2. Study of different types of eggs ( Insect, Frog, Hen)
3. Study of eggs, cleavage, blastula, gastrula, neurula, tail bud, hatching , mature, tadpole larval metamorphic stages of toad/froglet.
4. Study of embryological slides of various stages of frog.
5. Study of embryological slides of various stages of chick.
6. Study of development of chick with the help of charts/CD/s/Video/ MMetc.
  - i) Whole mounts : 18 hrs , 24 hrs, 33 hrs, 48 hrs, 56hrs, 72hrs, and 96 hrs, of incubation period embryos.
  - ii) Study of primitive streak stage in living embryo after removal of the blastoderm

from the egg or through multimedia film etc.

iii) Study of the embryo at various stages of incubation in vivo by making a window in the egg shell.

7. Frog embryology – Study of spawn, identification of different stages through model/charts/multimedia etc.
8. Microtomy – Fixation of tissue from cadaver/ unbanned animal, processing and infiltration of wax, preparation of blocks, cutting of blocks, spreading of ribbons and staining for permanent slides of histological studies.
9. Simulation of an ecosystem in the laboratory.
10. Determination of oxygen content of water sample by Winkler's method.
11. Determination of chloride content of water sample
12. Determination of sulphates content of water sample
13. Determination of dissolved CO<sub>2</sub> content of water
14. Determination of total solid content of water
15. Determination of pH of soil sample
16. Determination of water content in a given sample of soil
17. Detection of salts i.e. phosphates, sulphates, nitrates and chlorides in a given sample of water.
18. Exercise on mean, median, mode and test of significance

Note :

1. The use of animal/ materials for dissection or otherwise is subject to the condition that these are not banned under the wildlife Protection Act and /or as per UGC guidelines.
2. The above content will be covered through model /charts/ multimedia/slides etc.
3. The students are required to submit assignment on the following.
  - a. One assignment on the instrument /technique about its principle, working, precautions and applications; and/or reagents/ solutions preparations.
  - b. Report on study of wild life /ecosystem /industry etc from their natural habitat (excursion)

**Guidelines/Instructions for Practical Examination**

**Max. Marks : 50**

**Time allowed : 4 Hrs.**

**Min. Pass Marks : 18**

S. No.	Exercise	Marks
1.	Temporary mounting * one (Staining, identification, sketch)	3
2.	Simulated ecosystem	3
3.	Permanent slides –four ( Identification with reasons)	8
4.	Microtomy * -double staining and slide preparation	8
5.	Ecological experiment	6
6.	Statistical exercise	5
7.	Practical record and slides	5
8.	Viva	4
9.	Project report and assignment	8

\* as per UGC guidelines

<b>CC-4 BOTANY</b>			
<b>Scheme</b>	<b>Exam. Duration</b>	<b>Max. Marks</b>	<b>Min. Pass Marks</b>
Paper I	3 hrs.	40 (External) 10 (Internal)	} 36
Paper II	3 hrs.	40 (External) 10 (Internal)	
Practical	4 hrs.	50	18

**CC-4(I) Paper – I: Structure, Development and Reproduction in Flowering plants**  
**Duration: 3hrs** **Max. Marks: 40**

**UNIT- I**

The basic body plan of a flowering plant; Types of Tissue and Tissue System.

**The shoot system:** The shoot apical meristems and its histological organization; vascularization of primary shoot in monocotyledons and dicotyledons; formation of internodes, branching pattern; monopodial sympodial growth; canopy architecture; cambium and its functions; formation of secondary xylem; a general account of wood structure in relation to conduction of water and minerals; characteristics of growth rings, sapwood and heart wood; secondary phloem – structure – function relationships; periderm

**UNIT II**

**Leaf:** Origin, development, arrangement and diversity in size and shape; internal structure in relation to photosynthesis and water loss; adaptations to water stress; stomatal types and trichomes; senescence and abscission.

**The root system:** The root apical meristem and its organisation; differentiation of primary and secondary tissues and their roles; structural modifications for storage, respiration, reproduction and for interaction with microbes.

**UNIT – III**

**Flower:** A modified shoot; development, structure and function of anther and pistil; Development of male and female gametophytes; Types of pollination; attractions and rewards for pollinators.

**UNIT – IV**

**Pollen-pistil interaction:** Sexual incompatibility; Genetic, physiological and biochemical basis of rejection reaction; methods to overcome incompatibility.

**Fertilization:** Double fertilization, Apomixis, Parthenocarpy

**UNIT – V**

**Embryo:** Embryo development in Dicots and monocots; structure and function of suspensor; Polyembryony.

**Endosperm:** Types, development, structure and functions of endosperm, haustorial and ruminate endosperm.

**Fruits:** Development and types of fruits.

**CC-4(II) Paper – II: Plant Physiology**

**Duration: 3hrs**

**Max. Marks: 40**

**UNIT-I**

**Plant-water relations:** Importance of water to plant life; physical properties of water; diffusion and osmosis; DPD and water potential concept, absorption and transport of water: Transpiration and mechanism of opening and closing of stomata. Factors affecting transpiration.

**Translocation of organic substances:** mechanism of phloem transport; source – sink relationship; factors affecting translocation.

**UNIT – II**

**Photosynthesis:** Historical aspects; photosynthetic pigments; action spectra and enhancement effect; concept of two photosystems; photophosphorylation; C<sub>3</sub> cycle;

C4 cycle; CAM cycle; photorespiration; factors influencing photosynthesis; C3 & C4 plants. Significance of photosynthesis.

#### UNIT – III

**Respiration:** Aerobic and anaerobic respiration; respiratory substrates; Glycolytic pathway of glucose degradation to pyruvic acid; tricarboxylic acid cycle; electron transport mechanism (chemi – osmotic theory); redox potential; oxidative phosphorylation; pentose phosphate pathway. Factors affecting respiration.

#### UNIT – IV

**Mineral nutrition:** criteria of essentiality of elements; essential macro – and micro-elements and their role; mineral uptake; deficiency and toxicity symptoms; water culture technique; foliar nutrition.

**Nitrogen and lipid metabolism:** Biology of nitrogen – fixation; importance of nitrate reductase and its regulation; ammonium assimilation; structure and function of lipids; fatty acid biosynthesis;  $\beta$ -oxidation; saturated and unsaturated fatty-acids; storage and mobilization of fatty acids.

#### UNIT – V

**Growth and development:** Definitions; phases of growth and development; Growth Curve, kinetics of growth; seed dormancy, seed germination and factors of their regulation; plant movements; the concept of photoperiodism; physiology of flowering; florigen concept; biological clocks; physiology of senescence, fruit ripening; plant hormones auxins, gibberellins, cytokinins, abscisic acid and ethylene, history of their discovery, biosynthesis and mechanism of action, photomorphogenesis; phytochromes and cryptochromes, their discovery, physiological role and mechanism of action.

#### Suggested Readings:

- Hopkins W.G. 1995, Introduction to Plant Physiology, John Willey & Sons, New York USA.
- Salisbury F.B. & Ross C.W. 1992 Plant physiology, Widsworth Publishing Co. California, U.S.A.
- Taiz L. & Zeiger E, 1998, Plant Physiology (Second Edition) Sinauer Associates Inc. Publishing U.S.A.

### PRACTICALS

**Duration: 4 hours**

**Max. Marks: 50 Min. Pass Marks: 18**

#### Course Content

#### The following experiments are to be conducted:

1. Anatomy of primary and secondary growth in monocots and dicots using hand sections (or prepared slides). Structure of secondary phloem and xylem. Growth rings in wood. Microscopic study of wood in T.S., T.L.S. and R.L.S. Anomalous Sec. growth in *Boerhaavia*, *Nyctanthus* and *Dracaena*
2. Anatomy of leaf and Peel mount for stomatal types/trichomes.
3. Anatomy of the root. Primary and secondary structure.
4. Examination of a wide range of flowers available in the locality and methods of their pollination.
5. Structure of anther, microsporogenesis (using slides) and pollen grains (using whole mounts). Pollen viability using *in vitro* pollen germination.
6. Structure of ovule and embryo sac development (using serial sections).
7. Simple experiments to show vegetative propagation: leaf cuttings in *Bryophyllum*, *Sansevieria*, *Begonia*; stem cuttings in rose, *salix*, money plant, sugarcane and *Bougainvillea*.
8. Germination of non-dormant and dormant seeds.
9. To demonstrate osmosis using egg membrane, onion/tomato peels, potato osmoscope.
10. To study the effect of temperature and alcohol on the permeability of membranes.
11. To demonstrate plasmolysis.
12. To compare the water holding capacity of soils (clay, peat and sand).

13. To demonstrate transpiration pull.
  14. To compare the rates of transpiration in different environmental conditions.
  15. To demonstrate the evolution of oxygen during photosynthesis.
  16. To compare the rates of photosynthesis under different environmental conditions.
  17. To demonstrate the necessity of light, CO<sub>2</sub> and chlorophyll for photosynthesis.
  18. Separation of photosynthetic pigments by paper chromatography.
  19. Demonstration of aerobic respiration.
  20. Demonstration of anaerobic respiration.
  21. To demonstrate the liberation of CO<sub>2</sub> during aerobic respiration.
- (B). Maintenance of a record of all activities performed.

### CC-5 Mathematics

Scheme	Exam Duration	Max. Marks	Min.Pass Marks
Paper-I	3 hours	60 (External) 15( Internal)	} 54
Paper-II	3 hours	60 (External) 15( Internal)	

### CC-5 (I)Paper-I : Complex Analysis

**Duration: 3Hrs**

**Max.Marks:60**

**Unit I**

Complex numbers, function of a complex variable, limits, Cauchy Reimann equations (Cartesian & polar forms), continuity, differentiability of a function. Analytic functions,

**Unit II**

Harmonic functions, Construction of an analytic function Conformal mapping, Bilinear transformation, and its properties, Elementary maps.  $F(z) = \frac{1}{2} (z+1/z)$ ,  $z^2$ ,  $2z$ ,  $\sin z$  and  $\log z$

**Unit III**

Complex integration, Complex line integrals, Cauchy's integral theorem, Indefinite integral, Fundamental theorem of Integral calculus, Derivative of an analytic function, Liouville's theorem, Poisson's integral formula.

**Unit IV**

Morera's theorem, Taylor's & Laurents series, Maximum, modulus principle, Schwarz's Lamma, Singularities, Zeros of an analytic function, branchpoint, Moromorphic functions and Entire functions, Reimann's theorem, Casorati Wierstrass theorem,

**Unit-V**

Residue theorem, residue at a pole, residue at infinity computation of residue, Rouché's theorem, fundamental theorem of algebra, Mittag-Leffler expansion theorem, evaluation of real definite integrals by contour integration

**Textbooks and References:**

1. Complex Analysis: L. Ahlfors (1979) McGraw Hill
2. Functions of One Complex Variable I: J.B. Conway (1978) GTM Springer
3. Complex Analysis (Princeton Lectures in Analysis): E.M. Stein, R. Shakarchi (2003) Princeton University Press
4. **Complex Analysis:** G. N. Purohit and S. P. Goyal, JPH, 2005.
5. **Complex Analysis:** A. R. Vasishtha, Krishna Prakashan Media (P) Ltd., Meerut, 11<sup>th</sup> ed, 2010.
6. **Real and Complex Analysis:** Walter Rudin, Mc-Graw Hill, New Delhi, 2006.
7. **Functions of a Complex Variable:** J.N. Sharma, Krishna Prakashan, Meerut, 1998.
8. Function Theory of One Complex Variable: R.E. Greene and S.G. Krantz (2006) AMS

**CC-5 (II) Paper-II : Mechanics****Duration: 3Hrs****Max.Marks: 60**

- Unit I** Analytical conditions of equilibrium of coplanar forces, Virtual Work, Catenary, Center of Gravity.
- Unit II** Forces in three dimensions, Poincot's central axis, Wrenches, Null lines and planes, Stable and unstable equilibrium.
- Unit III** Velocities and accelerations along radial and transverse directions, and along tangential and normal directions, Simple Harmonic Motion, Rectilinear motion under variable laws.
- Unit IV** Motion in resisting medium, Hooke's law related problems on horizontal and vertical elastic strings. Constrained motion, circular and Cycloidal motion.
- Unit V** Impact, Direct and oblique, Central forces, Central orbits, p-r equation, Apses, Time in an orbit, Kepler's laws of planetary motion.

