# CURRICULUM
## FOR
### B.Sc. B.Ed.
### Four year-Integrated Programme

### UNDER CHOICE BASED CREDIT SYSTEM
### (CBCS)

# BURDWAN UNIVERSITY
## BURDWAN, WEST BENGAL

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# Symbols & Abbreviation

| Sl. No. | Symbol | Abbreviation |
|---|---|---|
| 1. | CC | Core Course |
| 2. | GE | Generic Elective |
| 3. | DSE | Discipline Specific Elective |
| 4. | AECC | Ability Enhancement Course |
| 5. | SEC | Skill Enhancement Course |
| 6. | CBC | Choice Based Course |
| 7. | PE | Perspective in Education |
| 8. | CPS | Curriculum and pedagogic Studies |
| 9. | EPC | Enhancing Professional Capacities |
| 10. | FE | Field Engagement |
| 11. | L | Lecture |
| 12. | P | Practical /Practicum |
| 13. | Cr | Credit |
| 14. | CH | Contact Hours |
| 15. | H | Hour |
| 16. | M | Marks |
| 17. | W | Weeks |
| 18. | CBCS | Choice Based Credit System |

NO. 385–Edn (CS)/ 10M–39//2015                                    Dated: 17.04.2017

## ORDER

Whereas, the National Council for Teachers Education (NCTE), a regulatory body constituted under the National Council for Teachers Education Act, 1973, being the National Regulator in respect of maintenance of standard of Teacher's Training Education in India and also being enriched with the mandate of the Right of Children to Free and Compulsory Education Act, 2009, is empowered to prescribe the mode and standard of Teacher's Training Education, including syllabus of courses, qualifications for recruitment of teachers in various Primary, Secondary, Senior Secondary and Higher Secondary Schools and Teacher's Training Colleges in India, and

2.      Whereas, by its Regulations published in the Gazette of India dated 12.11.2014, the NCTE has introduced a 4-year integrated B.A. B. Ed and B. Sc. B. Ed course with the view to enable a comprehensive Degree in regard to the teachers education programme, and accordingly, requested all State Government to introduce the said course curriculum in respective Teacher's Training Institutions of the States, and

3.      Whereas, requests have been received from various institutions, colleges and Universities of West Bengal to consider the introduction of these 4-years integrated degree programmes from the Academic Session 2017-2018, and

4.      Whereas, the whole issue needs to be appraised by an Expert Committee in detail showing the possible outcome of the courses, if introduced, including the acceptability of the Degree awarded under these programmes by various Universities in furtherance of Master's Degree courses and also by various employers and Recruitment Bodies, and

5.      Now, therefore, with the above mentioned objectives, the Governor is hereby pleased to constitute and Expert Committee under the Chairmanship of **Prof. Mita Bandopadhyay, the Vice Chancellor of the West Bengal University of Teacher's Training, Education Planning and Administration**, with the following members, namely;–
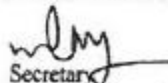
     (i) Prof. Jayasri Roy Chowdhury, Director of Public Instructions,

     (ii) Prof. Dipak Kumar Kar, Chairman, West Bengal College Service Commission,

     (iii) Chairman, West Bengal School Service Commission,

     (iv) State Government's Representative in the NCTE's Eastern Regional Committee,

     (v) Member Secretary, West Bengal State Council of Higher Education,

(vi) Vice Chancellors, or their nominees of Burdwan University, Vidyasagar University, North Bengal University, Sidho-Kanho-Birsha University, Gour Banga University and Aliah University,

(vii) Dr. Sujit Pal, Deputy Director of Public Instruction (Training)- Secretary to the Committee.

6.    The terms and reference to the Committee shall be as follows:-

(1) The Committee shall examine in detail the NCTE's Regulations on the 4-year integrated courses, the course curriculum, syllabus and other relevant documents in this regard,

(2) The Committee shall also design a detailed course structure, teaching hours, practical classes, expertise required for teaching of such course, the qualification and recruitment procedures of teachers who will teach these courses and other relevant details,

(3) The Committee shall also examine the feasibility of teaching these courses in various institutions, colleges and Universities in West Bengal and indicate the possible outcome of introduction of these courses in respect of employability as well as further higher studies in this regard.

(4) The Committee may meet various stake holders and institutions who desires to introduce these courses and also indicate the physical requirement of institutions in respect of building, classrooms, other facilities, teachers-student ratio, quality of teachers etc.

(5) The Committee shall also examine the employability potential of candidates doing the 4-year integrated courses, particularly with reference to teacher recruitment bodies in West Bengal.

(6) The Committee shall also examine the procedural formalities required to be taken by the Teachers' Training Colleges/ Universities, Departments before introducing such integrated courses.

(7) The Committee shall also prepare _ Roadmap/ timelines for implementation of the above mentioned courses in Colleges and Universities.

7.    The Committee shall submit to the State Government a report in this regard within one month.

By order of the Governor,

Secretary

Government of West Bengal

# Academic Committee

**Chairperson:** Prof. Mita Banerjee, Vice Chancellor, The West Bengal University of Teachers' Training, Education Planning and Administration (WBUTTEPA).

**National level Advisor:**
(i). Prof. S.C Panda, Former Professor, RIE, NCERT, Bhubaneswar.
(ii). Prof. B.N.Panda, Dean and HOD, RIE, NCERT, Bhubaneswar.

**Advisor:** All the Members of Expert Committee.

**Convenor:** Dr. Sujit Pal, Deputy DPI (Training), Education Directorate, Department of Higher Education, Science and Technology & Biotechnology, WB and OSD,WBUTTEPA.

**Co-ordinator:** Rakheebrita Biswas. Assistant Professor, Institute of Education (P.G.) for Women, Chandernagore, Hooghly.

## List of Members (For Subject Components)

| Sl. No. | Subject | Name | Designation |
|---|---|---|---|
| 1. | Botany | Prof. Ruma Pal. | Professor, Department of Botany, University of Calcutta |
| 2. | Zoology & Bio Science | Prof. Nirmal Kumar Sarkar | Former Professor, Department of Life Science, Presidency University |
| | | Prof. Gobinda Chandra Sadhukhan. | Prof. of Zoology & Former Director of UGC-HRDC, Jadavpur University. |
| 3. | Physics | Prof. ArabindaNayak | Professor of Physics & Dean of Facultyof Natural and Mathematical Sciences, PresidencyUniversity. |
| 4. | Chemistry | Prof.AshutoshGhosh | Professor, Dept. of Chemistry,University of Calcutta. |
| 5. | Mathematics | Prof. Sanjay Sen. | Former Professor, Dept. of Applied Mathematics, University of Calcutta. |
| 6. | Bengali | Prof. Arindam Chattopadhyay. | Professor & HOD of Bengali Dept., University of Burdwan. |
| 7. | English | Prof. Krishna Sen. | Former Professor,Department of English, University of Calcutta. |
| 8. | Hindi | Prof. Soma Bandyopadhyay. | Former Professor,Department of Hindi, University of Calcutta & Director,IISWBM |
| 9. | History | Prof. NirbanBasu. | Former Professor,Dept.of History, University of Calcutta. |
| 10. | Geography | Prof. Sunando Bandyopadhyay. | Professor,Dept. of Geography,University of Calcutta. |

## List of Members (For Education Components)

| Sl. No. | Subject | Name | Designation |
|---------|---------|------|-------------|
| 1. | Bio Science | Dr. Pronab Krishna Choudhury | Former Principal, David Hare Training College, Kolkata. |
| | | Dr. Subir Nag. | Principal, Satyapriya Roy College of Education, Salt Lake. |
| 2. | Physical Science | Dr. Subhas Chandra Bhat. | Assistant Professor, Department of Chemistry, Govt. College of Education, Banipur. |
| | | Sri. Palash Das. | Assistant Professor, WBUTTEPA [Erstwhile David Hare Training College] |
| 3. | Mathematics | Dr. Mili Das. | Former JDPI (Trg), Education Directorate, Govt. of West Bengal. |
| 4. | Language | Dr. SujataRaha. | Associate Professor, Dept.of Bengali, Govt. College of Education, Burdwan. |
| | | Smt. Amrita Das. | Assistant Professor, Dept.of English, Calcutta Girls B.T. College. |
| 5. | Hindi | Sri Pramod Kumar Yadav | Assistant Professor, WBUTTEPA [Erstwhile David Hare Training College] |
| 6. | Social Science | Dr.Mandira Mukherjee | Associate Professor, St. Xavier's College, Kolkata. |
| | | Prof. Sila Mukherjee. | Former Associate Professor and OIC, Institute of Education for Women, Hastings House, Kolkata. |
| 7. | Education | Prof. MadhumalaSengupta. | Former Professor, Department of Education, University of Calcutta. |
| | | (Dr.) SwamiTattwasarananda. | Principal, Ramakrishna Mission Sikshanamandira, Belur Math, Howrah. |
| | | Prof.BirbalSaha. | Professor, Department of Education, SKBU, Purulia. |
| | | Dr.ShyamsundarBairagya. | Associate Professor, VisvaBharati, Santiniketan |
| | | Prof.Bishnupada Nanda. | Professor, Department of Education, Jadavpur University. |
| 8. | Health & Physical Education | Dr.Atindranath De. | Director, School of Education, NSOU. |
| | | Prof. SudipSundar Das. | Department of Physical Education, JadavpurUniversity. |

Note : Academic committee was constituted by the Expert Committee in its meeting dated 16.05.2017 to expedite the process of curriculum framing following NCTE guidelines.

# Four Year B.A. B.Ed Programme: A Glance

## 1. Introduction

The system of teacher education has been evolving in India for more than one hundred years and has now established itself as a rigorous professional programme meant for preparing teachers for various stages of school education on the one hand and for different curricular areas on the other.

The latest revision of NCTE Regulations in 2014 has changed the character of teacher education in the country by enhancing the duration of B.Ed., M.Ed, and B.P.Ed.,M.P.Ed programmes, by making the integrated programme of four years' duration as the mainstream programme of teacher education and by allowing the flexibility of offering Teacher Education Programme in multi-disciplinary settings of Arts and Science Colleges. As per the new notification issued by the National Council for Teacher Education (NCTE) in respect of teacher education courses in India, now the candidates who have passed Plus Two will be eligible to apply for an Integrated BA B.ED/B.ScB.Ed degree course, the first ever four-year B.Ed programme. Earlier, the young aspirants had to enroll for a three-year BA/B.Sc and a two-year BEd course to become a teacher.

This four-year B.Ed. (Integrated) programme plays a major role in equipping the young aspirants planning to make a career as a teacher with comprehensive knowledge focused on best teaching practices and community-oriented approach to teaching.

The four-year integrated programme aims at integrating general studies comprising science (B.Sc.B.Ed.) and social sciences or humanities (B.A.B.Ed.), and professional studies comprising foundations of education, pedagogy of school subjects, and practicum related to the tasks and functions of a school teacher. It maintains a balance between theory and practice, and coherence and integration among the components of the programme, representing a wide knowledge base of a secondary school teacher. The programme aims at preparing teachers for upper Primary and Secondary stages of education.

The programme is now being formulated in accordance with the NCTE Regulations-2014vides Notification Dated 28th November 2014 in The Gazette of India: Extraordinary, Part III-Sec. 4, Appendix–13. Further, the provisions of Choice-Based Credit System (CBCS) and Grading have also been incorporated in the programme, as stipulated by UGC.

## 2. Salient Features of the Programme

The four-year integrated B.A.B.Ed. programme aims at preparing quality teachers in Social Sciences(SS) and Languages for upper primary and secondary stages of education by integrating *general studies* comprising SS and *language studies* to enhance communication skills, and *professional studies* comprising foundations of education, pedagogy of school subjects, and practicum related to the tasks and functions of a school teacher. It maintains a balance between theory and practice, and coherence among the components of the programme, representing a wide knowledge base of a secondary school teacher. The programme is of four academic years consisting of eight semesters including school based experiences and internship-in-teaching. Student-teachers shall, however, be permitted to complete the programme within a maximum period of six (4+2) years from the date of admission to the programme. On successful completion of the programme, they may enter teaching profession or opt for higher education in their respective areas of interest.

## 3. Objectives of Programme

The Four year integrated B.A.B.Ed. Programme aims at enabling the student-teachers to:

- Develop knowledge and performance competencies in SS and languages;
- Understand the nuances of child psychology and how children learn;
- Get acquainted with the content and pedagogical aspects of the teaching learning process suitable for secondary level of school education;
- Enhance the skill of communication
- Appreciate and apply the latest approach such as the constructivist approach to teaching learning;
- Adopt innovative strategies in classroom processes;
- Discover different human values inherent in content domains;
- Develop critical thinking, abstract reasoning, creativity and problem solving skills;
- Address issues related to natural resources and promote eco-friendly practices & sustainability;
- Use low-cost/no-cost learning materials to illustrate the social science and language concepts;
- Get functional familiarity with ICT and use it as a teaching learning tool;
- Become effective teachers of SS and languages at secondary level by imbibing appropriate professional values;
- Create awareness about the environment.

## 4. Streams
- Presently the B.A.B.Ed.programme has only one stream.

## 5. Programme Structure

Semester-wise and course-wise structure of the four-year integrated B.A.B.Ed. Programme is shown in Table 1. The structure is common to all disciplines under B.A.B.Ed. Following the UGC guide lines, the different B.A. related courses to be offered in the programme are categorized as Core Course (CC), Generic Elective (GE-1 & GE-2), Discipline Specific Elective (DSE), Ability Enhancement Compulsory Course (AECC), Skill Enhancement Course (SEC), and CBC or Choice Based Course. The CBC component may be taken by any student enrolled in any programme. The student may opt for any one of the following school subject areas, namely Geography, History in Social Science and Hindi, English and Bengali in languages. Besides, there are Professional Education Course (PEC) components. Details of papers for different courses are given in the corresponding syllabi.The credit and grade associated with the **CBC** (Choice Based Course) are not to be included in those of the main programme.

**Choice Based Course (CBC):** CBC Courses have to be offered in Semester VI. A student has to opt any one of the CBC courses from any subject area of his/her choice.

- Herbal plants for home gardening
- Chemistry and our life
- Renewable Energy and Energy Harvesting
- Food, Nutrition and Public Health
- General Mathematics
- Basics of Social Sciences
- English (creativity in translation)
- Hindi Bhasha aur Sahitya ka Samanya Gyan
- Communicative language (English II)
- Bangla Sahitya o Byakaran Gyana (Bengali)
- Educational Planning, Management and Leadership

## 6. Provision of Honours or Core Course (CC)

Students may opt for any of the five subject areas Geography and History in SS and Bengali, English and Hindi in Language for their honours course or core course (CC).

## 7. Provision of Generic Electives (GE-1, GE-2)

| Honours or Core Course (CC) | Generic Elective (GE-1, GE-2) |
|---|---|
| Geography | History, Bengali/ English /Hindi |
| History | Geography, Bengali/ English /Hindi |
| Bengali | Geography/History, English /Hindi |
| English | Geography/History, Bengali/Hindi |
| Hindi | Geography/History, Bengali/English |

## 8. Change of Subject

- Once chosen, subject change is not permissible under any circumstances in a given semester or subsequent semesters. However, in the First Semester only the student can go for change of subject in consultation with the Head of the Institute and necessary information need to be communicated by the College Authority to the affiliating University with immediate effect (within one month from the date of commencement of the academic session of that year).

## 9. Medium of Instruction

The medium of instruction for the programme is English /Bengali except for the other Indian language courses.

## 10. Programme Duration

The normal duration of the programme is eight semesters to be completed in four years. The maximum time limit allowed for programme completion is six (4+2) years from the date of admission to the programme.

Odd semester (1st, 3rd, and 5th, 7th) is from July to December and even semester (2nd, 4th, 6th, 8th) is from January to June.The respective semester-end examinations shall be normally held in November-December and April-May.

## 11. Working Days

In a year, there shall be at least two hundred and fifty working days per year excluding the period of examination and admission.

A working day will be of a minimum of 5- 6 hours adding up to a minimum of 36 hours per week. The Institution shall ensure theavailability of teachers and students for consultation and mentoring - providing group or individual guidance.

The minimum attendance of student-teachers shall have to be 80% for all course work and practicum, and 90% for school internship.

## 12. Basic Unit:

There shall be a basic unit of fifty (50) students. Intake capacity will be as per sanction ofNCTE and the affiliating University. The affiliating University may prescribe distribution of students for different subjects.

## 13. Eligibility and Admission

- Candidates with 50% marks or equivalent grade in the higher secondary or +2 Examination, Science, Arts or Commerce Streams (EXCEPT VOCATIONAL COURSES) are eligible for the programme.
- 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.
- Selection for admission to the programme is made on the combined score of the candidate in the qualifying examination and Common Entrance Examination (CEE) held for the purpose or any other selection process as per the policy of the State Government/ Affiliating University.

- On successful completion of a semester, the candidate shall be readmitted to the next semester on payment of the requisite fees.

## 14. Admission Procedure
- Admission shall be made on merit on the basis of marks obtained in the qualifying examination and in the entrance examination or any other selection process as per the policy of the State Government/ Affiliating University.
- At the time of admission to the programme, the student will need to indicate their selection of the subjects to be pursued for the discipline options and the accompanying pedagogic specializations for which they are applying, and these may be assigned on the basis of order of merit and availability.

## 15. Attendance
- Minimum 80% attendance is required in each course and minimum 90% attendance is required in internship for being eligible to appear at semester examination.
- Up to 15% waiver may be granted by VC on the recommendation of the Principal of the Institute on payment of usual fees prescribed by the University.If a student represents University/State/National/District in sports and games and NCC/NSS/Scout–Guides/cultural activities or any official activities,s/he is permetted to avail 30 days academic leave in an academic year based on the recommendation of the head of the institution.
- There shall be no condonation if the attendance is below 65% in any course during any semester, for any reason.
- A candidate who does not satisfy the requirement of attendance shall not be eligible to take the examination of the concerned semester, nor will be eligible to take admission to the next semester.
- A candidate who fails to satisfy the requirement of attendance in a semester may repeat that semester in the subsequent academic year.

## 16. Fees
The institution shall charge only such fee as prescribed by the State Government/Affiliating University concerned in accordance with provisions of National Council for Teacher Education (NCTE) (Guidelines for regulation of tuition fees and other fees chargeable by unaided teacher education institutions) Regulations, 2002, as amended from time to time.

## 17. Weightage (Percentage) Distribution for Evaluation
i) Paper without Practical

| 1st Internal Assessment | 2nd Internal Assessment | Semester End | Total |
|---|---|---|---|
| 20 | 20 | 80 | 100 |
| Average 20 | | | |

## ii) Paper without Practical

| 1st Internal Assessment | 2nd Internal Assessment | Semester End | Total |
|---|---|---|---|
| 10 | 10 | 40 | 50 |
| Average 10 | | | |

## iii) Paper with Practical

| 1st Internal Assessment (Sessional) | 2nd Internal Assessment (Sessional) | Semester End | | Total |
|---|---|---|---|---|
| 20 | 20 | Theory (A) | Practical (B) | 100 |
| Average 20 | | 50 | 30 | |

## iv) For Education Components

| Semester End | | Total |
|---|---|---|
| External | Internal | 100 |
| 70 | 30 | |

| Semester End | | Total |
|---|---|---|
| External | Internal | 50 |
| 35 | 15 | |

v) **Project cum Seminar : 100 marks**

vi) **No.of activities to be performed by the student teachers for each paper (Professional Education Component) :**

- 1 (One) suggested activity for 15 marks internal assessment
- 2(Two) suggested activities for 30 (15x 2 ) marks internal assessment

## 18. Grading System

A student's level of competence shall be categorized by a GRADE POINT AVERAGE, as specified below;

- **SGPA** – Semester Grade Point Average
- **CGPA** – Cumulative Grade Point Average

The following procedure shall be followed to calculate the Grade Point Average (GPA)

i) Converting mark to grade:

| Marks | Grade Point | Letter Grade | Interpretation |
|---|---|---|---|
| 90-100 | 10 | 'O' | Outstanding |
| 80-89 | 9 | 'E' | Excellent |
| 70-79 | 8 | 'A' | Very Good |
| 60-69 | 7 | 'B' | Good |
| 50-59 | 6 | C' | Fair |
| 40-49 | 5 | 'D' | Pass |
| <40 | 0 | 'F' | Fail |
| 0 | 0 | Ab | Absent |

ii) Calculating SGPA and CGPA

Point = Integer equivalent for each letter grade

Credit = Integer signifying the relative importance/ emphasis given to individual paper/ course in a semester as reflected in the course structure/ syllabus.

a) Credit point = Credit (in a paper) x grade point (secured in that paper)

b) Credit Index = Total Credit point of the course

c) Grade Point Average (for a course or subject) $= \dfrac{Credit\ Index}{Total\ Credit\ of\ the\ Course}$

d) Semester Grade Point Average (SGPA) $= \dfrac{Credit\ Index\ for\ a\ Semester}{Total\ Credit\ of\ the\ Semester}$

e) Cumulative Grade Point Average (CGPA)

$= \dfrac{Credit\ Index\ of\ all\ previous\ Semesters\ up\ to\ a\ Semester}{Total\ Credit\ up\ to\ Semester}$

### 19. Scheme of Examination; Requirement for Pass; Results

19.1 In each semester and in each paper, a candidate has to appear at both the internal assessments and secure minimum 40% in theory and 50% in practical/internal assessment. Otherwise, the candidate shall not be allowed to fill up forms for the semester examination.

A special internal assessment may be held for those who fail to meet the above requirement or remain absent with prior permission from competent authority.

19.2 There shall be a University examination at the end of each semester, comprising theory and practical, whereever applicable.

A candidate has to secure minimum 40% marks in theory and 50% marks in internal/practical papers separately.

Candidate obtaining Grade F is considered Failed and will be required to clear the back paper(s) in the subsequent examinations within the stipulated time.

Candidate securing 60% and above in CC/Hons. Courses shall be awarded **First Class** and 50% and above, but less than 60% shall be awarded **Second Class**, 40% and above, but less than 50% shall be awarded Q (Qualified).

The provision for Honours is applicable to the core courses of subject specialisation (B.A. components) of the programme.

In B.Ed(Professional Education) component a candidate has to secure minimum 40% in theory and 50 % in practical/practicum separately and 50 % in agreegate to pass the examination.

In B.Ed(Professional Education) component 60% and above will be awarded first class and 50% to less than 60% will be awrded second class

All other provisions as above apply to both the B.A. and B.Ed. components of the programme.

19.3 The details of grading system shall be printed on the backside of the Mark Sheet/ Grade Card.

**19.4** The performance of a candidate in his/her Choice Based Course (CBC) in the form of mark/grade will be indicated in the Mark Sheet/ Grade Card but will not be reflected in SGPA or CGPA.

**19.5** Candidates must obtain atleast the pass mark/grade/percentage in CBC to successfully complete the programme.

## 20. Repeat Examination

**20.1** If a candidate fails to clear any paper(s) in a semester in the first attempt, he/she is allowed to clear the back paper(s) in two more consecutive attempts. The candidate has to complete the programme within 6 (4+2) years at the most.

**20.2** No improvement in a paper will be allowed if the candidate has secured pass mark in the paper.

## 21. Hard Case Rule

**21.1** If a candidate fails maximum in two written papers, by not more than 2% of total theory marks for the Examination, the minimum marks required to make up the deficiency in the written papers be added in order to enable the candidate to pass the examination.In such cases the deficiency in aggregate should not be taken into account.

**21.2** 0.5% grace mark can be given for award of B Grade in each semester provided grace mark under 21.1 has not been awarded.

## 22. Examination Question Pattern

a) **Theoretical courses:** Full marks are 100 per course out of which 20 marks are allotted for internal assessment and 80 marks for semester end examination. Courses having 50 marks, out of which 10 marks are allotted for internal assessment and 40 marks for semester end examination.

b) **Practical Courses:**
Full marks are 100 per course out of which 20 marks are allotted for internal assessment, 30 marks for practical and 50 marks for semester end examination.

c) **Education Components:** Full marks are 100 per course out of which 30 marks are allotted for internal assessment and 70 marks for External assesment. Courses having 50 marks, out of which 15 marks are allotted for internal assessment and 35 marks for External assesment.