**Textbooks and References:**

1. **A Text Book on Dynamics:** M. Ray & G. C. Sharma, S.Chand and Co., New Delhi, 2006.
2. **Elementary Mechanics:** D.C. Gokhroo and S.L. Bhargava, JPH, 2002.
3. **The elements of Statics & Dynamics, Part I-Statics:** S.L. Loney, Cambridge University Press, Cambridge, 5<sup>th</sup> ed., 1954.
4. **An Elementary Treatise on the Dynamics of a Particle and of Rigid Bodies, Metric Edition:** S.L. Loney, Surjeet Publication, New Delhi, 1988.
5. **Elements of Dynamics:** D.C. Gokhroo, S.R. Saini, & R.K. Arora, JPH, 1998.
6. **Dynamics:** Y.N.Gaur, A.K. Mathur, & M.C. Goyal, Ramesh Book Depot, Jaipur-New Delhi, 2008-09.
7. **Elements of Statics:** K.C. Sharma, D.C. Gokhroo, & S.R. Saini, JPH, 1996.

**CC: 6 Gender School and Society****Instructional Time: 6 periods/week****Max. Marks: 75****Exam. Duration: 3 Hours****External: 60****Internal: 15****Course Objectives:**

1. Develop basic understanding of gender, gender bias, gender stereotype, empowerment, gender parity, equity and equality, Patriarchy and feminism.
- 2 Understand the problem of girl child education in our society.

3. Awareness of factors that shape gendered roles in Indian society.
- 4 To develop an understanding of feminist approaches to the social and cultural construction of gender.
- 5 Understand how gender, power and sexuality are related to education (in terms of access, curriculum and pedagogy).
- 6 Student to construct critically the impact of policies programmes and scheme for promotion of gender equality and empowerment.
- 7 Apply the conceptual tools learnt regarding gender and sexuality to understand issues related to Sexual Harassment at the workplace and Child Sexual Abuse.
8. Understand how gender relates to education and schooling.

**Course Contents:**

**UNIT – 1**

1. Concepts of Gender, sex, sexuality, patriarchy, masculinity and feminism
2. Gender bias, gender role, stereotyping and its consequences. Kanya-Bharun hatya.
3. Gender and other form of inequality in relation with (caste, class, ethnicity, disability).

**Unit-2**

1. Role of women in developing country, School cultures & issues of society.
2. RTI (Right to Education) , Equal opportunity in women education
3. Schooling of Girls, dropout rate, completion rate, Feminization of teaching profession.

**Unit 3**

1. Rights for gender equality and their implication for social change.
2. Reason, why girls feel uncomfortable in schools? Girls school v/s co education school.
3. Gender bias in curriculum, text books, analysis of hidden curriculum

**UNIT – 4**

1. Gender, culture and institution: Intersection of class, caste, religion and region
2. Construction of gender in curriculum framework since Independence, Gender and the hidden curriculum
3. Relationships within the school: child-child, teacher-child, and teacher-peer group relationships from the perspective of gen

**UNIT – 4**

1. Gender, culture and institution: Intersection of class, caste, religion and region
2. Construction of gender in curriculum framework since Independence, Gender and the hidden curriculum
3. Relationships within the school: child-child, teacher-child, and teacher-peer group relationships from the perspective of gender.

**UNIT – 5**

1. Understanding sexuality (sexual orientation and sexual identity – third gender) Legal (sexual and reproductive) rights of women.
2. Violence against women, Sexual harassment in family, neighborhood and other formal and informal institutions.
3. Reproductive rights and sexual rights. Institutions redressing sexual harassment and abuse

**Term Test: 10 Marks**

**Parcticum :5Marks**

**Any one assignment related to the Unit I to Unit V:**

**Books Suggested:**

1. Delpit, L.D. (2012) Multiplication is for white people: raising expectations for other people's children, the new press.
2. Deng, Z (2013) School subjects and academic disciplines. In A. Luke, A. Woods, & Wer (Eds.), Curriculum syllabus design and equity: A primer and model. Routledge.
3. Jefferey, P. and R. Jefferey Killing My Hear's Desire: EDUCATION AND Female Autonomy in Ruarl India, in Nita Kumar (ed.) Women as Subjects South Asian Histories. New Delhi.
- 4 Geetha, V. (2007) Gender, Stree: Calcutta
5. GOI. (1966). Report of the education commission: Education and national development. New Delhi: ministry of education.
6. GOI (1986). National policy of Education. GOI.
7. GOI. (1992, 1998), National policy on education, 1986 (As modified in 1992). Retrieved from [http://mhrd.gov.in/sites/upload\\_files/mhrd/](http://mhrd.gov.in/sites/upload_files/mhrd/)
- 8 Learning, livelihoods, and Soial mobility: Valuing Girls' Education in Central India, Peggy Froever, btunnel University, Anthropolgy and
- 9 Menon, N (2012) seeing like a feminist. India: Penguin.
- 10 Nirantar. (2010) textbook regimes: A feminist critique of nation and identity. New delhi

**Group C : Developing Teacher Sensibilities  
Section I : Experiences for Teacher Enrichment  
ETE 1: Strengthening Professional Development**

**Instructional Time: 2periods/week**

**Max. Marks: 50**

**ExamDuration: 3Hours**

**Internal: 50**

**Objectives ofthe course:**

Oncompletion ofthecoursethestudent-teacherwillbeableto:

- develop a sense of initiative, imagination and discernment of learning potential oftheresources available intheir surroundings.
- take some initiative inpursuing interests outside theformal course work from arange of available resources - the institute library, websites onthe internet, local events and facilities, as well as local issues (in the neighborhood or town), members oflocalcommunity andvisiting resource persons.

**Course Outline:**

**Unit I:Knowing ones Library**

Knowing your library, Library Management andAutomation.

**Unit II: Arrangement ofdocuments**

Types ofbooks andother materials. Searching and locating relevant reference materials.

**Unit III::Library for professional development**

Resources helpful forprofessional development: Newspaper, Magazines, Websites, Learning guides, Members oflocalcommunity, Resource persons, Websites.

**Modes ofLearning Engagement:**

Learning engagement includes lecture, discussion, observation, fieldvisits andassignments.



**Practicum:** Each student teacher is expected to:

1. Maintain a list of books and journals that have been read.
2. Make a dossier with relevant websites and notes on their learning potential.
3. Write reviews of at least two books of his/her own interest.
4. Make a plan for setting up of a school library and discuss it with the school he/she has attached with and write a programme-evaluation report.
5. A small survey to collect information about different kinds of libraries in the city.
6. A project to discern the present status of libraries in schools.
7. Discern learning opportunities in the local environment, and create an occasion and/or a strategy for some significant learning for fellow students.
8. Interview resource persons/member of local community and/or organize a 'learning encounter' with any of them for their fellow students.

**Modes of Internal Assessment**

	<b>Marks</b>
Written tests	20
Preparation of Bibliography	10
Evaluation of one reference book	10
An analytical study of a school library	10

**Suggested Readings:**

1. Krishna Kumar (2009). Library Organization. New Delhi. Vikas Publishing House.
2. Krishna Kumar (2000). Reference Service. New Delhi. Vikas Publishing House.
3. Krishna Kumar (2009). Library manual. New Delhi. Vikas Publishing House.
4. Krishna Kumar (2009). Library Administration and Management. New Delhi. Vikas Publishing House.
5. Roshan Lal Mittal (1978). Library Administration. New Delhi. Metropolitan Book.

**Group D : Pedagogical Courses**

**PC 1: Pedagogy of Science  
(for PCM Group)**

Instructional Time: 4 periods/week  
 External : 60 Internal : 15  
 Exam. Duration: 3 Hours

Max. Marks : 75

Min. Pass Marks : 27

**Objectives of the Course:**

On completion of the course, the student teacher will be able to:

- gain insight about the nature of science and its curriculum.
- comprehend the approaches and strategies of learning science at secondary level.
- apply pedagogic aspects in teaching-learning of science effectively by adopting appropriate teaching strategy.
- discuss a topic in science, construct test items to measure objectives belonging to various cognitive levels.
- use teaching aids effectively in teaching science.
- gain the knowledge and comprehend the principles of curriculum and analyse the organization of science content at secondary level.
- select and use the relevant methods, strategies and approaches in science class and laboratory.
- develop skills in organizing, using and maintaining the available resources in teaching science.
- transfer the fundamental experimental skills to the pupils and organize different activities related with science processes/skills to the pupils.

**Course Outline:**

**Unit-I**

**Nature of Science and its Curriculum:**

**Nature of Science:** History, Philosophy and nature of science, its role and importance in daily life, Science as interdisciplinary area of learning, development of science and

technology, their interdependence and impact on society, development of scientific attitude and values through science education.

**Curriculum Development:** need and salient features of curriculum, strategy and principles of curriculum construction, trends in science curriculum, development of science curriculum in India, basic criteria of validity of a science curriculum in the light of NCF – 2005, curriculum for the secondary level. Objectives of teaching science at Upper Primary level and Secondary level. Analysis of syllabus and textbooks of science at Upper Primary and Secondary level.

## **Unit II**

### **Approaches and Strategies of Learning Science**

**Lesson Planning:** Instructional objectives, identification of teaching points, organising the content, designing learning experiences, Pedagogical shift from science as fixed body of knowledge to process of constructing knowledge.

**Scientific Method:** observation, enquiry, hypothesis, experimentation, data collection, generalization.

**Unit and Lesson Planning:** using constructivist approach, taking examples from specific contents of science such as electric circuit, magnetic effects of current, physical and chemical changes, animal and plant kingdom.

**Strategies of Learning:** inquiry approach, experimentation, problem solving, concept mapping, collaborating learning and experiential learning in science, facilitating learners for self-study in science.

### **Learning Resources and strengthening Science**

**Learning Resources:** identification and use of learning resources in science from immediate environment such as natural pH indicators, common salts, fruits, lenses and mirrors, inter-conversion of one form of energy to other, exploring alternative sources of energy, audio-visual materials; multimedia—selection and designing; use of ICT in learning science.

**Instructional resources:** multimedia, computer, charts, models, improvised apparatus and their role and functions.

**Strengthening of Learning Science:** organisation of practicals in laboratory, use of science kits, investigatory project, field trips, science clubs, science fairs, use of worksheets.

## **Unit III**

### **Planning and Pedagogic Aspects in Teaching - Learning of Science**

Lesson Planning and learning concepts of science such as Newton's laws of motion, universal law of gravitation, heat as energy, temperature, transfer of heat, reflection, refraction and total internal reflection of light.

Mole concept and Avogadro's number, structure of atom, periodicity of elements, acid, base & salt and pH scale, carbon and its compounds.

Nutrition in amoeba and hopper, digestive and respiratory system in animals, control and coordination in animals, reproduction in animals.

Photosynthesis, factors affecting the process of photosynthesis, respiration in plants, transportation in plants, asexual and sexual reproduction, pollination, fertilization and partho-genesis in plants. Heredity and variations, structure of chromosome, RNA & DNA.

## **Unit IV**

### **Exploring Learning of Science**

Exploring learning of science concepts such as electric circuits, series and parallel combination of circuits, electric current, measurement of current and potential difference, ohm's law, resistance, factors effecting resistance, electrical energy, elementary ideas about a.c. and d.c. motors, characteristics of metals, metallurgical operations— dressing of the ore, calcinations, roasting, smelting and refining, concept of electrode potential and electrochemical series, reactivity of metals and non- metals, extraction of metals like iron, copper and aluminium.