➤ **Pattern of question papers for students under CBCS in the Semester-end Examination**

a) In the semester-end examination there will be two groups of questions. Group-A will be compulsory comprising 10 (1x10) restricted answer type questions covering all units. Group-B will comprise long answer type questions covering all units with unit-wise alternatives to each question.

b) For practical subjects, out of 50 marks in semester-end exam, Group-A will have 10 marks (1x10) and Group-B will have 40 marks. Alternative questions will be set unit-wise for long answer type questions in Group-B.

c) For non-practical subjects, out of 80 marks, Group-A will have 10 marks (1x10) and Group-B will have 70 marks. Alternative questions will be set unit-wise for long answer type questions in Group-B.

d) For courses having 50 marks, Group-A will be compulsory comprising 10 marks restricted answer type questions (1x10) covering all units. Group-B will comprise 40 marks comprising of long answer type questions covering all units with unit-wise alternatives to each question.

23. **The institutions will have to meet the following specific demands of the professional programme of study:**
   a. **Prepare a calendar for all activities**, including school internship. The school internship and other school related practicum shall be synchronized with the academic calendar of the school.

   b. **Make arrangement with sufficient schools for internship** as well as other practicum activities required for school engagement. These schools shall preferably be government schools and shall form the basic contact point for all practicum activities and related work throughout the programme of study. The state education administration may allot schools to different TEIs.

   c. **There shall be a coordinating mechanism between schools, TEIs of the region and Government** to ensure consonance with the school academic calendar and to ensure a rational and reasonable distribution of student-teachers in various schools, and consonance with the school calendar, to ensure school support and mutual cooperation.

   d. **Develop institutional mechanisms to involve school teachers of the Internship schools, in processes related to school internship.** An orientation may be planned at school with the commencement of the Internship programme, where faculty from the institute/college interacts with school teachers.

   e. **Initiate and deepen the discourse on education by organising seminars, debates, lectures and discussion groups for students and faculty.**

   f. **Organise inter-institutional interactions for students between various colleges on themes of Educational significance** and also participate in such events organized in other institutions.

   g. Be integrated into the life of the institution and have opportunities to participate with and interact with **students from the other under graduate programmes.**

   h. Adopt a **participatory teaching approach** to help students develop reflective thinking and critical questioning skills.

   i. Facilitate interns to maintain reflective journals and observation records which provide opportunities for **reflective thinking.**

   j. Maintain records of planning, observation schedules and feedback and reflective reports prepared by the **interns.**

k. The institution shall provide opportunities for faculty development and also **organize academic enrichment programmes for the professional development** of faculty. Faculty shall be encouraged to participate in academic pursuits and **pursue research, especially in secondary school.**

## 24.Staff

### a. Faculty:

For an intake of two basic units of 50 students each, there shall be 16 full-time faculty members.

The distribution of faculty across different curricular areas shall be as under:

- Principal/ HoD                                       One
- Perspectives in Education                      Four
- Pedagogy subjects                                 Eight

(Maths, Science, Social Science, Language)

- Health and Physical Education             One
- Fine Arts                                               One
- Performing Arts (Music/Dance/Theatre) One

### Note:

(i) The faculty positions listed under different subject categories may teach course(s) in the Teacher Education Programme across curricular areas specified, and can cater to both foundation and pedagogy course(s).

(ii) Faculty can be utilised for teaching a B.Sc.B.Ed./B.A.B.Ed programme in flexible manner so as to optimize academic expertise available.

### b. Administrative & Professional staff

For an intake of two basic units of 50 students each, there shall be 16 full-time faculty members.

The distribution of faculty across different curricular areas shall be as under:

- Librarian (B.Lib with 55% marks)              One
- Computer Lab Asstt. (BCA with 55% marks)  One
- Office Manager                                          One
- Office Assistant cum Date Entry Operator    One
- Curriculum Lab Co-ordinator                     One
- Accounts Assistant                                     One
- Helpers/Lab Attendant                              Two

### Note:

- The qualifications shall be as prescribed by the State Government / Affiliating body for equivalent posts.
- In a composite institution, the Principal and academic, administrative and technical staff can be shared. There shall be one Principal, and others may be termed as HoDs.

## 25. Infrastructure

- The minimum essential space for an Institute offering BSc, B.Ed and B.A., B.Ed programme includes an administrative wing, an academic wing and other amenities. All spaces should be inclusive and have barrier free access.

- The Department of Education shall possess 3000 sqmts (three thousand square meters) of exclusive well demarcated land for the initial- intake of one hundred students out of which 2500 sqmts (two thousand five hundred square meters) shall be the built up area and the remaining space for lawns, playfields etc.

- Classrooms: The Institute shall have one classroom for every 50 students with an area of 500 sq. ft for each classroom

## 26. a. Instructional
- Library
- Resource Centre
- Health and Physical Education Centre
- Multipurpose Hall
- Faculty Room
- Administrative Office Space
- Common room(s)
- Toilets
- Stores

### b. Other Amenities
- Functional and appropriate furniture in required number for instructional and other purposes,
- Arrangement may be made for parking of vehicles.
- Access to safe drinking water be provided in the institution.
- Effective arrangement be made for regular cleaning of campus, water and toilet facilities (separate for male and female students and teachers), repair and replacement of furniture and other equipments.

Note: In case of composite institution, the infrastructural, instructional and other facilities shall be shared by various programmes.

## 27. Provision for periodic review

There shall be a provision for review of the programme every Four years to identify and address relevant issues. Affiliating body may review the programme even before four years subject to approval from the concerned authority.

**(The Details about the Regulations and courses of Study of the Four year B.A. B.Ed Programme is given below.)**

The Curriculum components have been visualized in three clusters. They are indicated as: (1) Content Components in **Core Courses (CC)**, **Generic Electives** (GE-1 & GE-2) and **Discipline Specific Elective** (DSE), (2) Ability and Skill Enhancement Components in **Ability Enhancement Compulsory Courses** (AECC) and **Skill Enhancement Course** (SEC), and (3) **Professional Education Course** (PEC)Components in Education in Social Sciences and Humanities.

**Communicative English and Environmental study (Env. St.) through Ability and Skill Enhancement Components(AECC&SEC)** : It comprises of courses that are mandatory for all students.

a. Coomunicativel English and Env.St in AECC

b.Modern Indian Language (MIL) or Regional Language: Any one of the Languages in Hindi/Bengali or Alternative English in SEC.

### 21.The Professional Education. Course(PEC) Component consists of the following.

#### (i) Perspectives in Education (PE)

Perspectives in Education include courses on Basics in education, Childhood and growing up, Learning and teaching, Assessment for learning, Knowledge and curriculum, Schooling and socialization, Vision for Indian education and Inclusive education.

#### (ii) Curriculum and Pedagogic Studies (CPS)

These courses intend to facilitate student teachers to recognize the nature of knowledge in various subject areas (Social Science/Languages—Hindi/English/Bengali) and pursue to keep themselves abreast with advancements in their areas of specialization. In view of the requirement of hands on experiences, each of the courses is designed as Part I and II — to be spread over two semesters. Part I will help in developing understanding of and competence to render disciplinary knowledge into forms relevant to stage specific objectives and their pedagogic requirements. Part II will provide a comprehensive understanding of the teaching learning situations gained through intensive study of conceptual explanations, observation and analysis of real life classroom situations, simulations as well as on hands on experiences.

#### (iii)Enhancing Professional Capacities (EPC)

Running across the eight semesters specialized courses on learning to function as teachers, ICT and its application, health and yoga, Guidance and Counselling, arts in education, library resources and reading and reflecting on texts are offered to enhance the professional capacities of the student teachers. These courses act as curricular resources, developing personal and professional self and provide inputs on arts and aesthetics, yoga. These courses are focused on developing reflection, issues of identity (both personal and professional), interpersonal relations all in the context of school. The field related experience guides the student teachers to view schools as sites for social change, it develops sensitivity to the fellow citizens though listening and empathizing.

#### (iv) Engagement with the Field/Practicum (FE)

The Programme shall provide sustained engagement with the self, the child, the community and the school, at different levels and through establishing close connections between different curricular areas. These curricular areas would serve as an important link between the perspective and curriculum and pedagogic studies and enhancing professional capacities in the form of tasks and assignments and internship.

School Internship would be a part of this broad curricular area and shall be designed to lead to develop a broad repertoire of perspectives, professional capacities, teacher sensibilities and skills. The curriculum of B.Ed. shall provide for sustained engagement with learners and the school. Student-teachers shall be equipped to cater to diverse needs of learners in schools.

## 22. Subject Specialization

In the B.A. B.Ed. Programme, the subject specializations are chosen as Language (English, Hindi and Bengali) and Social Sciences (History, Geography) in CC, GE-1 and GE-2 In view of the need of Teacher Education in the country, Social Sciences and Languages are taken as a whole and the CC, GE-1 and the GE-2 courses are conceived accordingly. Students are expected to specialize in any one language or Social Science subject as honors in the form of CC and develop expertise in the teaching of minimum one Social Science or one Language. If the CC is a Language, the GE-1 and GE-2 are to be selected from Social Science subjects.if the CC is a Social Science subject, the GE-1 is one of the Languages and the GE-2 is a Social Science subject other than the subject opted as CC. This has been done with the objective of training Graduate Teachers for school, which is the mandate of the B.A.B.Ed. programme, with expertise in teaching Social Science and Language subjects as a whole.

The Course Structure is attached above (See Table-1) for comprehension. *If the CC is Hindi, which is a language, the GE-1 and GE-2 are two Social Science subjects. However, if the CC is History, which is a Social Science subject, the GE-1 has to be a Language and the GE-2 has to be a Social Science subject other than History.* At the end of the programme, the student has one language and two social science subjects, in which s/he has expertise in teaching. For higher learning she has one Hons in any of the SS or language subject areas.

A student opting for any honours course has to opt for English in DSE (Discipline Specific Elective) also.

## 23. Some Specific Modes of Learning Engagement Envisaged:

- Overarching lectures cum discussion
- Use of narratives based on research and documentation
- Project reviews
- Case studies
- Use of video-clips and transcripts of classroom teaching
- Success stories/innovations
- Observation in schools and other field sites
- Recording of observations and experiences
- Interviews with school personnel
- Panel or group discussion on issues
- Individual projects
- Journal writing
- Using library and ICT resources

**Enhancement of learning through School-based experiences**
Most courses require school experience for various purposes. Some significant aspects of these experiences are outlined:
- School visits and observations spread over the semesters, including
  - Observation visits
  - School attachment

- o Longer duration attachment, along with mentoring
- School as a site for practical learning linked with theory
- Single school visit for carrying out tasks related to more than one course
- Exposure to variety of schools in order to understand larger systemic issues
- School-based experience to learn not only classroom pedagogy, but also learning to function as a teacher in the school environment

### B.A.B.Ed Programme will have :

- CC ( Core Course) – 14 papers=1400marks = 14x 6 credits=84 credits.
- GE-1 (Generic Elective) – 4 papers=400 marks=4x6 credits=24 credits
- GE-2( Generic elective) – 4 papers= 400 marks=4x6 credits=24 credits
- AECC (Ability Enhancement Compulsory Course)- 2 papers=200 marks =2x4 credits= 8 cr.
- SEC ( Skill Enhancement Course) – 1 paper= 100 marks =4 credits
- DSE (Discipline Specific Elective ) – 2 paper= 200 marks =6 + 4=10 credits
- CBCS-1 paper= 100 marks =4 credits
- Professional Education – 2000 marks = 80 credits
- **Total- 2700+2000= 4700 marks= 154+80 credits =234 credits. For a course having 100 marks in CC and GE-1 and GE-2 there shall be 4 hours of Lectures (L) and 2 Practical/Practicum (P) per week = 06 credits. The Duration of a Lecture and a Tutorial is one hour .**

# Course Structure B.Sc. B.Ed.
## Semester – I

| Course | Course Paper | Marks (M) | Credit (Cr) | Contact Hours (CH) | | |
|---|---|---|---|---|---|---|
| | | | | Lecture (L) | Practical / Practicum (P) | Total (CH) |
| CC | CC-1 | 100 | 6 (4+2) | 4 H | 2 H | 6 CH |
| GE | GE-1.1 | 100 | 6 (4+2) | 4 H | 2 H | 6 CH |
| | GE-2.1 | 100 | 6(4+2) | 4 H | 2 H | 6 CH |
| DSE | - | - | - | - | - | - |
| AECC | AECC-1 | 100 | 4 | 4 H | - | 4 CH |
| SEC | - | - | - | - | - | - |
| CBC | - | - | - | - | - | - |
| Education | PE-1 | 100 | 4 | 4 H | | 6 CH |
| | EPC-1 | 50 | 2 | | 2 H | |
| **Total** | | **550** | **28** | | | **28 (CH)** |

❖ **Clarification regarding Core Course (CC) & Generic Elective (GE):**

⌗ Available science subjects (In a College affiliated to Burdwan University for B.Sc., B.Ed.) as Core Course (CC) are; Physics, Chemistry, Zoology, Botany & Mathematics.
- (CC) Core Course subject – anyone need to select out of above five subjects.
  - ➢ Suppose: A student has selected Physics as (CC) Subject.

⌗ Generic Elective:
- (GE-1) Subject: Any one subject need to select out of four except selected (CC) subject.
  - ➢ For example: The above student can choose any one subject out of Chemistry, Zoology, Botany & Mathematics for GE-1 (Except Physics selected as CC)
  - ➢ Suppose the student has selected Chemistry as GE-1.

- (GE-2) Subject: Any one subject need to select out of three, except selected (CC) subject & (GE-1) subject.
  - ➢ For example: The above student can select any one subject out of Zoology, Botany & Mathematics as GE-2.
  - ➢ Suppose the student has selected Mathematics as GE-2.

⌗ Now as per the Course structure, papers of selected (GE-1) & (GE-2) subjects to be continued up to Sem.-IV.

## Semester – II

| Course | Course Paper | Marks (M) | Credit (Cr) | Contact Hours (CH) | | |
|---|---|---|---|---|---|---|
| | | | | Lecture (L) | Practical / Practicum (P) | Total (CH) |
| CC | CC-2 | 100 | 6 (4+2) | 4 H | 2 H | 6 CH |
| GE | GE-1.2 | 100 | 6 (4+2) | 4 H | 2 H | 6 CH |
| | GE-2.2 | 100 | 6 (4+2) | 4 H | 2 H | 6 CH |
| DSE | - | - | - | - | - | - |
| AECC | - | - | - | - | - | - |
| SEC | SEC-1 | 100 | 4 | 2 H | 2 H | 4 CH |
| CBC | - | - | - | - | - | - |
| Education | PE-2 | 100 | 4 | 4 H | | 6 CH |
| | CPS-1 | 50 | 2 | | 2 H | |
| **Total** | | **550** | **28** | | | **28 (CH)** |


## Semester – III

| Course | Course Paper | Marks (M) | Credit (Cr) | Contact Hours (CH) | | |
|---|---|---|---|---|---|---|
| | | | | Lecture (L) | Practical / Practicum (P) | Total (CH) |
| CC | CC-3 | 100 | 6 (4+2) | 4 H | 2 H | 6 CH |
| GE | GE-1.3 | 100 | 6 (4+2) | 4 H | 2 H | 6 CH |
| | GE-2.3 | 100 | 6 (4+2) | 4 H | 2 H | 6 CH |
| DSE | - | - | - | - | - | - |
| AECC | AECC-2 | 100 | 4 | 4 H | - | 4 CH |
| SEC | - | - | - | - | - | - |
| CBC | - | - | - | - | - | - |
| Education | PE-3 | 100 | 4 | 4 H | | 8 CH |
| | PE-4 | 100 | 4 | 4 H | | |
| **Total** | | **600** | **30** | | | **30 (CH)** |

## Semester – IV

| Course | Course Paper | Marks (M) | Credit (Cr) | Contact Hours (CH) | | |
| --- | --- | --- | --- | --- | --- | --- |
| | | | | Lecture (L) | Practical / Practicum (P) | Total (CH) |
| CC | CC-4 | 100 | 6 (4+2) | 4 H | 2 H | 6 CH |
| GE | GE-1.4 | 100 | 6 (4+2) | 4 H | 2 H | 6 CH |
| | GE-2.4 | 100 | 6 (4+2) | 4 H | 2 H | 6 CH |
| DSE | DSE-1 | 100 | 6 (4+2) | 4 H | 2 H | 6 CH |
| AECC | - | - | - | - | - | - |
| SEC | - | - | - | - | - | - |
| CBC | - | - | - | - | - | - |
| Education | PE-5 | 100 | 4 | 4 H | | 6 CH |
| | PE-6 | 50 | 2 | | 2 H | |
| **Total** | | **550** | **30** | | | **30 (CH)** |

## Semester – V

| Course | Course Paper | Marks (M) | Credit (Cr) | Contact Hours (CH) | | |
| --- | --- | --- | --- | --- | --- | --- |
| | | | | Lecture (L) | Practical / Practicum (P) | Total (CH) |
| CC | CC-5 | 100 | 6 (4+2) | 4 H | 2 H | 6 CH |
| | CC-6 | 100 | 6 (4+2) | 4 H | 2 H | 6 CH |
| | CC-7 | 100 | 6 (4+2) | 4 H | 2 H | 6 CH |
| | CC-8 | 100 | 6 (4+2) | 4 H | 2 H | 6 CH |
| GE | - | - | - | - | - | - |
| | - | - | - | - | - | - |
| DSE | - | - | - | - | - | - |
| AECC | - | - | - | - | - | - |
| SEC | - | - | - | - | - | - |
| CBC | - | - | - | - | - | - |
| Education | CPS-2.1 | 100 | 4 | 4 H | | 10 CH |
| | CPS-3.1 | 100 | 4 | 4 H | | |
| | EPC-2 | 50 | 2 | | 2 H | |
| **Total** | | **650** | **34** | | | **34 (CH)** |

## Semester – VI

| Course | Course Paper | Marks (M) | Credit (Cr) | Contact Hours (CH) | | |
|---|---|---|---|---|---|---|
| | | | | Lecture (L) | Practical / Practicum (P) | Total (CH) |
| CC | CC-9 | 100 | 6 (4+2) | 4 H | 2 H | 6 CH |
| | CC-10 | 100 | 6 (4+2) | 4 H | 2 H | 6 CH |
| | CC-11 | 100 | 6 (4+2) | 4 H | 2 H | 6 CH |
| | CC-12 | 100 | 6 (4+2) | 4 H | 2 H | 6 CH |
| GE | - | - | - | - | - | - |
| | - | - | - | - | - | - |
| DSE | - | - | - | - | - | - |
| AECC | - | - | - | - | - | - |
| SEC | - | - | - | - | - | - |
| CBC | CBC-1 | 100* | 4* | 4 H | - | 4 CH |
| Education | CPS-2.2 | 100 | 4 | 4 H | | 4 CH |
| | CPS-3.2 | 100 | 4 | 4 H | | 4 CH |
| | FE-1 | 50 | 2 | | 2 W | 2 W |
| **Total** | | **750** | **34+4*** | | | **32+4* (CH) + 2 W** |

## Semester – VII

| Course | Course Paper | Marks (M) | Credit (Cr) | Contact Hours (CH) | | |
|---|---|---|---|---|---|---|
| | | | | Lecture (L) | Practical / Practicum (P) | Total (CH) |
| CC | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| GE | - | - | - | - | - | - |
| | - | - | - | - | - | - |
| DSE | - | - | - | - | - | - |
| AECC | - | - | - | - | - | - |
| SEC | - | - | - | - | - | - |
| CBC | - | - | - | - | - | - |
| Education | PE-7 | 100 | 4 | 4 H | | 4 CH |
| | EPC-3 | 50 | 2 | - | 2 W | 2 W |
| | EPC-4 | 50 | 2 | - | 2 W | 2 W |
| | FE-2 | 350 | 14 | Internship (Teaching) (Field Engagement) **14 W** | | 14 W |
| **Total** | | **550** | **22** | | | **4 (CH) + 18 W** |

# Semester – VIII

| Course | Course Paper | Marks (M) | Credit (Cr) | Contact Hours (CH) | | |
| --- | --- | --- | --- | --- | --- | --- |
| | | | | Lecture (L) | Practical / Practicum (P) | Total (CH) |
| CC | CC-13 | 100 | 6 (4+2) | 4 H | 2 H | 6 CH |
| | CC-14 | 100 | 6 (4+2) | 4 H | 2 H | 6 CH |
| GE | - | - | - | - | - | - |
| DSE | DSE-2 | 100 | 4 | 4 CH | - | 4 CH |
| AECC | - | - | - | - | - | - |
| SEC | - | - | - | - | - | - |
| CBC | - | - | - | - | - | - |
| Education | PE-8 | 100 | 4 | 4 H | | 4 CH |
| | EPC-5 | 50 | 2 | | 2 W | 2 W |
| | EPC-6 | 50 | 2 | 2 H | | 2 CH |
| | EPC-7 | 50 | 2 | 2 H | | 2 CH |
| | FE-3 | 50 | 2 | | 2 W | 2 W |
| **Total** | | **600** | **28** | | | **24 (CH) + 4 W** |

# Syllabus of Subjects
# (Semester wise)

# Semester-I

(B.Sc. B.Ed.)
Semester Structure & Title of Papers

| Sl. No. | Course Paper | Subject | Paper Name | Marks | Page No. |
|---|---|---|---|---|---|
| 1 | **CC-1**<br>(Need to select any one subject) | Physics | Mathematical Physics-1 | 100 | 29 |
| | | Chemistry | Inorganic and Organic Chemistry | | 33 |
| | | Botany | Plant Kingdom Part-1 (Microbes and Non-flowering Plants) | | 36 |
| | | Zoology | Animal Diversity (Non-Chordata) | | 39 |
| | | Mathematics | Elementary Algebra & Calculus | | 41 |
| 2 | **GE-1.1**<br>(Need to select anyone except selected CC subject) | Physics | Same as CC-1 Physics Paper | 100 | 29 |
| | | Chemistry | Same as CC-1 Chemistry Paper | | 33 |
| | | Botany | Same as CC-1 Botany Paper | | 36 |
| | | Zoology | Same as CC-1 Zoology Paper | | 39 |
| | | Mathematics | Same as CC-1 Mathematics Paper | | 41 |
| 3 | **GE-2.1**<br>(Need to select anyone except selected CC & GE-1 subjects) | Physics | Same as CC-1 Physics Paper | 100 | 29 |
| | | Chemistry | Same as CC-1 Chemistry Paper | | 33 |
| | | Botany | Same as CC-1 Botany Paper | | 36 |
| | | Zoology | Same as CC-1 Zoology Paper | | 39 |
| | | Mathematics | Same as CC-1 Mathematics Paper | | 41 |
| 4 | **AECC-1** | Compulsory | Communicative English-1 | 100 | 45 |
| 5 | **PE-1** | Education | Basics in Education | 100 | 46 |
| | **EPC-1** | | Understanding ICT and its Application | 50 | 49 |
| **Total** | | | | **550** | |

## PHYSICS
## SCHEME OF EXAMINATION
### Semester I:

**GE/CC 1.1: Mathematical Physics-I**

Contact Hours per Week : 4
Credit : 4
Examination Duration : 3 Hours
Maximum Marks : 70 (Terminal-50, Sessional-20)

### Unit 1: Functions of Several Variables:

Calculus of functions of more than one variable: Partial derivatives, exact and inexact differentials. Differentiation of composite functions. Implicit functions. Taylor series expansion of function of more than one variable. Maxima and minima. Applications to error. Constrained Maximization using Lagrange Multipliers.

### Unit 2: Vector Calculus:

Recapitulation of vectors: Properties of vectors under rotations. Scalar product and its invariance under rotations. Vector product, Scalar triple product and their interpretation in terms of area and volume respectively. Scalar and Vector fields.

Vector Differentiation: Directional derivatives and normal derivative. Gradient of a scalar field and its geometrical interpretation. Divergence and curl of a vector field. Vector identities.