Types and structure of cell, brief account of functions of various cell organelles, cell division, elementary idea of mitosis and meiosis. Structure and function of meristems (apical meristems), permanent tissue (complex, secretory) structure and functions of epithelial, connective, muscular and nervous tissues, feeding mechanism, nutrients, balance diet and nutrition deficiency diseases, communicable and non communicable diseases

## Unit V

### Evaluation in Science

Modes of evaluation: oral, observation and written, objective and essay type questions, Types of objective test items: short answer type, multiple choice type, fill-in-blank type, true-false, matching type, construction of test items: achievement test, diagnostic test and their construction, Preparation of blue print: taking examples of concepts of science mentioned in unit III and IV, continuous and comprehensive evaluation for overall development of child.

**Tools and Techniques of Assessment:** learning indicators, performance-based assessment, learners' records of observations, field diary, oral presentation of learners work, portfolio, assessment of project work, assessment of learning based on content mentioned in unit III and IV.

### Modes of Learning Engagement:

**Constructivist Approach:** Activity based learning experimentation, Interactive learning, Group work, demonstration method, Peer learning, Project work, Assignments followed by presentation, Discussion, Inquiry approach, Concept mapping etc.

### Practicum:

Activities based on Science syllabus of Classes IX and X:

1. Preparation of teaching aids: charts, models, Preparation of one working model.
2. Preparation of a model lesson plan followed by seminar/ presentation before the whole group.
3. Preparation of kit for teaching learning of a topic along with write up (name of unit, name of the theme/topic, material used, procedure, learning outcomes).
4. Preparation of blue print and construction of an achievement test, its administration on one section of a class and analysis of results.

Practicals:

1. Study of laws of reflection and refraction.
2. Verification of Ohm's law.
3. Demonstration of Magnetic effect of current.
4. Determination of given resistance and specific resistance of a material using wheat stone bridge and post office box.
5. Preparation of crystals of copper sulphate.
6. Study of Exothermic and endothermic, combination and decomposition reactions.
7. Preparations of gases ( $H_2$ ,  $O_2$  &  $CO_2$ ) and study of their properties.
8. Study nature of soft and hard water from a given water sample and its removal.
9. Preparation of blood film/blood group testing.
10. Study of diffusion and osmosis.
11. Study of evolution of  $CO_2$  and heat in respiration.
12. Study of evolution of  $O_2$  in photosynthesis.
13. Check adulteration in food items.
14. Demonstration of interaction between a magnet and current.
15. Examine bacteria from curds and milk under microscope.

### Modes of Internal Assessment

### Marks

Written Tests

10

Any Two activities based on Science syllabus of Classes IX & X from Sr. No. 1-4 2

Practical Work: any two practicals from S.No. 1-15.

3

### Suggested Readings:

1. Lewis, J. 1972 Teaching of school physics, Penguin Book, UNESCO,.
2. Anderson, Hans O and Koutnik, Paul G, 1972 Towards More effective science Instruction in secondary education. The MacMillan Co., New York and Courier MacMillan, London,.

3. Das, RC. 1984 Curriculum and Evaluation. National Council of Educational, Research and Training, New Delhi,.
4. Driver, R The pupil as scientist, Open University Press, Buckingham, 1983.
5. Saxena A.B. 1988. Vigyan Shikshan Ka Ayonjan Har Prasad Bhargava & Sons, Agra,
6. Science for Class IX and X, NCERT Publication.
7. National Curriculum Framework 2005, NCERT Publication. 2006
8. NCERT (2005) National Curriculum Framework. New Delhi. NCERT
9. Science Teachers and Educators 1985., UNESCO Bangkok
10. NCERT: Teacher Education Curriculum Framework 1978 NCERT, New Delhi.
11. Teaching Life Sciences, J.K.Sood, Kohli Publication.
12. Science Teaching In Schools by Du RC (1985) Sterling Publication.
13. Science for Class IX and X, NCERT Publication New Delhi
14. R.C..Sharma Modern Science Teaching, , Dhanpat Rai & Sons, Delhi.
15. Teaching Technology for College Teachers, Sterling Publishers. New Delhi
16. Food and Nutrition by E.P.G Arya Book Depot., New Delhi.

**Web Sites :**

1. <http://www.tc.columbia.edu/mst/science.ed/courses.asp>.
2. <http://www.edu.uwo.ca>

**PC 1: Pedagogy of Physical Science  
(for CBZ Group)**

**Instructional Time: 4 periods/week**

**Max. Marks : 75**

**External**

**60**

**Internal**

**15**

**Exam. Duration: 3 Hours**

**Min. Pass Marks: 27**

**Objectives of the Course:**

On completion of the course, the student teacher will be able to:

- gain insight about the nature of science and its curriculum.
- comprehend the approaches and strategies of learning physical science at secondary level.
- apply pedagogic aspects in teaching-learning of physical science effectively by adopting appropriate teaching strategy.
- discuss a topic in science, construct test items to measure objectives belonging to various cognitive levels.
- use teaching aids effectively in teaching science.
- gain insight the salient features of curriculum, strategy and principles of curriculum and science curriculum for the secondary level.
- comprehend the objectives of teaching science at secondary level.
- apply the principles of learning processes in the teaching of science.
- teach a topic in science effectively by adopting appropriate teaching strategy.
- construct test items to measure objectives belonging to various cognitive levels.
- use effectively the teaching aids in teaching science.

**Course Outline:**

**Unit-I**

**Nature of science and its Curriculum:**

**Nature of Science:** History, Philosophy and nature of science, its role and importance in daily life, Science as interdisciplinary area of learning, development of science and technology, their interdependence and impact on society.

**Curriculum Development:** need and salient features of curriculum, strategy and principles of curriculum construction, trends in science curriculum, development of science curriculum in India, basic criteria of validity of a science curriculum in the light of NCF – 2005,

curriculum for the secondary level. Objectives of teaching science at upper primary level and secondary level. Analysis of syllabus and textbooks of science at upper primary and secondary level.

## **Unit II**

### **Approaches and Strategies of Learning Physical Science**

**Lesson Planning:** Pedagogical shift from science as fixed body of knowledge to process of constructing knowledge, scientific method: observation, enquiry, hypothesis, experimentation, data collection, generalization, unit and lesson planning: using constructivist approach taking examples from specific contents of science such as electric circuit, magnetic effects of current, physical and chemical changes.

**Strategies of Learning:** inquiry approach, experimentation, problem solving, concept mapping, collaborating learning and experiential learning in science, Facilitating learners for self-study in science.

**Learning Resources:** identification and use of learning resources in science from immediate environment such as natural pH indicators, common salts, fruits, lenses and mirrors, inter-conversion of one form of energy to other, exploring alternative sources of energy, improvisation of apparatus, audio-visual materials; multimedia– selection and designing; use of ICT in learning science.

**Strengthening of Learning Science:** organisation of practicals in laboratory, use of science kits, investigatory project, field trips, science clubs, science fairs, relationship between science and other subjects, scientific attitude, development of values through science education, concept mapping and its use, co-operative learning.

## **Unit III**

### **Pedagogic Aspects in Teaching - Learning of Physical Science**

Pedagogic aspects in teaching-learning of science concepts such as nature of matter: classification of matter based on chemical constitution elements, compounds and mixtures, types of mixtures- homogenous and heterogeneous solution, atoms and molecules, atomic theory of matter, atomic and molecular masses, concept of mole, chemical reactions, types of chemical reactions: combination, decomposition displacement reactions, electronic concept of oxidation reduction, oxidation number of redox reactions, elementary idea of electrochemical cell and dry cell.

### **Planning and Pedagogic Aspects for Teaching - Learning of Physical Science**

Planning and pedagogic aspects– lesson planning and learning of science concepts such as Charge, electrostatic force, quantization of charge, capacitance, potential and potential difference, Ohm's law, series and parallel connections of resistances and capacitances, electric power, magnetic effect, heating effect of current, Faraday's law of induction Lenz Law, motor and generators, oscillations and waves, periodic and non-periodic motion, sound as wave motion, longitudinal and transverse waves.

## **Unit IV**

### **Exploration of learning of Physical Science**

Exploration of learning of science concepts such as displacement, motion and its types, speed, velocity and acceleration, angular velocity and acceleration, force: magnitude and direction, addition and subtraction, resultant, balanced and unbalanced force, momentum, work: work done by force, dependence of work on relative orientation of force and displacement, energy (kinetic and potential) work - energy equivalence, power, conversion of K.E. into P.E. and vice-versa, law of conservation of energy and momentum, gravitation: Newton's laws of gravitation, acceleration due to gravity, factors affecting 'g'. Chemical reactions, type of chemical reactions - combination, decomposition, displacement reactions, endothermic and exothermic reactions, concept of oxidation, reduction, redox reactions, rate of reaction, factors affecting the rate like concentration, temperature, pressure and catalyst.

## **Unit V**

### **Evaluation in Science**

Concept of CCE, modes of evaluation: oral, observation and written, objective and essay type questions, types of objective test items: short answer type, multiple choice type, fill-in-blank type, true-false, matching type, making of test items, achievement test, diagnostic test

and their construction, preparation of blue print taking examples of concepts of science mentioned in unit III and IV, continuous and comprehensive evaluation for overall development of child.

**Tools and Techniques of Assessment:** development of learning indicators, Performance-based assessment, learners' records of observations, field diary, oral presentation of learners work, portfolio, assessment of project work, construction of test items and administration of tests, exploring content and assessments of learning based on content mentioned in unit III and IV.

**Modes of Learning Engagement:**

Constructivist approach: Activity based learning experimentation, Interactive learning, Group work, Peer learning, Project work, Assignments followed by presentation, Discussion, Inquiry approach, Concept mapping etc.

**Practicum:**

Activities based on Science syllabus of classes IX and X

1. Preparation of one working model.
2. Preparation of a model lesson plan followed by seminar /presentation before the whole group.
3. Preparation of kit for teaching learning of a topic along with write up (name of unit, name of the theme/topic, material used, procedure, learning outcomes).
4. Construction of an achievement test, its administration on one section of a class and analysis of results.

**Practical Work**

1. Preparation of designs of ideal Laboratory/Herbarium/Aquarium/terrarium.
2. Measuring the rates of water absorption and loss in plants and animals.
3. To design and perform experiment to demonstrate that by product of Respiration in plants and animals is heat.
4. To demonstrate oxygen consumption during respiration in plants and animals.
5. Perform experiments to detect the presence of carbohydrates, lipids and proteins in food by qualitative chemical tests.
6. Measurement of length, mass, time, temperature, current, voltage.
7. Graphic manipulation like (a) distance-time graph (b) velocity – time graph (c) voltage – current graph (d) temperature – time graph.
8. Study of motion under force (design and demonstration).
9. Methods of preparation of common laboratory reagents.
10. Separation of substances of a given mixture like (i) NaCl, NH<sub>4</sub>Cl and sand and (ii) Sulphur, NaCl and Iron scrap.
11. Demonstration of laws of electromagnetic induction.
12. Study heating effect of current.
13. Qualitative chemical test for some common food stuffs.
14. Preparation of Chlorine (Cl<sub>2</sub>) and Ammonia (NH<sub>3</sub>) and Study of their properties.
15. Study nature of soft and hard water.

**Modes of Internal Assessment**

**Marks**

Written Test	10
Any Two activities based on Science syllabus of Classes IX & X from the S.No. 1-4	2
Practical Work: any two practicals from S.No. 1-15	3

**Suggested Readings:**

1. P.K.G.Nair, 1985 Principle of Environmental Biology, UNESCO training of science teachers and educators Bangkok UNESCO.
2. NCERT: 1978 Teacher Education curriculum framework, NCERT, New Delhi
3. Science Teaching in Schools by Das. R.C.(1985), Sterling publication.

4. Modern Science teaching by Heiss, E.d. Obourn, E.S. Hoffman, C.W (1961) MacMillian Publication, New York.
5. NCERT (2006) Science for Class IX & X. New Delhi. NCERT.
6. Lewis, I. 1972 Teaching of school physic, Penguin Book, UNESCO,.
7. Anderson, Hans O and Koutnik Paul G. 1912 Towards More effective science instruction in secondary education. The Macmillan Co., New York and Courier Macmillan, London,:
8. Das; RC. 1984 Et a. Curriculum and Evaluation National Council of Educational research And Training New Delhi,.
9. Driver, R 1983 The pupil as scientist? Open University Press, Buckingham,.
10. Saxena, A.B. 1988 Vigyan Shikshan Ka Ayonjan Har Prasad Bhargava & Sons, Agra.
11. NCERT (2006) Science for class IX and X , New Delhi. NCERT
12. NCERT (2005) National Curriculum Framework. New Delhi. NCERT

#### Web Sites

1. <http://www.tc.columbia.edu/mst/science.ed/courses.asp>.
2. <http://www.edu.uwo.ca>

### PC- 2: Pedagogy of Mathematics (for PCM Group)

**Instructional Time: 4 periods/week**

**Max. Marks : 75**

**External            60**

**Internal             15**

**Exam. Duration: 3 Hours**

**Min. Pass Mark:27**

#### Objectives of the Course:

On completion of the course, the student teachers will be able to:

- acquire a clear perspective of the nature of mathematics
- gain insight on the meaning, nature, scope and objective of mathematics education
- appreciate the changes in curriculum and evolve new approaches to teaching
- formulate instructional objectives for different topics of mathematics.
- appreciate mathematics to strengthen the student's resource.
- design the process of developing a concept.
- appreciate the role of mathematics in day-to-day life.
- channelize, explain, reconstruct and evaluate their thinking.
- pose and solve meaningful problems.
- appreciate the historical perspective and contribution of Indian mathematicians in development of the subject.
- appreciate and explore Technology Integrated Mathematics Module (TIMM) based on different subject specific open source software on various concepts of Geometry at secondary stage; and
- appreciate and develop dynamical digital applets with emphasis on process involved in teaching and learning of mathematics at secondary stage.
- be conversant with the nature, values, structure and scope of Mathematics.
- interpret the principles of child development for planning lessons;
- understand the principles of learning
- understand the principles, processes relationships and to design appropriate strategies for teaching.
- design appropriate activities for developing a concept.
- design mathematics laboratory.
- develop competencies in designing appropriate diagnostic and remedial tests.
- construct appropriate assessment tools for evaluating mathematics learning.
- appreciate the importance of mathematics lab in learning mathematics.
- develop the competencies in preparation of appropriate teacher aids unit

- plan lesson plan and test items.
- construct appropriate assessment tools for evaluating mathematics learning.
- appreciate and develop Technology Integrated Mathematics Module (TIMM) using on different subject specific open source software on various concepts of Geometry at secondary stage; and
- appreciate and develop dynamical digital applets with emphasis on process involved in teaching and learning of mathematics at secondary stage.
- explain the meaning of evaluation
- infer the effect of evaluation on students

### **Course Outline:**

#### **Unit I**

##### **Nature of Mathematics**

- Human Needs as a Basis of Growth in Mathematics
- Mathematical Statements are Unambiguous, Truth Criteria, Use of Symbols
- The role of Intuition and Logic in Mathematical Thinking
- Axiomatic Framework of Mathematics : Axioms, Postulates, Undefined Terms, Defined Terms, Reasoning, Type of Reasoning, Proofs - Types of Proofs.
- Language of Mathematics

##### **Exploring learners**

- Cultivating learner's sensitivity like listening, encouraging learner for probing, raising queries, appreciating dialogue among peer group, promoting the student's confidence.
- Exploring ways of Learning Engagements
- Providing opportunities for group activities, Group/individual presentation, Providing opportunity for sharing ideas, Exposing to exemplar constructivist learning situations in mathematics, Visit to district, state and national level science exhibition/ field visit, Audio visual presentation followed by its analysis and discussion, Reflective written assignments, Case studies.

#### **Unit II**

##### **Aims and objectives of Mathematics**

- Need and Importance of Mathematics in School Curriculum
  - Social Aspects
  - Mathematical Aspects
  - Applications of Mathematics
- Aims, objectives and scope of mathematics at the secondary stage.
- Writing of objectives for each stage (Primary, Secondary and Sr. Secondary).
- Writing objectives in behavioral terms for each stage. Piaget's operational thinking.
- Emphasis on the use of mathematics in daily life situations
- Role of mathematics in other subject areas – Interdisciplinary approaches.
- Developing Skills in learners - Problem solving, Logical thinking, Drawing inferences, Handling abstraction, Visualising etc. in learner's personality
- History of development of mathematics and contributions of Indian mathematicians.

##### **Integration of mathematical content with activities through Mathematics Laboratory**

- Designing and setting up models,
- Teaching aids and activities/ laboratory work -using open source software in Mathematics Lesson (Expressive way- to create their own from scratch, as they express themselves with contentment by means of a more open application or resource )
- Identifying activity in several content areas at secondary level conducive to the comprehension level of learner. Inculcating skills in Designing, Demonstrating, Interpreting and drawing inference of digital applets/concrete models.

#### **Unit III**

##### **Approaches of Teaching Mathematics**

- Basic Principles of Methods of Teaching Mathematics-
- Principles of Child Development and Learning



- Problem posing / solving in Mathematics
- Problem posing: Problem posing skill contextualised to recognition of pattern, Extension of pattern, Formulation of conjecture and generalisation through several illustrations drawn from learners immediate environment, Skill development of Process Questioning, can stimulate discussion of an idea, leading to further exploration and use of oral language to explain and justify a thought.
- Problem solving: Understanding of Problem, Splitting the Problem in known and unknown parts, Symbolisation and mathematical formulation, Solving problem with multiplicity of approaches- exploration of alternative methods through Probing questions and concrete analogies, Attitude build up of internal questioning – learn to ask themselves key questions before, during and after the solution process.
- Methods of Teaching Mathematics
  - Induction and Deduction
  - Analytic and Synthetic Methods
  - Heuristic or Discovery Method

### **Assessment and Evaluation**

#### ∑ Exploring ways of Assessment

Presentation and communication skills in mathematics, Posing conceptual questions from simple situations, interpretation and analysis, Designing innovative learning situations, Performance in group activity, Laboratory/ Technological experiences, Reflective written assignment, Written test on conceptual understanding of specific topics and its pedagogy, A year and summative assessment by the university.

#### □ Informal creative Evaluation

Encouraging learner to examine a variety of methods of assessment in mathematics so as to assess creativity, problem solving and practical performance. Appreciating evaluation through overall performance of the child. Self and peer evaluation.

#### □ Formal ways of Evaluation

Variety of assessment techniques and practices. Assessing Product vs. Process, Knowing vs. Doing. In practice midterm / terminal examination, practicing continuous and comprehensive evaluation to test regular programs / achievement of learner.

## **Unit IV**

### **Construction of concepts and Techniques of Teaching Mathematics**

- Trends in Organising Content
- Recall and consolidation of various concepts with varied examples and illustrations in teaching of Arithmetic, Algebra, Co-ordinate Geometry, Geometry, Trigonometry, Mensuration, Statistics and Probability using Inductive and Deductive, Analytic and Synthetic, Heuristic ,Project and problem solving methods.
- Analysis of concepts coherently in graded way.
- Misconception and common errors
- **Developing Blue print for designing question paper**
- Identifying and organizing components for developing frame work of question paper at different stages of learning different types of questions and framing questions based on concepts and sub concepts so as to encourage critical thinking, promote logical reasoning and to discourage mechanical manipulation and rote learning. Framing of open ended questions providing the scope to learners to give responses in their own words. Framing of conceptual questions from simple questions.

## **Unit V**

### **Planning for Classroom Transaction**

Planning Classroom Strategies:

Analysis of textual and supplementary print materials, connecting lab/field experiences and suitable planning for classroom interaction.

- Desirable Characteristic of a Good Instructional Programme in Mathematics
- Identifying desired outcome, designing essential questions guiding teaching/ learning.
- Determining acceptable evidences that show students understanding.
- Integrating learning experiences and instructions – sequence of teaching /learning experiences that enable students to develop / demonstrate desired understanding.

Developing unit plan and lesson plan for teaching of mathematics:

- Learning Objectives
- Introduction of the topic
  - Some thought-provoking questions
  - Flow of chapter
- Examples
- Hands on activities
  - Self exploratory experiments (if any)
  - Daily life application
  - Application (Problem Solving)
  - Interdisciplinary Applications / Problems
  - HOTS questions
- Extension activities
  - External Web resources for the content
  - Suggested Readings
  - Thought-provoking questions that lead students to do more exploration
- Planning ICT Based Mathematics Lesson, Distinct ways of using open source software in Mathematics Lesson (Exploratory way only- by giving already created ready-made document or file and invite them to explore it.), Thinking Geometrically (Dynamics in Mathematics using software) Technological Pedagogical Content Knowledge (TPCK)- Developing competencies required to make appropriate use of technology, learner teachers will be required to make pedagogical choices critically about when and where technology should be used.
- The role of cooperative learning in mathematics.
- **Learning Styles, Learning Difficulties and Diagnostic Tests**
- What are the learning styles in Mathematics? - Visual Learners, Auditory Learners and Kinesthetic Learners, Identification of learning difficulties, Error Patterns, Diagnostic and Remedial Teaching, Preparation of Diagnostic tests

**Modes of Learning Engagement:**

- Providing opportunities for group activities.
- Hands on experimentation within digital environment.
- Group/ individual presentation.
- Providing opportunity for sharing ideas.
- Exposing to exemplar constructivist learning situations in mathematics.
- Designing and setting up models, teaching aids and activities/ laboratory work.
- Visit to district, state and national level science exhibition.
- Digital presentation followed by its analysis and discussion.
- Reflective written assignments.
- Case studies.
- Providing opportunities for group activities.
- Group/ individual presentation.
- Providing opportunity for sharing ideas.
- Exposing to exemplar constructivist learning situations in mathematics.
- Designing and setting up models, teaching aids and activities/ laboratory work.
- Visit to district, state and national level science exhibition.
- Audio visual presentation followed by its analysis and discussion.
- Reflective written assignments.
- Case studies.



**PC- 2: Pedagogy of Biological Science  
(for CBZ Group)**

**Instructional Time: 4 periods/week**

**Max. Marks 75**

- External 60 Internal 15
- Exam. Duration: 3 Hours Min. Pass Mark :27

• **Objectives of the Course:**

On completion of the course, the student teachers will be able to:

- develop insight on the meaning, nature, and effective use of different activities/experiments/demonstrations/ laboratory experiences for determining aims and strategies of teaching-learning of biological science;
- prepare and use the lesson plans and unit plans required for instructional purposes;
- integrate with other school subjects and to identify and relate everyday experiences with learning of biological science;
- explore the curricular processes and skills in science at secondary level and laboratory in teaching– learning;
- formulate meaningful inquiry episodes, problem-solving situations, investigatory and discovery learning projects based on upper primary, secondary stages during teaching-learning of biological science;
- identify and relate approaches of teaching-learning of biological science with social relevance;
- explore the process skill in science and develop competency to organise laboratory facilities and equipment in teaching– learning of biological sciences;
- use effectively different activities – ICT, excursion, visits, research methodology etc for teaching–learning of biological science;
- examine different pedagogical issues in learning biological science;
- construct appropriate assessment tools for evaluating learning of biological science;
- develop ability to use biological science concepts for life skills; and
- develop professional competencies for teaching, learning of biological science.
- appreciate that science is a dynamic and expanding body of knowledge

**Course Outline:**

**Unit I**

**Aims, Objectives and Pedagogy of Biological Science**

- Developing scientific attitude and scientific temper : Nurture the natural curiosity, aesthetic senses and creativity in biology,
- Acquire the skills to understand morphology, taxonomy, genetics, cell biology, development biology etc.
- Understanding biology in relation to society and human welfare,
- Imbibe the values of honesty, integrity, cooperation, concern for life and preservation of environment;
- Solving problems of everyday life;
- Know the facts and principles of biology and its applications consistent with the stages of cognitive development of learners;
- Specific objective of different content areas in biology.