Vector Integration: Ordinary Integrals of Vectors. Multiple integrals, Jacobian. Notion of infinitesimal line, surface and volume elements. Line, surface and volume integrals of Vector fields. Flux of a vector field. Gauss' divergence theorem, Green's and Stokes's Theorems and their applications. Irrotational field.

**Orthogonal Curvilinear Coordinates:** Orthogonal Curvilinear Coordinates. Derivation of Gradient, Divergence, Curl and Laplacian in Cartesian, Spherical and Cylindrical Coordinate Systems.

### Unit 3: Matrices and Vector spaces:

Linear vector spaces, basis for a space, basis transformation, linear transformations, dual space, representations of transformations by matrices, Norm and inner products. Special types of square matrix, Eigenvalues and eigenvectors, Change of basis and similarity transformation, Diagonalization of matrices.

### Unit 4: Ordinary Differential Equations:

First-Order homogeneous and nonhomogeneous equations with variable coefficients, Superposition principle, Second-Order homogeneous and nonhomogeneous equations with constant and variable coefficients, Second-Order homogeneous equations with variable coefficients.

**Reference Books:**

1. Mathematical Methods for Physicists, G.B. Arfken, H.J. Weber, F.E. Harris, 2013, 7th Edn., Elsevier.
2. Differential Equations, George F. Simmons, 2007, McGraw Hill.
3. Mathematical methods for Scientists and Engineers, D.A. Mc Quarrie, 2003, Viva Book
4. Advanced Engineering Mathematics, Erwin Kreyszig, 2008, Wiley India.
5. Essential Mathematical Methods, K.F.Riley & M.P.Hobson, 2011, Cambridge Univ. Pres.

**GE/CC 1.2: Practical**

Contact Hours Per Week   : 2
Examination Duration     : 3 Hours
Maximum Marks          : 30 ( Expt-20, Viva-5, Record-5)

**Computer Programing & Numerical Analysis**

1. **Introduction and Overview**: Computer architecture and organization, memory and Input/output devices.
2. **Basics of scientific computing**: Binary and decimal arithmetic, Floating point numbers, algorithms, Sequence, Selection and Repetition, single and double precision arithmetic, underflow & overflow- emphasize the importance of making equations in terms of dimensionless variables, Iterative methods.
3. **Errors and error Analysis**: Truncation and round off errors, Absolute and relative errors, Floating point computations.
4. **Review of C/C++ Programing fundamentals**: Introduction to Programming, constants, variables and data types, operators and Expressions, I/O statements, scanf and printf, c in and c out, Manipulators for data formatting, Control statements (decision making and Review of C & C++ looping statements) (*If statement. If else Statement.* fundamentals Programming *Nested if Structure. Else if Statement. Ternary Operator. Goto Statement. Switch Statement. Unconditional and Conditional Looping. While Loop. Do-While Loop. FOR Loop. Break and Continue Statements. Nested Loops*), Arrays (*1D & 2D*) and strings, user defined functions,

   Structures and Unions, Idea of classes and objects.
5. **Programs**: Sum & average of a list of numbers, largest of a given list of numbers and its location in the list, sorting of numbers in ascending descending order, Binary search.

6. **Random number generation**: Area of circle, area of square, volume of sphere, value of pi ($\pi$).
7. **Solution of Algebraic and Transcendental equations by Bisection, Newton Raphson and Secant methods**: Solution of linear and quadratic equation, solving equations $\alpha = \tan(\alpha); I = I_0 \left(\frac{\sin\alpha}{\alpha}\right)^2$ in optics.
8. **Interpolation by Newton Gregory Forward and Backward difference formula, Error estimation of linear interpolation**: Forward Evaluation of trigonometric functions e.g. $\sin\theta$, $\cos\theta$, and $\tan\theta$, *etc.*
9. **Numerical differentiation (Forward and Backward difference formula) and Integration (Trapezoidal and Simpson rules), Monte Carlo method**: Given Position with equidistant time data to calculate Backward difference formula) and velocity and acceleration and vice versa. Find the area of Integration (Trapezoidal and Simpson B-H Hysteresis loop.

10. **Solution of Ordinary Differential Equations (ODE) First order Differential equation Euler, modified Euler and Runge-Kutta (RK) second and fourth order methods:** First order differential equation:

(i) Radioactive decay

(ii) Current in RC, LC circuits with DC source

(iii) Newton's law of cooling

11. **Solution of the following problems using RK 4 order method:**

a) Solve the coupled differential equations

$$\frac{dx}{dt} = y + x - \frac{x^3}{3}; \frac{dy}{dx} = -x$$

for four initial conditions: x(0) = 0, y(0) = -1, -2, -3, -4. Plot x vs y for each of the four initial conditions on the same screen for $0 \leq t \leq 15$.

b). The differential equation describing the motion of a pendulum is $\frac{d^2\vartheta}{dt^2} = -\sin(\vartheta)$. The pendulum is released from rest at an angular displacement $\alpha$, i.e. $v(0) = \alpha$ and $v'(0) = 0$. Solve the equation for $\alpha = 0.1$, 0.5 and 1.0 and plot $\vartheta$ as a function of time in the range $0 \leq t \leq 8\pi$. Also plot the analytic solution valid for small $\vartheta$.

## Referred Books:

1. Introduction to Numerical Analysis, S.S. Sastry, 5th Edn., 2012, PHI Learning Pvt. Ltd.

2. Schaum's Outline of Programming with C++. J. Hubbard, 2000, McGraw-Hill Pub.

3. Numerical Recipes in C: The Art of Scientific Computing, W.H. Pressetal, 3rd Edn., 2007, Cambridge University Press.

4. A first course in Numerical Methods, U.M. Ascher & C. Greif, 2012, PHI Learning.

5. Elementary Numerical Analysis, K.E. Atkinson, 3rd Edn., 2007, Wiley India Edition.

6. Numerical Methods for Scientists & Engineers, R.W. Hamming, 1973, Courier Dover Pub.

7. An Introduction to Computational Physics, T.Pang, 2nd Edn., 2006,Cambridge Univ. Press

8. Computational Physics, Darren Walker, 1st Edn., 2015, Scientific International Pvt. Ltd.

# CHEMISTRY

## Semester- I

### GE/CC 1.1: Inorganic and Organic Chemistry

Contact Hours per Week : 4
Credit : 4
Examination Duration : 3 Hours
Maximum Marks : 70 (Terminal-50, Sessional-20)

### Unit 1: (a) Atomic Structure & Periodicity

Recapitulation of Bohr's Theory, Sommefeld's model, wave nature of matter, de Broglie's equation, Heisenberg's uncertainity principle, probability and shapes of orbitals, Schrodinger's wave equation. Significance of $\Psi$ and $\Psi^2$. Quantum numbers, probability distribution curves. Shapes of s, p, d, f orbitals, Hund's rule of maximum multiplicity rule, Calculation of exchange energy, Pauli's exclusion principle, Aufbau principle, electronic configuration of atoms. **(b)** Periodicity of Elements: s, p, d, f block elements, the long form of periodic table. Detailed discussion of the following properties of the elements, with reference to s & p-block. (a) Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table. (b) Atomic radii (van der Waals) (c) Ionic and crystal radii. (d) Covalent radii (octahedral and tetrahedral) (e) Ionization enthalpy, Successive ionization enthalpies and factors affecting ionization energy. Applications of ionization enthalpy. (f) Electron gain enthalpy, trends of electron gain enthalpy. (g) Electronegativity, Pauling's/ Mulliken's/ Alfred-Rachow's electronegativity scales. Variation of electronegativity with bond order, partial charge, hybridization, group electronegativity. Secondary periodicity, Relativistic effect, lnert pair effect.

### Unit 2: Chemical bonding-I and Molecular shape

General characteristics of ionic bonding. Energy considerations in ionic bonding: lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds. Statement of Born-Landé equation for calculation of lattice energy, Born-Haber cycle and its applications, polarizing power and polarizability. Fajan's rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character. Defects in solid (elementary idea).

Covalent bonding: VB Approach: Shapes of some inorganic molecules and ions on the basis of VSEPR theory and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements.

Concept of resonance and resonating structures in various inorganic and organic compounds. Equivalent and non-equivalent hybrid orbitals, Bent's rule.

MO Approach: Rules for the LCAO method, bonding and antibonding MOs and their characteristics for s-s, s-p and p-p combinations of atomic orbitals, nonbonding combination of orbitals, MO treatment of homonuclear diatomic molecules of 1st and 2nd periods (excluding the idea of s-p mixing). Comparison of VB and MO approaches.

## Unit 3: a) Introduction to organic chemistry and Basics of organic reactions

(i)Classification, IUPAC nomenclature of organic compounds. (ii) Electronic Displacements: Inductive, electromeric, resonance and mesomeric effects, hyperconjugation and their applications; Dipole moment; Organic acids and bases; their relative strength.

Homolytic and Heterolytic fission with suitable examples. Curly arrow rules, formal charges; Electrophiles and Nucleophiles; Nucleophlicity and basicity; Types, shape and their relative stability of Carbocations, Carbanions, Free radicals and Carbenes. Influence of hybridization on bond properties: bond dissociation energies; bond distances, bond angles, concept of bond angle strain (Baeyer's strain theory).

### b) Aliphatic Hydrocarbons

Orbital representation of methane, ethane, ethyne.

**Alkanes:** (Upto 5 Carbons). Methods Preparation: Wurtz reaction, Kolbe's synthesis, Corey-Hourse synthesis, from Grignard reagent. Reactions: Free radical Substitution: Halogenation.

**Alkenes:** (Upto 5 Carbons) Preparation: Elimination reactions: Dehydration of alcohols and dehydrohalogenation of alkyl halides (Saytzeff's rule); cis alkenes (Partial catalytic hydrogenation) and trans alkenes (Birch reduction). Reactions: cis-addition (alk. $KMnO_4$) and trans-addition (bromine), Addition of HX (Markownikoff's and anti-Markownikoff's addition), Hydration, Ozonolysis, oxymecuration-demercuration, Hydroboration-oxidation.

**Alkynes:** (Upto 5 Carbons) Preparation: Acetylene from $CaC_2$ and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalides.

**Reactions:** formation of metal acetylides, addition of bromine and alkaline $KMnO_4$, ozonolysis and oxidation with hot alk. $KMnO_4$. Hydration to form carbonyl compounds, alkylation of terminal alkynes.

## Unit 4: Stereoisomerism

Concept of Isomerism, Types of isomerism.

a)**Geometrical Isomerism**- determination of configuration of geometric isomers, cis-trans, sequence rules and E & Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds.

b)**Optical isomerism**-elements of symmetry, molecular chirality, writing the Fischer projection and flying wedge formulae.Illustration of inter-conversion of one type of structural representation into another type of formulae.Enantiomers,dia-stereomers, stereogenic centre, optical activity, properties of enantiomers, optical purity, chiral and achiral molecules with two stereogenic centres,threo and erythro designation, meso compounds. Resolution of enantiomers by salt forming method, inversion, retention and racemization.

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

c)**Conformational isomerism**-conformational analysis of ethane and n-butane:conformations of cyclohexane, axial and equatorial bonds. Fisher projection, Newman Projection and Sawhorse projection and their inter translations. Difference between configuration and conformation.

**GE/CC 1.2: Practical**

Contact Hours Per Week    :    2
Examination Duration    :    3 Hours
Maximum Marks    :    30 ( Expt-20, Viva-5, Record-5)

1.Inorganic Chemistry: Qualitative analysis of known and unknown (acid and basic radicals) inorganic salts. Dry tests and wet tests (not mixture of salts).

# BOTANY

## Semester-I

### GE/CC1.1: Plant Kingdom Part I (Microbes and non flowering plants)

Contact Hour per Week: 4
Credits: 4
Examination duration: 3 Hours
Maximum marks :70 (Terminal- 50, Sessional- 20)

### Unit 1: Microbes

Introduction to microbial world, nutrition, growth and metabolism. Discovery, physiochemical and biological characteristics; classification (Baltimore), general structure with special reference to viroids and prions; replication (general account), DNA virus (T-phage), lytic and lysogenic cycle; RNA virus (TMV);Bacteria, general characteristics, types- Archaebacteria, Eubacteria, wall-less forms (mycoplasma and spheroplasts), cell structure, nutritional types, reproduction-vegetative, asexual and recombination(conjugation, transformation and transduction).

### Unit 2: Cyanobacteria and Algae:

Origin of Cyanobacteria and Algae; Habit and Habitat; Thallus organization; Algal cell structure: variation in cell wall and plastids; Life cycle patterns; Economic Importance and Scope of Algal biotechnology(Food,feed ,bioactive compounds); Classification up to phylum level(Lee 2008) and Basis of algal classification; Salient features of Cyanobacteria (Ultrastructure of cell ;Structure and Function of Heterocyst), Rhodophyta, Chlorophyta , Heterokontophyta (Bacillariophyceae :cell structure, Auxospore formation; Phaeophyceae – Plant body ,anatomical features)

### Unit 3 :

- **Fungi :**General characterises; Status of Slime molds, Classification (Ainsworth), Occurrence; Types of plasmodia; Types of fruiting bodies; Ascomycota and Basidiomycota: General characteristics (asexual and sexual fruiting bodies); Ecology; Life cycle, Heterokaryosis and Parasexuality; life cycle and classification with reference to *Aspergillus* and *Peziza*.

- **Applied Mycology :**
- Role of fungi in biotechnology, Application of fungi in food industry (Flavour & texture, Fermentation, Baking, Organic acids, Enzymes, Mycoproteins); Mycotoxins; Biological control (Mycofungicides, Mycoherbicides, Mycoinsecticides, Myconematicides).

### Unit 4:

- **Bryophytes:** General characteristics, adaptations to land habit, Classification, Range of thallus organization, morphology, anatomy and reproduction of *Marchantia, Anthoceros* and *Funaria*. (Developmental details not to be included).

- **Pteridophytes:** General characteristics, classification, Early land plants (*Rhynia*). Classification (up to 11family), morphology, anatomy and reproduction of *Selaginella, Equisetum* and *Marselia*, Heterospory and seed habit, stelar evolution.

## GE/CC1.2: Practical

Contact Hour Per Week: 2
Examination duration: 3 Hours
Maximum marks: 30 (Exp. 20, Viva-5, Record-5)

1. Electron micrographs/Models of viruses – T-Phage and TMV, Line drawings/ Photographs of Lytic and Lysogenic Cycle.

2. Types of Bacteria to be observed from temporary/permanent slides/photographs. Electron micrographs of bacteria, binary fission, endospore, conjugation, root Nodule.

3. Gram staining.

4. Endospore staining with malachite green using the (endospores taken from soil bacteria).

5. Algae: Vegetative and reproductive structures of the following taxa through temporary preparations and permanent slides: *Oscillatoria, Oedogonium, Vaucheria , Polysiphonia.*

6. Fungi: Vegetative and reproductive structures of the following taxa through temporary preparataion and permanent slides: *Rhizopus.Penicillium ,Ascoboloous.*

7. Morphology (vegetative and reproductive structures) and anatomy of the following taxa through temporary preparations and permanent slides: Bryophytes:*Riccia, Marchantia, Anthoceros* and *Funaria.*

8. Pteridophytes: Morphology (vegetative and reproductive structures) and anatomy of the following taxa through temporary preparations and permanent slides:*Lycopodium Selaginella, Equisetum* and *Marsilea.*

### Reference Books :

1. Pelczar, M.J. 2001. Microbiology, 5th edition, Tata McGraw-Hill Co, New Delhi.
2. Kumar, H. D. 1999. Introductory phycology, affiliated East-West press Pvt.Ltd delhi 2nd edition.
3. Phycology(4th Edition) –Robert Edward Lee, Cambridge University Press,2008
4. Gangulee, H.C. and Kar, A.K. College Botany Vol.II, New Central Book Agency,
5. Calcutta
6. Parihar, N.S. 1965. An Introduction to Bryophyta Central Book Depot, Allhabad.
7. Smith, G.M. 1938. Crytogamic Botany Vol.II. Bryophytes and Pteridophytes. Mc Graw Hill Book Company, London.
8. Sporne, K.R.1967. The Morphology of Bryophytes. Hutchinson University Library, London.
9. Vasishta, B.R. Bryophyta., S. Chand and Co. New Delhi.

10. Alexopolous, J. and Charles, W. M. 1988. Introduction to Mycology. Wiley Eastern, New Delhi.
11. Pandey, B. P. 2001. College Botany, Vol. I: Algae, Fungi, Lichens, Bacteria, Viruses, Plant, S. Chand & Company Ltd, New Delhi.
12. Pandey, B. P. 2006. College Botany, Vol. II: Pteridophyta, Gymnosperms and Paleobotany.
13. Sharma, O. P. 1992. Textbook of Thallophyta. McGraw Hill Publihing Co., New Delhi.

14. Thakur, A. K. and Bassi, S. K. 2008. A Textbook of Botany: Diversity of Microbes and Cryptogams. S. Chand & Company Ltd, New Delhi.
15. Vashishta, P. C., Sinha, A. K. and Kumar, A. 2006. Botany - Pteridophyta (Vascular Cryptogams). S. Chand & Company Ltd, New Delhi.
16. Introduction to Fungi –John Webster and RWS Weber
17. Introductory Mycology – Alexopoulos C.J., C.W.Mims and M.Blackwell

# ZOOLOGY

## Semester I

### GE/CC1.1: Animal Diversity (Non-Chordata)

Contact Hour per Week: 4

Credits: 4

Examination duration : 3 Hours

· Maximum marks : 70 (Terminal - 50, Sessional - 20)

### Unit1:
#### Systematics and Classification
- Study of systematics and classification, Taxonomic hierarchy.
- Principles and types of classification (Phenetics and Cladistics).
- Classification of Animal kingdom: General characteristics, classification of different non-chordates [Protozoa (up to phyla); Porifera, Cnidaria, Ctenophora, Annelida, Helminthes, Mollusca, Arthropoda and Echinodermata up to classes with examples].

### Unit 2:
#### Protozoa to Helminthes
- Locomotion, nutrition and reproduction (conjugation) in Protozoa [Type Study *Paramecium sp.*].
- Origin of Metazoa
- Canal system and skeletal/spicules in Porifera.
- Polymorphism in Siphonophora.
- Coral and coral reefs – significance and conservation.
- Parasitism and parasitic adaptation in Helminthes.

### Unit 3:
#### Annelida and Arthropoda
- Metamerism, excretion and reproduction in Annelida.
- Respiration and excretion in cockroach, prawn and scorpion.
- Larval forms in Crustacea.
- Onychophora - distribution, structural organization and affinity.

### Unit 4:
#### Mollusca and Echinodermata
- Respiration and excretion in *Pila* and *Unio*.
- Torsion and detorsion in Gastropoda.
- Water vascular system in Echinodermata (*Asterias sp.*).
- Larval forms of Echinodermata.

## GE/CC1.2: Practical

Contact Hour per Week: 2
Examination duration:3 Hours
Maximum marks: 30 (Expt. 20, Viva-5, Record-5)

- Study of permanent slides: Amoeba, Paramecium, Plasmodium, Sponge spicules, Crustacean larvae (Mysis, Megalopa, Nauplius, Zoea), Larval form of Echinodermata (Bipinnaria), Molluscan larva (Glochidium).
- Study of museum specimens: Porifera, Cnidaria, Helminthes, Annelida and Arthropoda: Sycon, Obelia colony, Aurelia, Metridium, Male and female Ascaris, Fasiola hepatica, Taenia solium, Nereis, Aphrodite, Centiped, Limulus, Peripatus.
- Study of museum specimens: Mollusca and Echinodermata: Chiton, Pila, Mytillus, Nautilus, Octopus, Sepia, Loligo, Asterias, Cucumaria, Antedon, Echinus.
- Mounting and temporary slide preparation: Setae and nerve ring of earthworm; Mouth parts and salivary gland of cockroach; Appendages and exoskeleton of prawn, Osphradium and radula of Pila.
- Sessional activities.

**Reference Books:**
1. Barnes, R. D. Invertebrate Zoology (1982). 6th Edition. Holt Saunders.
2. Barnes, R. S. K., Calow, P., Olive, P. J. W., Golding, D. W. and Spicer, J. I. (2002). The Invertebrates: A New Synthesis. 3rd Edition. Blackwell Scientific.
3. Barrington, E. J. W. (1979). Invertebrate Structure and Function. 2nd Edition. ELBS and Nelson.

4. Boradale, L. A. and Potts, E. A. (1961). Invertebrates: A manual for the use of students. Asia Publishing Home.
5. Bushbaum, R. (1964). Animals without Backbones. University of Chicago Press.
6. Kotpal, R. L. Invertebrate Zoology (latest edition), Rastogi Publication, New Delhi.
7. Brusca, R. C. and Brusca, G. J. Invertebrates. 2nd Edition. Sinauer Associates.
8. Pechenik, J. Biology of the Invertebrates. 7th Edition. McGraw-Hill.

# MATHEMATICS

## GE/CC 1.1: Elementary Algebra & Calculus

Contact Hours per Week : 4
Credit : 4
Examination Duration : 3 Hours
Maximum Marks : 70 (Terminal-50, Sessional-20)

### Elementary Algebra

**Unit1:**

- Polar representation of complex numbers, $n$-th roots of unity, De Moivre'a™s theorem for rational indices and its applications. Exponential, logarithmic, trigonometric and hyperbolic functions of complex variable.

- Theory of equations : Relation between roots and coefficients, transformation of equation, Descartes rule of signs, Sturm's theorem, cubic equation (solution by Cardan's method) and biquadratic equation (solution by Ferrari's method).

- Inequality : The inequality involving $AM \geq GM \geq HM$, Cauchy-Schwartz inequality.

- Linear difference equations with constant coefficients (up to 2nd order).

**Unit2:**

Systems of linear equations, row reduction and echelon forms, vector equations, the matrix equation Ax=b, solution sets of linear systems, applications of linear systems, linear independence. Matrices of real and complex numbers : Algebra of matrices. Symmetric and skew-symmetric matrices, Hermitian and skew-Hermitian matrices, Orthogonal matrices. Elementary operations on matrices. Echelon matrix. Rank of a matrix. Determination of rank of a matrix (relevant results are to be state only).

### Calculus
**Unit3:**

Limits of functions ($\in$-$\square$approach), Left and right limit, Continuity, Sequential criterion for continuity, Algebra of continuous functions and theorems related to continuity of functions, Discontinuity, kinds of discontinuity, Uniform continuity,
Differentiability, Left and right derivative, Algebra of differentiable functions,

Higher order derivatives, Leibnitz rule and its applications to problems of the type $e^{(ax+b)} \sin x$, $e^{(ax+b)} \cos x$, $(ax + b)^n \sin x$, $(ax + b)^n \cos x$, Concavity and inflection points, asymptotes, curve tracing in Cartesian coordinates, tracing in polar coordinates of standard curves, L-Hospitals rule.

**Unit-4**

Reduction formulae, derivations and illustrations of reduction formulae of the type $\int \sin^n x\, dx$, $\int \cos^n x\ dx$, $\int \tan^n x\ dx$, $\int \sec^n x\ dx$, $\int \sin^n x \cos^n x\ dx$, Rectification length of plane curves, volume and surfaces of revolutions, Beta and Gamma functions.

## GE/ CC 1.2: PRACTICAL

Contact Hours Per Week   : 2
Examination Duration     : 3 Hours
Maximum Marks          : 30 ( Expt-20, Viva-5, Record-5)

1. Plotting the graphs of the functions $e^{(ax+b)}$, $\log(ax + b)$, $\frac{1}{ax+b}$, $\sin(ax + b)$, $\cos(ax + b)$ and to illustrate the effect of a and b on the graph.
2. Plotting the graphs of the polynomial of degree 4 and 5.
3. Sketching parametric curves (Eg. Trochoid, cycloid, hypocycloid).
4. Obtaining surface of revolution of curves.
5. Applications of L-Hospital rule in business, economics and life sciences.