**Planning for Teaching-Learning of Biological Science**

- Identification and organisation of concepts for teaching-learning of biology;
- Determining acceptable evidences that show learners' understanding.
- Understanding Constructivist Approach
- Instructional materials required for planning teaching-learning of biological science and learners' participation in developing them; Identifying and designing teaching-learning experiences;
- Planning field visits, Zoo, Sea shore life, Botanical garden, etc.;

- Organising activities, laboratory experiences, making groups, planning ICT applications in learning biology.

## **Unit II**

### **Nature and Scope of Biological Science**

- Science as a domain of enquiry, dynamic body of knowledge and as a process of constructing knowledge;
- Biological Science for environment and health, History of biological science, its nature and knowledge of biological science independent of human application;
- Origin of life and evolution, biodiversity, observations and experiments in biological sciences;
- biological sciences and society.

### **Learning Resources in Biological Science**

- Identification and use of learning resources in biological science from immediate environment exploring alternative sources;
- Developing and designing science kit and biological science laboratory; Planning and organising field observation; Collection of materials, etc.;
- Textbooks, audio-visual materials, multimedia-selection and designing;
- ICT introduction, Use of ICT in teaching and learning, ICT resources to support Biology teaching and learning;
- e-learning and changing nature of classroom, challenges and drawbacks of e-learning.
- Using community resources for biology learning; Pooling of learning resources in school complex/block/ district level; Handling hurdles in utilisation of resources.

## **Unit III**

### **Exploring Biology**

- Motivating learner to bring his/her previous knowledge in science/biology gained through classroom/environment/parents and peer group;
- Cultivating in teacher-learner the habit of listening to child;
- Generating discussion, involving learners in teaching-learning process, encouraging learners to raise questions,
- appreciating dialogue amongst peer groups,
- encouraging learners to collect materials from local resources and to develop/fabricate suitable activities in biological science (individual or group work);
- Understanding the role of learners in negotiating and mediating learning in biology.

### **Tools and Techniques of Assessment for Learning in Biological Science**

- Performance-based assessment; Developing indicators for performance assessment in biological sciences; Learners record of observations;
- Field diary, herbarium;
- Oral presentation of learners work in biological science, Portfolio; Assessment of project work in biology (both in the laboratory and in the field), Assessment of participation in collaborative learning;
- Construction of test items (open-ended and structured) in biological science and administration of tests;
- Developing assessment framework in biological science;
- Assessment of experimental work in biological science;
- Exploring content areas in biological science not assessed in formal examination system and their evaluation through various curricular channels;
- Encouraging teacher-learners to examine a variety of methods of assessments in biological science;
- Continuous and comprehensive evaluation.

## **Unit IV**

### **School Science Curriculum (Biological Science)**

- Trends in Science curriculum; Consideration in developing learner-centred curriculum in biology

- Concept of curriculum, historical background of Biology curriculum and its studies. Biological sciences curriculum study project.
- Principles of curriculum construction, curriculum development process, techniques of structuring and restructuring of curriculum, trends in curriculum development in Biology, analysis of existing Biology syllabi and study of recent trends/innovations in biological sciences.

### **Biological Science – Life long Learning**

- Nurturing natural curiosity of observation and drawing conclusion; Facilitating learning progress of learners with various needs in biology;
- Ensuring equal partnership of learners with special needs;
- Stimulating creativity and inventiveness in biology; Organising various curricular activities, such as debate, discussion, drama, poster making on issues related to science/biology;
- Organising events on specific day, such as Earth Day, Environment Day, etc.;
- Planning and organising field experiences, Science club, Science exhibition; Nurturing creative talent at local level and exploring linkage with district/state/central agencies.

### **Unit V**

#### **Approaches and Strategies of Learning Biological Science**

- Pedagogical shift from science as fixed body of knowledge to process of constructing knowledge, scientific method - observation, enquiry, hypothesis, experimentation, data collection, generalisation (teacher- educator will illustrate taking examples from different stage-specific content areas keeping in mind the variation, e.g. structure and function, interaction between living and non-living, biodiversity, etc.);
- Communication in biological sciences;
- Problem solving, investigatory approach, concept mapping, collaborative learning, and experiential learning in biological science (teacher-learner will design learning experiences using each of these approaches);
- Facilitating learners for self-study
- Lesson plan format for learning objectives, preparation and use of teaching aids, time management, recapitulation and evaluation strategies for learners and presentation of lesson plan in biological sciences in class-room transaction.

#### **Professional Development of Biology Teacher**

- Professional development programmes for science/biology teachers;
- Participation in seminar, conferences, online sharing membership of professional organisation; Teachers as a community of learners;
- Collaboration of school with colleges, universities and other institutions;
- Journals and other resource materials in biology education;
- Role of reflective practices in professional development of biology teachers;
- Teacher as a researcher: Learning to understand how children learn science – action research in biological science.

#### **Modes of Learning Engagement:**

Constructivist approach, Activity based learning experimentation, Interactive learning, Group work, Peer learning, Project work, Assignments followed by presentation, Discussion, Inquiry approach, Concept mapping etc.

#### **Practicum**

Activities based on Science syllabus of Classes IX and X

1. Preparation of teaching aids: charts, models, Preparation of one working model.
2. Preparation of a model lesson plan followed by seminar/ presentation before the whole group.
3. Preparation of kit for teaching learning of a topic along with write up (name of unit, name of the theme/topic, material used, procedure, learning outcomes).
4. Construction of an achievement test, its administration on one section of a class

and analysis of results.

### Practicals

1. Tools and Technique in Biological Science
2. Perform experiments to detect presence of carbohydrates, Lipids and proteins in food by qualitative test
3. Different Microscope and its observation techniques.
4. Experiments on Diffusion and osmosis
5. Evolution of CO<sub>2</sub> and heat in respiration
6. Evolution of O<sub>2</sub> in photosynthesis
7. Preparation of microscopic slides to demonstrate stages of mitosis and meiosis/animal tissue observations.
8. Preparation of Herbarium and Herbarium techniques
9. Establishment of Science Laboratory
10. Respiration in plants and animals
11. Nutrition in plants and animals
12. Excretion in plants and animals
13. Movements in Plants and animals
14. Techniques of formulating science project in laboratories as per secondary curriculum

### Modes of Internal Assessment

### Marks

Written Tests	10
Any Two activities based on Science syllabus of Classes IX & X from S. No. 1-4 02	
Practical Work: any two practicals from S.No. 1-14.	03

### Suggested Readings:

1. NCERT, National Curriculum Framework –2005.
2. NCERT, Position Paper of NFG on Teaching of Science -2005.
3. NCERT, Position Paper of NFG on Habitat and Learning –2005
4. N. Vaidya, Science Teaching for 21<sup>st</sup> Century, Deep & Deep Publications (1999). Dat Poly, Encyclopaedia of Teaching Science, Sarup & Sons, New Delhi (2004)
5. Sutton, CR and Hayson JH, The Art of the Science Teacher, McGraw Hill Book Company Ltd. (1974)
6. Their, DH, (1973) Teaching Elementary School Science: A Laboratory Approach, Sterling Publication Pvt. Ltd
7. Science Teacher (peer reviewed journal for secondary science teachers)
8. Journal of Research in Science Teaching (Wiley-Blackwell)
9. Turner Tony and Wendy Di Macro, Learning to Teach School Experience in secondary school teaching, Routledge, London and New York.
10. Methods of Teaching Biological Science by Dr. P. Ameeta, Published by Neelkamal Publications Pvt. Ltd. Educational Publishers 2008 edition or later ed.
11. Modern Science Teaching by R.C. Sharma, 1987 or later edition, published by New Delhi, Dhanpatarai & Sons.
12. Teaching of Science Today and Tomorrow by Siddiqui and Siddiqui published by Docba House, New Delhi

### Web Sites:

1. <http://www.tc.columbia.edu/mst/science.ed/courses.asp>
2. <http://www.edu.uwo.ca>

**PC 3: Learning to Function as a Teacher Duration  
:Four weeks Max. Marks:50 Internal:50**

### Objectives of the Course:

On completion of the Course, the student teachers will be able to:

- understand about the activities to be carried out during school internship

programme.

- observe classroom teaching, various school activities and gain a feel of the multiple roles of a teacher.
- develop skill in content analysis, preparing TLM and observing classroom processes.
- plan and implement teaching learning activity for peers and actual classroom.

### **Pre-Internship Tasks:**

(The Internship Committee formulated by the Institute will prepare a Schedule for execution of Pre- Internship Tasks)

During the four week duration, the student teachers are oriented to the school internship programme.

For the first two weeks, they will be provided training in core teaching skills, content analysis, preparing Teaching Learning Material (TLM), writing observation records, Reflective Journals, conducting Action Research and Case Study, organizing school activities and their reporting, developing Achievement Tests, administering and analyzing. Student teachers will also write lesson plans and take up peer teaching.

For the next two weeks, student teachers will be placed in the schools. They will observe the classes being handled by the regular teachers as well as their peers. Every student teacher will teach at least one lesson in each teaching subject and reflect on the teaching.

### **Modes of Learning Engagement:**

Pre internship will be carried out both in the Institute and the School.

First two weeks they will be exposed to theoretical knowledge about internship and receive information on various activities that are required to be carried out by the student teachers. Student teachers will get hands on experience on performing certain tasks which they are expected to perform in the school.

In the beginning they learn to teach in a simulated condition by teaching their peers.

Next two weeks, student teachers are attached to the school on full time basis, observe the teaching by the regular classroom teacher, teach at least one lesson in each teaching subject, involve in all the activities of the school and learn to understand the school.

Student teachers keep a record of all the work carried out by them in the school (Details to be worked out).

### **Modes of Assessment:**

The assessment of the student teachers will be carried out on the basis of their day to day participation and performance by a group of teacher educators. The details of activities and the marks allotted are given below.

<b>Activity</b>	<b>Marks</b>
a. Content Analysis in each teaching subject	10
b. Preparation and use of TLM during Peer Teaching in each teaching subject	10
c. Observation Record Five classes of regular classroom teacher Five classes of peer	10
d. Actual classroom teaching One lesson in each teaching subject	20
<b>Total</b>	<b>50</b>



**B.Sc. B.Ed. Part-IV**  
**Group B : Core Courses (CC)**  
**CC – 1 (I) PHYSICS**

<b>Scheme</b>	<b>Exam Duration</b>	<b>Max. Marks</b>	<b>Min. Pass Marks</b>
Paper I	3hrs.	80	36
Internal		20	}
Practical	5hrs.	50	
			18

**Note:** There will be two experiments. The distribution of marks will be as follows:

Two experiments	30 marks
Each of 15 marks Viva voce	10 marks
Record	10 marks
<b>Total</b>	<b>50 marks</b>

**CC – 1 (I) Paper I: ATOMIC, MOLECULAR AND  
NUCLEAR PHYSICS Duration- 3 hours Max. Marks : 80**

**Unit – I**

**Atomic Physics:** Spectra of hydrogen, Frank-Hertz experiment and discrete energy states, Stern and Gerlach experiment, deuteron and alkali atoms, spectral terms, doublet fine structure, screening constants for alkali spectra for s, p, d and f states, selection rules, L-S and J-J couplings, Atoms in a magnetic field, Zeeman effect, Zeeman splitting.

Weak spectra: continuous X-ray spectrum and its dependence on voltage, Duane and

Hunt's law, Characteristics X-rays, Moseley's law, doublet structure of X-ray spectra, X-ray absorption spectra.

**Unit II**

**Molecular Physics:** Discrete set of electronic energies of molecules, quantisation of vibrational and rotational energies, determination of internuclear distance, pure rotational and rotational-vibrational spectra, Dissociation limit for the ground and other electronic states, transition rules for pure vibrational and electronic vibrational spectra. Raman effect, Stokes and anti-Stokes lines, complimentary character of Raman and infrared spectra, experimental arrangements for Raman spectroscopy.

Spectroscopic techniques: Sources of excitation, prism and grating spectrographs for visible, UV and IR, absorption spectroscopy, double beam instruments, different recording systems.

**Unit III**

**Accelerators:** Ion sources, Cockcroft-Walton high voltage generators, Van de Graaff generators, Drift tube, Linear accelerators, Wave guide accelerators, Magnetic focusing in Cyclotron, Synchrocyclotron, Betatron, The electromagnetic induction Accelerator, Electron synchrotron, Proton Synchrotron.

**Detectors:** Interaction of charged particles and neutrons with matter, working of nuclear detectors, Geiger-Muller counter, proportional counter and scintillation counter, cloud chambers, spark chamber, emulsions.

**Unit IV**

**Nuclear Fission:** Theory of Nuclear Fission, Liquid Drop Model, Shell Model, Barrier Penetration-Theory of Spontaneous Fission, Nuclear Fission as a source of Energy, The Nuclear Chain reaction, Condition of controlled Chain Reaction, The Principle of Nuclear Reactors, Classification of Reactors, Power of Nuclear Reactors, Critical size of Thermal Reactors, The Breeder Reactors, Reprocessing of spent fuel, Radiation hazards and Fission products poisoning.

**Nuclear Fusion:** The sources of stellar energy, The Plasma: The fourth state of the matter, Fusion reaction, Energy balance and Lawson Criterion, Magnetic confinement of Plasma, Classical Plasma losses from the Magnetic Container, Anomalous losses, Turbulence and Plasma instabilities, The Laser Fusion Problem, Fusion reactor

**Unit V**

**Structure of Nuclei:** Structure of nuclei, basic properties (angular momentum, magnetic moment, Quadrupole moment and binding energy), deuteron binding energy, p-p and n-p scattering and general concepts of nuclear forces. Beta decay, range of alpha particles, Geiger-Nuttall law, Gamow's explanation of alpha decay, gamma decay, continuous and discrete spectra.

**Elementary Particles:** Classification of Elementary Particles, Fundamental interactions, Unified Approach (basic ideas), The Conservation laws, Quarks (basic ideas), Charmed and Colour Quarks, Higgs Boson, Large Hadron Collider.

**Textbooks and References**

H.S. Mani and G.K. Mehta, Introduction to Modern Physics, Affiliated East West Press Pvt. Ltd. New Delhi, 1998.

A Beiser, Prospective of Modern Physics H E

White, Introduction to Atomic Physics

Barrow, Introduction to Molecular Physics

R P Feymann, R B Leighton an M Sands, The Feymann Lectures on Physics, Vol.,



Record

05 marks

Total

50 marks

**CC 2 (I) - Paper-I - ADVANCE CHEMISTRY**

**Duration- 3 hours.**

**Max. Marks:80**

**Unit-I Spectral and Magnetic Properties of Transition Metal Complexes**

**(A) Electronic spectra of Transition Metal Complexes:** Types of electronic

transitions, selection rules for d-d transitions, spectroscopic ground states, spectrochemical series, Orgel-energy level diagram for  $d^1$  to  $d^9$  states, discussion of the electronic spectrum of  $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$  complex ion.

**(B) Magnetic Properties of Transition Metal Complexes:** Types of magnetic behaviour, methods of determining magnetic susceptibility, spin-only formula, L-S coupling, correlation of  $\mu_s$  and  $\mu_{\text{eff}}$  values, orbital contribution to magnetic moments, application of magnetic moment data for 3d metal complexes.

Unit-II Heterocycles and Bioinorganic

**(A) Heterocyclic Chemistry:** Introduction: Molecular orbital picture and aromatic characteristic of pyrrole, furan, thiophene and pyridine. Methods 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.

**(B) Bioinorganic Chemistry :** Essential and trace elements in biological processes, metalloproteins with special reference to haemoglobin and myoglobin. Biological role of alkali and alkaline earth metals ions with special reference to Ca. Nitrogen fixation.

**Unit-III Spectroscopy**

**(A) Nuclear magnetic resonance (NMR) spectroscopy:** Proton magnetic resonance (NMR) spectroscopy, nuclear shielding and deshielding, chemical shift and molecular structure, area of signals and proton counting, splitting of signals, spin-spin coupling and coupling constant, interpretation of NMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1, 1, 2-tribromoethane, ethyl acetate, toluene and acetophenone.

**(B) Problems pertaining to the structure elucidation of simple organic compounds using UV, IR and NMR spectroscopic techniques.**

**Unit-IV Chemistry of Biomolecules**

**(A) Carbohydrates:** Classification and nomenclature. Monosaccharide, Configuration of monosaccharides. Mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Erythro and threo diastereomers. Structure of glucose including ring size determination and cyclic structure. Conversion of glucose into mannose. Formation of glycosides, ethers and esters. Mechanism of mutarotation. Structure of ribose and deoxyribose.

Introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination.

**(B) Amino Acids, Peptides, Proteins and Nucleic Acids:** classification, structure and stereochemistry of amino acids. Acid-base behaviour, isoelectric point and electrophoresis. Preparation and reactions of  $\alpha$ -amino acids.

Structure and nomenclature of peptides and proteins. Classification of proteins. Peptide structure determination, end group analysis, selective hydrolysis of peptides and proteins. Primary and secondary structures of proteins. Protein denaturation/renaturation.

Nucleic acids: introduction, Constitution of nucleic acids, Ribonucleosides and ribonucleotides. The double helical structure of DNA.

**Unit-V New dimensions of Chemistry**

- (A) **Nano Chemistry:** Introduction to Nanochemistry, Nano and nature, nano the beginning, introduction to carbon Nanotubes; types, synthesis and purification, Brief introduction to self-assembled monolayers (SAMs), Monolayers on Gold, Preparation, Mixed monolayers, SAMs and applications; Sensors, affinity biosensors, chemical sensors, corrosion prevention, wetting control, molecular electronics, Process of synthesis of Nano powders, Sol-Gel process, Electro-Deposition, Plasma enhanced vapour decomposition, sputtering of Nano crystalline powders, Application of SEM, TEM and AFM to nanotechnology.
- (B) **Green Chemistry:** History, need, and goals, Green chemistry and Sustainability, 12 Basic principles of Green Chemistry and their illustrations with examples, Examples of green synthesis/reaction: Green starting materials, Green reagents, Green solvents and reaction conditions, Green catalysis, Green synthesis- Real world cases (Traditional processes and green ones), Synthesis of Ibuprofen, Adipic acid etc and selected examples from US Presidential Green Chemistry Challenge Award Winners.
- (C) **Inorganic Polymers: Silicones and Phosphazenes** Silicones and Phosphazenes as examples of inorganic polymers, nature of bonding in triphosphazenes

#### Text books and References

1. Sharma Y. R. elementary organic spectroscopy: principles and chemical applications paperback.
2. Mehta and Mehta, Organic chemistry, PHI
3. Donald L. Pavia Gary M. Lampman George S. Kriz James A. Vyvyan, Introduction to Spectroscopy, 5th Edition.
4. Bahl B S & Bahl Arun 5000 Solved Problems In Organic Chemistry, S. Chand Publishing.
5. Madan R L, Chemistry for Degree Students B.Sc. 3Rd Year S. Chand Publishing.
6. Nafis Haider S, Fundamental of Organic Chemistry, S. Chand Publishing.
7. Pradeep. T. Nano: The Essentials; Understanding Nanoscience and Nanotechnology. Tata McGraw-Hill Education Pvt. Ltd., New Delhi.
8. Kenneth J. Klabunde and Gleb B. Sergeev Nanochemistry (Second Edition)
9. Bandyopadhyay, A. K. Nano Materials. New Age International Publishers, New Delhi
10. P.T. Anastas and J.C. Warner, Green Chemistry: Theory and Practice. Oxford University Press.
11. Lancaster M. Green Chemistry: Introductory Text. Royal Society of Chemistry (London).
12. Ryan M.A. and Tinnesand M. Introduction to Green Chemistry. American Chemical Society (Washington).
13. Cann M. C. and Connelly M. E. Real world cases in Green Chemistry, American Chemical Society (Washington).
14. Cann M. C. and Umile T. P. Real world cases in Green Chemistry (Vol 2) American Chemical Society (Washington)
15. Ahluwalia, V.K., Kidwai, M. New Trends in Green Chemistry, 2004
16. Inorganic Polymers by Stone and Graham.

#### PRACTICALS

**Duration: 5 Hours**

**Max. Marks: 50**

**Min. Pass Marks: 18**

**Note:** The students should be given exposure of any research labs and instrumentation center/ reputed university lab/ industry/ government labs of northern region.

#### A. Inorganic Chemistry

- a. Quantitative estimation of one metal volumetrically from a given mixture.
- b. To estimate magnesium volumetrically from a mixture containing  $Ba^{2+}$  and  $Mg^{2+}$  Ions/  $Zn^{2+}$  and  $Mg^{2+}$  ions.
- c. To estimate  $Ca^{2+}$  periodometrically from a given mixture containing  $Pb$  and  $Cu$  ions.
- d. Estimation of Glucose with the help of Fehling's solution.
- e. Determination of Total hardness of water.

#### B. Organic Chemistry

- a. Two stage preparation: *p*-nitroacetanilide from Aniline and *p*-Bromoacetanilide from Aniline.
- b. Determination of Iodine value of an oil/fat.
- c. Separation of two component mixture using water or  $NaHCO_3$  solution & identification of the two components. Preparation of one derivative

#### C. Physical Chemistry

##### 1. Colorimetry

- a. Determination of formula of complex by Job's method.
- b. Verification of Beer – Lambert law for  $KMnO_4/K_2Cr_2O_7$  and determine the concentration of the given solution of the substance.

##### 2. Polarimetry

Determination of the specific rotation of a given optically active compound and determination of the concentration of given solution of an optically active substance

##### 3. Solvent Extraction

Separation and estimation of  $Mg(II)$  and  $Zn(II)$

##### 4. Ion Exchange Method

Separation and estimation of  $Mg(II)$  and  $Zn(II)$

#### CC – 3 Zoology

Scheme	Exam Duration	Max.Marks	Min.Pass Marks
Paper I	3 hours	80 (External) 20 (Internal)	36

#### CC – 3 (I) -PAPER-1 MOLECULAR GENETICS, BIOTECHNOLOGY AND INSTRUMENTATION

**Duration : 3 hours**

**Max.Marks: 80**

##### Objectives

To enable students to comprehend the modern concepts and applied aspects of Molecular Genetics, Biotechnology and instrumentation.

**Note :** The paper is divided in five independent units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit.

##### Unit – I

- a) Nucleic acids: DNA ( prokaryotic and eukaryotic)- Structure, forms, chemical composition functions and units of DNA, Genetic Code
- b) RNA : Genetic RNA ,non – genetic RNAs ( mRNA, tRNA, and rRNA) – Structure and functions.
- c) Replication of DNA

## Unit –II

- a) Gene mutation : nature of mutation, types of mutation and causes of mutation
- b) DNA repair : mismatch repair, direct repair, base-excision, nucleotide- excision repair and other types of DNA repair. Genetic diseases and faulty DNA repair.
- c) Gene expression : Transcription and translation of prokaryotes and eukaryotes.
- d) Regulation of gene expression in prokaryotes ( Lac and tryptophan operon)

## Unit –III

- a) Genetic engineering : Gene cloning
  - (i) Cloning vectors
  - (ii) Restriction endonucleases , staggered and blunt ended cuts, ligation and example.
  - (iii) Recombinant DNA technology
- b) Gene amplification
  - (i) cDNA library
  - (ii) Genomic library and
  - (iii) Polymerase chain reaction
- c) Applications of recombinant DNA technology – DNA finger printing, human gene therapy, ethical concerns and cloning.