## Reference Books:

1. 1.S.L. Loney, Trigonometry Part-II, Macmillan and Co., London. Chapter[II, III, IV]
2. S.K. Mapa, Higher Algebra (Classical), Sarat Book Distributors.
3. PK. Mittal & Shanti Narayan , Differential Calculus , S. Chand and Co. Chapters [5(5.1, 5.2,5.3, 5.4, 5.5), 13(13.1, 13.2), 15, 17]
4. P.K. Mittal & Shanti Narayan, Integral Calculus, S.Chand and Co. Chapters[2(2.8), 4(4.1 to 4.6), 9, 10]
5. S. Ponnusamy, Foundations of complex analysis.
6. Burnside and Panton, The Theory of Equations (Vol. I).
7. Chandrika Prasad,Theory of Algebra, (Pothisala).
8. Thomas Calculus & Analytic Geometry, Dorling Kindersley Pvt. Ltd.
9. Anton B.Davis, Calculus, Wiley Publication house.

10. Schaum's Outline of Calculus, 6th Edition.
11. Robert A. Wredge and Murray Spiegel, Advanced Calculus.

# GE-1.1 Courses

| Course Paper | Subject | Paper Name | Page No. |
|---|---|---|---|
| **GE-1.1**<br><br>(Need to select anyone except selected CC subject) | Physics | Same as CC-1 Physics Paper | 29 |
| | Chemistry | Same as CC-1 Chemistry Paper | 33 |
| | Botany | Same as CC-1 Botany Paper | 36 |
| | Zoology | Same as CC-1 Zoology Paper | 39 |
| | Mathematics | Same as CC-1 Mathematics Paper | 41 |

# GE-2.1 Courses

| Course Paper | Subject | Paper Name | Page No. |
|---|---|---|---|
| **GE-2.1**<br><br>(Need to select anyone except selected CC subject) | Physics | Same as CC-1 Physics Paper | 29 |
| | Chemistry | Same as CC-1 Chemistry Paper | 33 |
| | Botany | Same as CC-1 Botany Paper | 36 |
| | Zoology | Same as CC-1 Zoology Paper | 39 |
| | Mathematics | Same as CC-1 Mathematics Paper | 41 |

# ABILITY ENHANCEMENT COMPULSORY COURSES

## SEMESTER-I

### ABILITY ENHANCEMENT COMPULSORY COURSE (AECC-I)
### COMMUNICATIVE ENGLISH -I

Contact Hours: 4 per week
Credit. 4
Exam Duration: 3 Hours
Maximum Marks: 100
Term End Exam : 80 Marks,Sessional : 20 Marks

**Objectives:** At the end of the course the students are expected to :

* understand the Basics of communication
* distinguish between the types of communication and their applications
* observe the various uses of communication
* differentiate between verbal and non-verbal communications
* identify the barriers to communications

**Unit-I: Introduction**

1. Communication :meaning and nature
2. Types of communication

* Horizontal
* Vertical
* Interpersonal
* Grapevine

**Unit-II: Language of Communication**

1. Verbal: spoken and written
2. Non-verbal

* Proxemics
* Kinesics
* Haptics
* Chronemics
* Paralinguistics

**Unit-III: Barriers to communication**

* Semantic
* Physical
* Physiological
* Cultural
* Organizational
* Personal
* Perceptional
* Socio-psychological
* Overcoming barriers to communication

**Unit-IV:**

* Importance of Communication
* Communicative English

**Transactional Strategies:**

* Lecture, group interaction, material review and presentation, etc.

**Suggested books:**

* Communicative English: 1 and 2 – Sanghita Sen (Foundation / Cambridge UP)
* Written and spoken communication in English – Universities Press; First edition (2007)
* Chapter 1 *Applying Communication Theory for Professional Life: A Practical Introduction* by Dainton and Zelley.
* Business Communication, Orient BlackSwan. 2012
* http://tsime.uz.ac.zw/claroline/backends/download.php?url=L0ludHJvX3RvX2NvbW11bmljYXRpb25fVGhlb3J5LnBkZg%3D%3D&cidReset=true&cidReq=MBA563

**PE 1: Basics in Education**

| Semester-1 | Credits-4 |
|---|---|
| Total Marks:100 | Contact Hours: |
| (Internal: 30, External: 70) | 4 hours per week |

### Introduction

India, as a country and society has been in transition and has evolved as the melting pot for various diversities including religious, cultural, socio-economic, linguistic, geographical, regional and philosophical thoughts operating through maturing democratic system of interactions and governance. The country administered through rule of law and the constitution embodies the aspirations for our evolution as a cohesive society and a strong and leading nation in the world community. The continuing evolution of our egalitarian society and peaceful transformation of the nation needs to be understood by the student teachers. This will enable them to effectively discharge their role in the society with numerous diversities. The teachers are also required to understand the role of education as an intervention tool for desired changes in the country and also to appreciate the influence of social set-up on education in which it operates.

### Objectives:

The course will enable the student teachers to:

- Understand and analyse educational concepts, their premises and contexts that are unique to education
- Understand meaning, nature and process of education from oriental and western perspectives
- Understand (**Develop an insight**) philosophical, psychological and sociological foundations of education
- **Know** and appreciate educational thoughts of Indian and Western philosophers
- Understand education as a sub system of social system and its impact on the othersub systems of society
- **Learn about** the dimensions and indicators of national development and role of education for inclusive development ( All **objectives should not start with same verve 'Understand'**)

### Unit-I: Education: Meaning, Process and Purpose

- Education: derivational meaning, broad and narrow meanings, Oriental and western views on education.
- Factors of education: Educand, Educator, Curriculum and Environment, their interrelationships.
- Nature and process: Bipolar, tri-polar and multi-polar; Schooling and life-long process.
- Modes/Types: Formal, Informal and Non-formal.
- Purpose: individual and social; determinants of aims of education; aims of education as per the Secondary Education Commission (SEC) (1952-53), Indian Education Commission (1964-66) and NPE 1986. ( OK)

### Unit-II: Foundation of Education

- Philosophical: Relationship between philosophy and education; Aims of education, curriculum, and school organisation with reference to Idealism,

Naturalism and Pragmatism. (Sankhya and Buddhism)method of teaching,role of teacher

- Sociological: Relationship between sociology and education; Implications of sociology for aims of education, curriculum, pedagogy and school organisation.
- Psychological: Relationship between psychology and education; Implications of psychology for curriculum and pedagogy.

### Unit-III: Educational thinkers and their contributions

- Educational thoughts of Mahatma Gandhi, Rabindranath Tagore, Swami Vivekananda and Shri Aurobindo: elevance of their thoughts to education.
- Educational thoughts of Rousseau, Plato, Froebel and Dewey: their relevance to education.

### Unit-IV: Education, Society and Culture

- Social system: education as sub system of social system and their inter relationship.
- Social change:Meaning, definition, characteristics, factors and constraints;dimensions and role of education for social change; education as an instrument of social change.
- Education and Modernization: Meaning, characteristics, nature and role of education for modernization.
- Social issues in education- Globalization, modernization,multiculturalism, nationalism, universalism,secularism, education for sustainable development (Basic concepts only).
- Education and culture: Meaning and role of education for conservation, transmission and promotion of culture; Education as process of acculturation and enculturation; cultural lag.
- Social Groups: Primary, Secondary and Tertiary.

### Unit-V: Emerging Issues in Education

- Constitutional provisions for education in India and their implications for education;Inculcation of National Values as enshrined in the constitution of India.
- Education for National Development: Dimensions and indicators; role of education for National Development.
- Education for development of Human Resources: indicators of quality human resource and role of education.
- Education for inclusive development, Women Education& Dalit Education: Meaning and dimensions, characteristics, problem and prospects (social, economic, cultural, political, technological and spatial); Addressing challenges of inclusive development.

### Suggested Activities:

- List different non-formal agencies of education available in your locality and prepare report on objectives, process and relevance for school education.
- Prepare a report on reflections of philosophical, sociological and psychological foundations on school curriculum, organization, textbook, methods of teaching.
- Reflect on similarity and differences between educational ideas of Indian philosophers and Western philosophers.
- Observe society (rural and urban) and prepare report on cultural influence on educational practice.

- Critically analyse nearby locality on criteria of inclusive development and suggest strategy for it.

**Suggested Readings:**

- Agrawal, A (1995). *Dismantling the Divide Between Indigenous and Scientific Knowledge: Development and Change*, 26:413-39.
- Ant Weiler, C. (1998). *Low Knowledge and Local Knowing: An Anthropological Analysis of Contested "Cultural Products" in the Context of Development*. Anthropos, 93:46-94.
- Butchvarov, P. (1970), *The Concept of Knowledge*, Evanston, Illinois: North Western University Press.
- Chomsky, N. (1986). *Knowledge of Language*, Prager, New York.
- Datta, D.M. (1972). *Six ways of Knowing*. Calcutta University Press, Calcutta.
- Dewey, J. (1997).My Pedagogic Creed', in D.J. Flinders and S.J. Thorton(eds.) *The Curriculum Studies Reader*, Routledge: New York.
- Dewey, J. (1997) *Experience and Education*, Touchstone: New York.
- Dewey, J. (1956). *The Child and the Curriculum and School and Society*, University of Chicago Press, Chicago, Illinois: U.S.A.
- Keddie, N.(1971). *Classroom Knowledge*, in. M.F.D Young.
- Krishna Murthy, J. (1947).*On Education*, Orient Longman: New Delhi.
- Kumar, Krishna (1996). *Learning From Conflict*, Orient Longman: New Delhi.
- Peters, R.S. (1967). *The Concept of Education*, Routledge: UK.
- Margaret, K.T. (1999). *The open Classroom*, Orient Longman: New Delhi.
- NCERT (2014). *Basics in Education*: Textbook for B.Ed Course. NCERT, New Delhi.
- Prema, Clarke. (2001). *Teaching & Learning: The Culture of Pedagogy*, Sage Publication: New Delhi.
- Phenix, P.H. (1964). *Realms of Meaning*. MacGraw-Hill: New York.
- Steven, H. C. (1970). *The Philosophical Foundation of Education*, Harper & Row Publishers: New York.
- Sykes, Marjorie. (1998). *The Story of NaiTaleem*,NaiTaleemSamiti: Wardha.
- Thapan. M. (1991). *Life at School: An Ethnographic Study*. Oxford University Press, Delhi.
- Taneja, V.R (1978). Educational Thought and Practice. Sterling Publishers Pvt Limited, New Delhi.

## EPC.1: Understanding ICT and Its Application

| Semester-1 | Credits-2 |
|---|---|
| Total Marks: 50 (Internal: 15, External: 35) | Contact Hours: 2 hours per week |

### Introduction

Preparing teachers to use technology in a classroom is an important step for ICT enabled education in the country. The present course focuses on moving beyond computer literacy and ICT-aided learning, to help student-teachers interpret and adapt ICTs in line with educational aims and principles. It explores ICTs along three board strands; teaching-learning, administrative and academic support systems, and broader implications for society. The course will help student-teachers explore comprehensively through the resource reflect critically and act responsibly. It will show student-teachers how ICTs can be adapted to support decentralized structures and processes as well as build the 'digital public' to make education a participatory and emancipatory process.

### Objectives

The student teachers will be able to:-

- Understand the social, economic, security and ethical issues associated with the use of ICT
- Identify the policy concerns for ICT
- Describe a computer system
- Operate the Windows and/or Linux operating systems
- Use Word processing, Spread sheets and Presentation software
- Acquire the skill of maintaining the computer system and the skill of trouble shooting with the help of Anti-Virus and Other tools
- Operate on Internet with safety
- Elucidate the application of ICT for Teaching Learning
- Develop various skills to use computer technology for sharing the information and ideas through the Blogs and Chatting groups

### Unit I: Digital Technology and Socio-economic Context

- Concept of information and communication technology; application of ICT in education.
- Need and importance of digital Literacy; Characteristics of digital learners.
- Universal access VS Digital Divide - issues and initiatives
- Challenges of Integration of ICT in School; Aims and objectives of National Policy on Information and Communication Technology (ICT) in School Education in India; IT@ School Project.