## Unit – IV

- a. Animal Cell, Tissue and organ culture. History of animal Cell & organ culture requirements. Characteristics of animal cell culture. Culture media (Natural & Synthetic).
- b. Sterilization of glassware, equipment isolation of animal tissue; somatic cell fusion, hybridoma technology.
- c. Elementary idea of bio informatics, genomics, proteomics

## UNIT -V

- a. Microscopy : Principle structure and function of simple and compound microscope
- b. Spectrophotometry : Principle of spectrophotometer, structure of simple & UV visible spectrophotometer Principles of Chromatography.
- c. Principles of electrophoresis, separation technique of proteins and DNA,.
- d. Principles of Centrifugation, simple, Gradient & Ultracentrifuge.
- e. General Principle & functions of instrument related to ECG, EEG, CT scanning and Sonography.

### Textbooks and References:

- Molecular Biology of the Cell, Alberts et al, 5<sup>th</sup> ed, Garland Science 2008
- Molecular Biology of the Gene Watson Baker et al, 7<sup>th</sup> ed, Pearson 2014.
- Biochemistry , Molecular Biology and Genetics 5<sup>th</sup> and Wilkinson, 2013
- Biochemistry D Voet & JG Voet, Wiley 2011.
- Immunology , Kuby 7<sup>th</sup> ed, Owen Punt Stanford McMillan, 2013
- Fundamentals of Biochemistry , JL Jain , S Chand Pub 2014
- Essentials of Molecular Biology 2ed , David Freifelder, Panima Publishing N Delhi 1996.

- Genetics and Biotechnology , Dr KC Soni Hindi Edition, College book centre Chaura Rasta Jaipur.
- Microbiology and biotechnology , Dr KC Soni Hindi Edition, College book centre Chaura Rasta Jaipur.
- Biochemistry and Molecular Biology, K Wilson & J Walker, 7<sup>th</sup> 2010.
- Animal Cell Culture – A practical approach, Ed, John, R. W. Masters IRL Press
- Gunther S. Stent , Molecular Genetics, MacMillian Publishing Co Inc.
- R.W. Old and S.B. Primorse: Principle of gene manipulation: An introduction to genetic engineering.
- R.A. Meyers (Ed) : Molecular Biology and Biotechnology .( VCH Publishers )
- Genetics – Analysis and Principles- Robert J. Brooker , McGraw Hill
- Principles of Cell and Molecular Biology –L.J Kleinsmith & V.M Kish, Harper Collins College Publisher.
- Molecular Cell Biology 7<sup>th</sup> Ed, 2013- Lodish ,Berk, Matsludaira, Kaiser Kriegar , Scott, Zipursky, Darnell,W.H Freeman And Co.
- Bioinformatics, Shurma Munjal and Shankar, 2012 Rastogi Publications , Gangotri , Shivaji Road, Meerut-25002
- Biotechnology – BD Singh ( Hindi Ed ) , Kalyani Publisher B1/292, Ludhiana, -141008 Punjab

### PRACTICALS

**Duration : 3 hrs**

**Max Marks 50**

**Objectives:**

To develop the molecular and biotechnological techniques and to develop skills of preparing media, separation of nucleic acids and culture of animal cells.

**Course Contents:**

1. Study of DNA by Fulgent reaction in the salivary gland chromosomes.
2. Isolation of genomic DNA
3. Molecular separations by chromatography, electrophoresis, precipitation etc.
4. Isolation of milk protein form the milk sample.
5. Separation of serum by using centrifuge
6. Estimation of protein by Biuret Method.
7. Separation of plasma by centrifugation.
8. Separation of biomolecules by paper and gel chromatography.
9. Preparation and use of culture media for microbes.
10. Preparation and use of culture media for animal tissues.
11. Media preparation media sterilization and inoculation.
12. Cell culture techniues- Design and functioning of tissue culture laboratory, cell proliferation measurements , culture media preparation and cell harvesting methods.
13. Isolation and staining of bacteria.
14. Determination of pH value of different water samples, blood urine andslaiva.
15. Qualitative tests for carbohydrates.
16. Qualitative test for proteins.
17. Qualitative test for lipids.
18. Effects of temperature on the activity of enzyme.



19. Chart, model Power point/multimedia presentation preparation related to evidence of evolution Human /Horse evolution , Geographical time scale etc.
20. Students are expected to visit different laboratories ( RRL, CSIR, ICMR, Science centers etc).

**Guidelines/Instructions for Practical**

**Examination Max. Marks : 50 Time Allowed : 4 Hrs. Min. Pass**

**Marks : 18**

S. No.	Exercise*	Marks
1.	Molecular Biology Experiment	4
2.	Biotechnological Experiment	6
3.	Biochemical tests	6
4.	Bacteriological experiment	5
5.	Instrumentation-major	7
6.	Instrumentation - minor	3
7.	Practical record	5
8.	Viva	4
9.	Project report	10

\* as per UGC guidelines

**CC-4 Botany**

Scheme	Exam Duration	Max. Marks	Min Pass
<b>Marks</b>			
Paper. I	3 hours	80 (External ) 20 (Internal) }	36
Practical	4 hours	50	18

**CC-4(I) Paper I - Genetic Engineering, Molecular Biology, Ecology & Economic Botany**

**Unit -I**

Tools and Techniques in Plant Tissue Culture, Media Preparations , Solid media, Liquid media, sterilization techniques, sterilization of glasswares and medium , Aseptic manipulation and Culture maintenance, Inoculation and Sub culture.

Concept of Cellular totipotency, Methods of application of micro propagation, Haploid production , Zygotic embryo culture, Endosperm Culture, Somatic embryogenesis and Synthetic Seeds.

**Unit-II**

An Overview of Genetic Engineering, Tools & Techniques of genetic engineering, recombinant DNA technology , Methods and applications in agriculture, horticulture, pharmaceuticals, Genetic markers, PCR.

Concept of genomics and proteomics, application of biotechnology.

**Unit III**

Atmosphere (gaseous composition), Climatic factors, Edaphic factors, morphological, anatomical and physiological, responses of plants to water, temperature light and Salinity. Population ecology with special reference to Growth Curves, ecotypes, ecads and plant Indicators.

Community ecology with special reference to life forms, biological spectrum, ecological succession.

**Unit IV**

Ecosystem, Structure and function, Abiotic & biotic components, food chain,

food Web ecological pyramids, energy flow, biogeochemical cycles of carbon, nitrogen & phosphorous

General vegetation of India

Intellectual property Rights (IPR) and Patent.

### Unit V

Economic Botany: - Origin, Cultivation and value added products of following: Cereals: Rice, Wheat and Maize

Oil Yielding Plants: Mustard, Groundnut and Coconut Fibre Yielding Plants: Cotton, Sun-hemp

Spices : Cardamom, Fennel, Cumin, Coriander

Medicinal plants : Opium, Cinchona,

Sarpagandha. Beverages : Tea & Coffee

Rubber : General Account

### Suggested Readings:

- Σ Vasil. I.K. and Thorpe, T.A. 1994, Plant Cell and Tissue Culture, Kluwer Academic Publishers, The Netherlands.
- Σ Kochar, S.L. 1998. Economic Botany in Tropics 2<sup>nd</sup> edition. Macmillan India Ltd. New Delhi.
- Σ Simpson. B.B. and Conner-Ogorzaly, M. 1986. Economic Botany – Plants in Our World, Mc. Graw Hill, New Delhi.

### Practicals

1. Basic requirements of a tissue culture laboratory.  
(a) Common Glassware, (b) test tubes, culture tubes and screw-capped tubes, (c). Petridish (d). Pipette (e). Pasteur pipette (f) Erlenmeyer (b) flask (g). Volumetric flask (h) Cleaning glassware (i). Inoculation needle and inoculation loop (j). Bunsen burner (Spirit-lamp), (k) water baths (l). Autoclaves. (m) laminar air flow (n) Incubator (o) Hot air oven (p) Colony counter (q) pH meter (r) Electric balance (s) Spectro photometer (t) Centrifuge (u) binocular Microscope.
2. Method of using balance  
Preparation of temporary cotton plug  
Preparation of permanent cotton plugs.  
Preparation of culture media
  - a) Preparation of liquid medium (broth)
  - b) Preparation of Solid media (PDA medium and plates)
  - c) Preparation of agar slants.
  - d) Preparation of agar deep tubes.
3. Methods of Sterilization.
4. Demonstration of the techniques of micro-propagation by using different explants, e.g. axillary buds, shoot meristems etc.
5. To determine the minimum size of quadrat by species area curve method.
6. To determine the minimum number of quadrat to be laid down in field under study.
7. To study the vegetation structure through profile diagram
8. To determine moisture content and water holding capacity of different types of soil
9. To determine the dust holding capacity of different types of leaves.
10. **Fibres:** Study of cotton flowers, sectioning of the cotton ovules/developing seeds to trace the origin and development of cotton fibres. Microscopic

study of cotton and test for cellulose. Sectioning and staining of jute stem to show the location and development of fibres. Microscopic structure. Tests for lignocellulose.

11. **Spices:** Examine Coriander, Fennel and Cumin (hand sections) and opened fruits of cardamom and describe them briefly.
12. **Preparation of an illustrated inventory of 5 medicinal plants used in indigenous systems of medicine or allopathy:** Write their botanical and common names, parts and diseases/disorders for which they are prescribed.

### CC-5 Mathematics

Scheme	Exam Duration	Max. Marks	Min. Pass Marks
Paper-I	3 hours	60 (External) 15( Internal)	54
Paper-II	3 hours	60 (External) 15( Internal)	

### CC-5 (I) Paper –I: Numerical Analysis

#### Duration

: 3Hrs

#### Max.Marks:

60

#### Unit 1

Error - its sources, propagation and analysis, Numerical solution of system of linear equations, Direct methods-The matrix inversion method. Gauss elimination method, Gauss-Jordan method, Iterative methods: Gauss-Jacobi Method, Gauss Siedel method.

#### Unit-2

Differences, Relation between difference and derivatives, Differences of polynomials, Newton's formula for forward and backward interpolation Divided differences and simple differences, Newton's general interpolation formula, Lagrange's interpolation formula, Error in interpolation.

#### Unit-3

Numerical differentiation and numerical integration- Simpson's Weddle's and Trapezoidal rules, Newton's Cotes Quadrature formula, Gauss Quadrature formula. **Unit-4**

Root finding for nonlinear equations (Transcendental and Algebraic equations), Iterative method, Bisection method, Regula-Falsi method, Newton Raphson's method order of convergence.

#### Unit-5

Numerical solution of first and second order differential equations, Euler's Method picard's Method, Taylor's series approximation, Runge-Kutta Method.

#### Textbooks and References:

- 1 An Introductory Methods in Numerical Analysis: S.S. Sastri, P.H.I, New Delhi, 4<sup>th</sup> edition 2005.
- 2 Numerical Analysis: J.L. Bansal, J.P.N. Ojha, JPH, Jaipur, 1991.
- 3 An Introduction to Numerical Analysis: Kendall E. Atkinson, John Wiley, New York, 2<sup>nd</sup> edition
- 4 Computer Based Numerical Methods and Statistical Techniques: P.K. De, CBS Publication, New Delhi, 1<sup>st</sup> edition 2006.

### CC-5 (II) Paper –II: Discrete Mathematics

**Duration: 3Hrs**

**Max.Marks:60**

#### Unit-1

Set Relation and function, binary Relations, equivalence relations and partitions,

partial order relation and lattices chains and ant chains pigeon hole principle.  
Principle of inclusion and exclusion.

#### **Unit-2**

Computability and formal languages ordered sets languages. Phase structure grammars types of grammars and languages permutations, combinations' and discrete probability

#### **Unit-3**

Graphs and planar graphs; Basic terminology, multigraphs, weighted graphs paths and circuits travelling sales person problem, planar graphs, trees.

#### **Unit-4**

Finite state machines; Equivalent machines, finite state machine as language recognizers computable functions

#### **Unit-5**

Boolean algebra: Lattices, algebraic structures, duality, distributive and complemented lattices, Boolean lattices, and Boolean algebras, Boolean functions as expressions.

#### **Textbooks and References:**

1. Elements of Discrete mathematics: C.L. Liu, McGraw Hill, International editions, 2008.
2. Graph Theory: Narsingh Deo, Prentice Hall of India, 2004.
3. Discrete Mathematics: N.L. Biggs, Oxford Science Publication, 1985.
4. Discrete Mathematics and its Applications: Kenneth H. Rosen, McGraw Hill, 1999.
5. Discrete Mathematics with Applications: T. Koshy, Academic Press, 2005.

### **CC 6: ASSESMENT FOR LEARNING**

Instructional Time: 4 periods/week

Max.

Marks: 75

**Exam. Duration: 3 Hours**

**Internal: 15**

**EXTERNAL: 60**

#### **Course Objectives:**

1. To enable assessing children's progress,
2. Understand the different dimensions of learning and related Evaluation procedures,
3. To enable to differentiate measurement, evaluation and assessment.
4. To enable to use wide range of assessment tools and techniques.
5. To realize the importance of CCE

#### **Course Content**

##### **Unit - I**

- (a) Concept of measurement, evaluation and assessment.
- (b) Types need and purpose of evaluation. Principal of Assessment and evaluation.
  - (c) Monitoring of Learning, Observation of learning processes by self, by peer and by
  - (d) teacher, self-assessment and peer assessment.

##### **Unit 2**

- (a) Construction of test: subjective test and objective test.
- (b) Characteristic of a good test. Standardized and teacher made test.

(c) Nature of information gathered (Qualitative, Quantitative) Mode of response (Oral and written),  
**Unit 3**

(A) Classification of assessment: Base on purpose (Prognostic, Formative, Diagnostic and Summative), Scope (Teacher made, Standardized) Attribute measured (Achievement, Aptitude, Attitude

(B) Providing Feedback, types of feedback (written comment, oral), peer feedback.

#### **Unit – 4**

(a) Continuous and Comprehensive Evaluation: Meaning, concept and characteristics of CCE, Need and Process.

(b) Grading: Concept, types and Application, Indicators for grading Psycho-Social and Political dimensions of assessment. Marking system and grading system.

(c) Assessment of affective learning: attitude and values, interest,

#### **Unit – 5**

(a) Use of projects, Assignments, Worksheet, Practical Work, and Performance based activities, seminars and reports as assessment devices.

(b) Commercialization of assessment. Teacher assessment by student, institutional evaluation.

(c) Participatory assessment and community monitoring critical analysis of prevalent practices of assessment.

**Term Test: 10 Marks**

**Practicum :5 Marks**

**Any on assignment related to the Unit I to Unit V**

**Recommended Books;**

- 1- vLFkkuk] fofiu %2009% eukfoKku vkj f"kk{kk e ekiu ,o eY;kdu] vxo ky idk"ku] vkxj kA
- 2- iky] gLjkt ,o "kek] etyrk %2009% ekiu vkdyu ,o eY;kdu f"kk{kk idk"ku] t; ijA
- 3- vfuy dekj f"kk{kk e ekiu ,o eY;kdu tjr idk"ku] fnYyA 4- ik M; ] Hkh?kj %2010% f"kk{kk e ekiu eY;kdu] Hkonh; idk"ku] dtkoknA
- 5- "kek T;kfr %2009% j"kf{kd ekiu ,o eY;kdu] vxo ku idk"ku] vkxj kA
6. Paul, Black (2012). Assessment for learning McGraw.
7. East, Lorna M. Assessment as learning sage pub. 2010
8. Ecclestone, Kathryn. Transforming formative assessment in life long learning. Mc Grau H,II. Eng.2010

### **CC7: KNOWLEDGE AND CURRICULUM**

Instructional time: 4 periods /week

Max. Marks: 75

Exam Duration: 3 Hours

Internal: 15

**External: 60**

#### **Course Objectives:**

1. To critically analyse various samples of textbook
2. To identify various dimensions of the curriculum and their relationship with the aims of Education.
3. To examine the epistemological basis of education.
4. To discuss the basics of modern child centered education.
5. To identify relationship between the curriculum framework and syllabus.
6. To understand the relationship between power, ideology and the curriculum.

#### **Course Content:**

##### **Unit I**

1. Concept, Meaning & nature of knowledge
2. Distinction between Data, knowledge, Information and skill Teaching and Training, Knowledge and

information, reason and belief.

3. Process of Knowledge generation: Local window, Sharing, practice Creation.

#### **Unit 2**

1. Curriculum: meaning, concept, nature and its basis..
2. Type of curriculum. Syllabus, curriculum & co-curriculum
3. Knowledge as the bases of curriculum, various structures of society and knowledge and their linkage and relationship

#### **Unit 3**

1. Factors affecting curriculum change: Social factors, Pressure groups, Writers and publishers.
2. Role of teacher as a curriculum maker
3. Concept of curriculum development and other curricular fields (curriculum design and curriculum engineering)

#### **Unit 4**

1. Meaning & Concept of nationalism, universalism and secularism and their interrelationship with Education.
2. Concept of National curriculum, curriculum reform in India.
3. Review of present curriculum (school subjects)

#### **Unit 5**

1. The salient features of national curriculum framework 2005 and NCFTE 2010 Analyze of these documents with respect to various aspects of foundations, concerns and the changes made with important considerations.
2. Nuffield, BSCS, PSCS, NSES. SMSG, with respect to their priorities, concerns and goals towards school education

#### **Term Test:10 Marks**

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#### **Books Suggested:**

1. Audrey & Howard Nocholls (1978) :—Developing Curriculum II, A practical guide- George Allen & Unwin, Boston, Sydney, London.
2. Davies, Iron, K. (1976) : —Objectives in Curriculum Design II, Mcgraw Hill Book Company Limited, England.
3. Denis Lawton (1986) : —School curriculum planning —. Hodder & Stoughton, London, Sydney.
4. Edward, A. Krug (1960) : The Secondary School Curriculum II, Harper
5. Erickson, H. Lynn (1998) : Concept-based Curriculum, E. Anderson (1962) : —Principles and Procedures of Curriculum Improvement II.
6. Edward, A. Krug (1960) : The Secondary School Curriculum II, Harper and Row Publishers, New York & Evanston.
7. Erickson, H. Lynn (1998) : Concept-based curriculum and instruction, Corwin Press, Inc
8. Gakhar, S.C. (2009): Curriculum Development, Panipat, N.M. Publications
9. Goodson, I. F. (1994) : II Studying Curriculum II, Open University Press, Buckingham
10. Zais, R.S. (1976) : —Curriculum Principles and Foundations II, Harper & Row Pub., London.

### **Group D: Pedagogical Courses**

#### **PC 1: Learning to Function as a Teacher (School Internship)**

Duration: Sixteen weeks Max. marks: 300 Internal: 300

#### **Objectives of the course:**

On the completion of the course the student teachers will be able to:

- observe the classes of regular teachers and peers and learn about teaching learning process and classroom management.
- develop skill in planning and teaching in actual classroom environment.
- reflect, learn to adapt and modify their teaching for attaining learning outcomes of students.

- maintain a Reflective Journal.
- acquire skill in conducting Action Research/ Case Study.
- inculcate organisational and managerial skills in various school activities.
- create and maintain resources for teaching and learning in internship schools.
- work with the community in the interest of the learner and their learning outcomes.

**Internship Tasks:**

The student teachers will perform the following in the school attached to her/him.

**(a) Delivery of lessons**

- The student teachers will deliver a minimum of 40 lessons including two<sup>th</sup> criticism lessons (one at the end of 9 week and the other during the last week of the teaching assignment) in each Pedagogy course. In total they will teach 80 lessons in two Pedagogy courses (Preferably 20 lessons for Upper Primary classes and 20 for Secondary classes in each Pedagogy course).
- The student teachers will visualize details of teaching learning sequences, keeping all considerations in view. They will also involve themselves in discussion, reflection, reconsideration and consolidation after each lesson as well as at the end of the unit.

**(b) Practicum**

- Preparation, administration and analysis of achievement tests in two Pedagogy courses.
- Conducting Action Research / Case Study.
- Observing ten lessons of a regular teacher and ten lessons of peers in each Pedagogy course and preparing an Observation Record.
- Preparing and using teaching aids in each Pedagogy course.
- Writing a Reflective Journal.
- Organising any two co curricular activities and reporting.
- Preparing a suggestive comprehensive plan of action for improvement of some aspects of the school, where they have been teaching during Internship.
- Reporting on activities conducted with the community.

Any other activity given under Suggested School Activities can be studied after consultation with the Faculty, in charge of Learning to function as a teacher (School Internship).

**Suggested School Activities**

- Organising cultural, literary, sports and games activities
- Framing of time table
- Organising Morning Assembly
- Maintenance of school discipline
- Maintenance of school records, library and laboratories
- Providing Guidance and Counseling services
- Studying the role of community in school improvement
- School Mapping
- Water Resource Management in schools
- Mass awareness of social evils and taboos
- Organising educational fair, exhibition, club activities, nature study and field trip

(Any other activity/ activities decided by the Institute)

**Post Internship Tasks:**

- Post Internship is organized for a day mainly for reflection and review of



internship programme as a whole, to facilitate the understanding of the effectiveness of various activities undertaken during the internship. The tasks include the following.

- Seeking reactions from students, teachers, Heads and teachers of cooperating schools and supervisors of the Institute.
- Exhibition of the Teaching Learning Material used by the student teachers during the internship.
- Any other activity decided by the Institute.
- Inviting suggestions for improving the programme.

**Modes of Learning Engagement:**

- Internship tasks will be carried out as a part of the ‘in-school’ practice. A mentor/cooperating teacher and supervisor of the Institute will guide the student teacher periodically.
- Student teachers will observe at least 10 lessons of regular classroom teacher and 10 lessons of their peers.
- Adequate classroom contact hours - a minimum of 40 lessons including two criticism lessons in each Pedagogy course preferably 20 lessons for Upper Primary classes (VI-VIII and 20 lessons for Secondary classes (IX and X) for subject based teaching – learning will be under taken in consultation with the school authorities.
- A Reflective Journal will be maintained by the student teacher in which she/he records his/her experiences, observations and reflections on classroom experiences.
- A portfolio will be maintained by the student teachers which includes lesson plans, resources used, assessment tools, student observations and other records.
- Student teachers will always work in liaison with the regular teachers in the schools involving themselves in all the school activities and conducting at least two activities.
- The Institute in consultation with the schools will prepare the details of the internship programme for each of the schools.
- External examiners will be appointed by the University for award of external marks.

**Modes of Assessment:**

The assessment of the student teachers will be carried out on the basis of their day to day participation and performance by a group of teacher educators. The details of activities and the marks allotted are given below.

<b>Activity</b>	<b>Marks</b>
a. Classroom teaching ( two Pedagogy courses)	200
b. Criticism lessons ( four lessons in total) :	40
c. Reflective Journal ( two Pedagogy courses):	10
d. Observation Records	
Ten lessons of school teacher :	05
Ten lessons of peer :	05
e. Achievement test- development,	
Administration and analysis :	10
f. Case study/ Action Research :	10
g. Detailed Record of any two activities organized by the student teacher :	10
h. One Teaching Aid in each of the Pedagogy courses	10
<b>Total</b>	<b>300</b>