### Unit II: MS Office and Internet

- Computer hardware and software fundamentals- Basic concepts and components.
- MS Word
- MS Power Point
- MS Excel
- Introduction to Internet, E-mail, Search Engines, Info-Savvy Skills, Digital Age Skills, safe surfing mode.
- Internet resources for different disciplines like Natural Sciences, Social Sciences, Humanities and Mathematics.
- General Introduction to E-learning, Mobile-learning, distance learning, Online learning.
- Virtual University, Wikipedia, MassiveOpen Online Courses (MOOCs), Social networking

## Unit III: Techno-Pedagogic Skills:

- Approaches to integrate ICT in teaching and learning, ICT for Pedagogical Innovations.
- Media Message Compatibility
- Contiguity of Various Message Forms
- Message Credibility & Media Fidelity
- Message Currency, Communication Speed & Control
- Sender-Message-Medium-Receiver Correspondence

**Field Work:** Visit to EDUSAT Center/ICT Studio/NIC

**Suggested activities:**

- Analysis of school textbook and identify suitable ICT for teaching learning.
- Developing ICT integrated lesson plan in any school subject.
- Surfing and collecting OER materials relating to school education.

- Developing e-portfolio and rubrics.

**Suggested Readings:**

- Benkler, Y. (2006). The wealth of networks: How social production transforms markets and freedom. Yale University Press.
- Brian K. Williams, Stacey Sawyer (2005)Using Information Technology, 6th Edition Tata Macgrow hill _ Curtin, Dennis, Sen, Kunal, Foley, Kim, Morin, Cathy(1997)
- Information Technology: The Breaking Wave, Tata Macgrow hill http://en.wikibooks.org/wiki/Computers_for_Beginners. An exhaustive source for beginners.
- Douglas Comer(2007) The Internet Book: Everything You Need to Know about Computer Networking and How the InternetWorks, Prentice Hall,
- DSERT Karnataka. (2012). Position paper on ICT mediation in education. DSERT.

# Semester-II

(B.Sc. B.Ed.)
Semester Structure & Title of Papers

| Sl. No. | Course Paper | Subject | Paper Name | Marks | Page No. |
|---|---|---|---|---|---|
| 1 | **CC-2** (Course / Paper from same subject selected as CC subject in Sem.-1) | Physics | Mechanics | 100 | 52 |
| | | Chemistry | Organic and Physical Chemistry | | 54 |
| | | Botany | Plant Kingdom Part-II (Flowering Plants) | | 57 |
| | | Zoology | Animal Diversity (Chordata) | | 59 |
| | | Mathematics | 2D & 3D Geometry and Differential Equation-I | | 61 |
| 2 | **GE-1.2** (Course / Paper from same subject selected as GE-1 in Sem.-1) | Physics | Same as CC-2 Physics Paper | 100 | 52 |
| | | Chemistry | Same as CC-2 Chemistry Paper | | 54 |
| | | Botany | Same as CC-2 Botany Paper | | 57 |
| | | Zoology | Same as CC-2 Zoology Paper | | 59 |
| | | Mathematics | Same as CC-2 Mathematics Paper | | 61 |
| 3 | **GE-2.2** (Course / Paper from same subject selected as GE-2 in Sem.-1) | Physics | Same as CC-2 Physics Paper | 100 | 52 |
| | | Chemistry | Same as CC-2 Chemistry Paper | | 54 |
| | | Botany | Same as CC-2 Botany Paper | | 57 |
| | | Zoology | Same as CC-2 Zoology Paper | | 59 |
| | | Mathematics | Same as CC-2 Mathematics Paper | | 61 |
| 4 | **SEC-1** (Paper need to select form selected CC subject) | Physics | Basic Instrumental Skill | 100 | 65 |
| | | Chemistry | Soil Chemistry | | 67 |
| | | Botany | Biofertilizers and Mushroom Cultivation | | 69 |
| | | Zoology | Aquaculture | | 71 |
| | | Mathematics | Discrete Mathematics and Graph Theory | | 73 |
| 5 | **PE-2** | Education | Childhood and Growing up | 100 | 74 |
| | **CPS-1** | | Language Across the Curriculum | 50 | 77 |
| **Total** | | | | **550** | |

## GE/CC 2.1: Mechanics

Contact Hours per Week : 4
Credit : 4
Examination Duration : 3 Hours
Maximum Marks : 70 (Terminal-50, Sessional-20)

### Unit 1: Mechanics of a single particle:

Kinematics – velocity and acceleration in plane polar coordinates, Inertial frame of reference, Newton's laws, Analytical solutions of the dynamical equation in various cases, Conservative forces and concept of potential, Linear momentum.

### Unit 2: Mechanics of a system of particles:

Centre of mass decomposition, Angular momentum and energy, Conservation principles, Two-body system, Collision problems.

### Unit 3: Rotational motion :

Torque, energy and angular momentum of rotating rigid bodies, Moment of inertia – calculation for simple symmetric bodies, Ellipsoid of inertia and inertia tensor, Principal axes, Euler's equation and its solution for symmetric rigid bodies, Non-inertial frames of reference, Coriolis and centrifugal forces, Foucault's pendulum.

### Unit 4: Elasticity and Fluid Motion:

Hooke's law. Stress-strain diagram. Elastic moduli. Relation between elastic constants. Poisson's Ratio: Expression for Poisson's ratio in terms of elastic constants. Twisting couple on a cylinder. Determination of Rigidity modulus by static torsion. Torsional pendulum. Determination of Rigidity modulus and moment of inertia . Determination of Y, $\eta$ and $\sigma$ by Searle's method. Bending of beams, Vibration of loaded cantilever. Viscosity of a liquid, Poiseuille's formula for steady flow of a viscous liquid.

### Suggested Books:

1. An introduction to Mechanics, D. Kleppner, R.J. Kolenkow, 1973, McGraw-Hill.
2. Mechanics, Berkeley Physics, vol.1, C. Kittel, W. Knight, et.al. 2007, Tata McGraw-Hill.
3. Feynman Lectures, Vol. I, R.P. Feynman, R.B.Leighton, M.Sands, 2008, Pearson Education
4. Introduction to Mathematical Physics, Charlie Harper, 2012, PHI Learning Private Ltd.
5. Advanced Engineering Mathematics, Erwin Kreyszig, 2008, Wiley India.
6. Essential Mathematical Methods, K.F.Riley&M.P.Hobson, 2011, Cambridge Univ. Press.
7. Mathematical Method for Physical Sciences - M. L. Boas, 2007, Wiley India.
8. Elements of Properties of Matter, D.S. Mathur, 2003, S. Chand and Company Ltd., New Delhi.

### GE/CC 2.2: Practical

Contact Hours Per Week   : 2
Examination Duration    : 3 Hours
Maximum Marks        : 30 ( Expt-20, Viva-5, Record-5)

**Pre-requisition:**

Dimensional analysis and significant figures, Basic statistical distributions: Normal distribution, Error analysis: random and systematic error. Percentage of errors. Regressions.

**Laboratory Experiments**

1. Torsion Experiment and determination of rigidity modulus.
2. Determination of Young's modulus of the material of a metallic bar by bending of a beam.
3. Determination of thermoelectric power using thermocouples
4. Determine Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille'smethod).
5. Determine the elastic Constants of a wire by Searle's method.
6. Determine the value of g using Bar Pendulum.

**Suggested Books:**

1. Advanced Practical Physics: Vol-I &II, B. Ghosh and K.G. Mazumdar, 2004, Sreedhar Publishers, Kolkata.
2. Advanced Course in Practical Physics, D. Chattopadhyay and P.C. Rakshit, 2015, Central, Kolkata.
3. Advanced Practical Physics for Students, B. L. Flint and H.T. Worsnop, 1971, Asia Publishing House.

### GE/CC 2.1: Organic and Physical Chemistry

| | | |
|---|---|---|
| Contact Hours per Week | : | 4 |
| Credit | : | 4 |
| Examination Duration | : | 3 Hours |
| Maximum Marks | : | 70 (Terminal-50, Sessional-20) |

### Unit 1: Aromatic hydrocarbons and reactions of benzene derivatives

**Aromatic hydrocarbon:** Structure of benzene, kekule structure, resonance structure, resonance energy calculation and molecular orbital structure.C-C bond length of benzene and stability.Aromaticity, Huckel rule, Aromatic ions, antiaromaticity and non aromaticity.Aromatic electrophilic substitution, mechanism, role of sigma and pi complexes, energy profile diagram, mechanism of nitration, halogenations, sulphonation, mercuration and Friedel craft's reaction. Substitution of mono substituted benzenes, activating and deactivating substituents, directive effects of the groups and its theory,ortho- , para-ratio, substitution of disubstituted benzene.

### Unit 2:

**a) Alkyl and Aryl Halides:** Nomenclature and classes of alkyl and aryl halides, methods of preparation and chemical reactions (substitution, elimination and miscellaneous reactions).

**b) Alcohols and Phenols:**

**Alcohols:**Classification, Monohydric alcohols-nomenclature, methods of formation by reduction of aldehydes, ketones, carboxylic acids and esters.Hydrogen bonding, acidic nature, reactions of alcohols.Dihydric alcohols-Nomenclatue, methods of formation, chemical reactions of vicinal glycols, oxidation cleavage, (lead acaetate, and periodic acid).Trihydric alcohols-nomenclature and methods of formation, chemical reactions of glycerol.

**Phenols:** Nomenclature, structure and bonding, preparation of phenols.Physical properties and acidic character. Efect of substituents on acidity, comparision of acidic strengths of alcohols and phenols. Resonance stabilization of phenoxide ion.Reactions of phenol-Electrophilic aromatic substitutuion,acylation and carboxylation.Mechanism of Claisen rearrangement, Gatterman synthesis. Hauben-Hoesch reaction.Lederer Manasse reaction, Reimer-Tiemann reaction.

### Unit3:

**Gaseous State of Matter:**

Kinetic molecular theory, derivation of kinetic gas equation, deduction of gas laws from kinetic gas equation,gas constant.Behavior of real gases, van der Wall equation of state.Qualitative discussion of Maxwell's distribution of molecular velocities and energies (derivation excluded), Molecular velocities-root mean

square, average, most probable velocities (derivations excluded).Liquefaction of gases and critical phenomena, Laws of corresponding state,collision number, collision diameter, mean free path.

## Unit4: Chemical and Ionic equilibria

Free energy change in a chemical reaction.Thermodynamic derivation of the law of chemical equilibrium. Distinction between $\Delta G$ and $\Delta Go$ , Le Chatelier's principle. Relationships between $Kp$, $Kc$ and $Kx$ for reactions involving ideal gases. Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect.Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts.Buffer solutions.Solubility and solubility product of sparingly soluble salts – applications of solubility product principle.Acid-Base indicator.

**GE/CC 2.2: Practical**

| | | |
|---|---|---|
| Contact Hours Per Week | : | 2 |
| Examination Duration | : | 3 Hours |
| Maximum Marks | : | 30 ( Expt-20, Viva-5, Record-5) |

**Inorganic Chemistry:**

Qualitative analysis of Inorganic salt mixtures (four radicals), including interfereing cations and anions and insoluble inorganic salts.

## SEC 1.1 : SOIL CHEMISTRY

| | | |
|---|---|---|
| Contact Hours per Week | : | 2 |
| Credit | : | 2 |
| Examination Duration | : | 3 Hours |
| Maximum Marks | : | 50 (Terminal-30, Sessional-20) |

**Unit 1:**

**Introduction to Soil science :** Components of Soil, Soil Profile, Soil Physical properties, Soil Texture, Textural classes, particle size analysis, soil structure, classification, soil aggregates, significance, bulk density and particle density of soils and porosity, their significance and manipulation, soil compaction, soil color, elementary knowledge of soil classification of India, retention and potentials, soil moisture constants, soil colloids, properties, types and significance, adsorption of ions, ion exchange, CEC & AEC, factors influencing ion exchange and it's significance. Soil organic matter, composition, decomposability, Humus, fractionations of organic matter, carbon cycle, C:N ratio.

**Unit 2:**

**Soil Chemistry, Soil fertility, nutrient management :** Soil as a source of plant nutrients, essential and beneficial elements, criteria of essentiality, forms of nutrients in soil, problem soils – Acid, salt affected and calcareous soils, characteristics, nutrient availabilities, reclamation – mechanical, chemical and biological methods. Fertilizers and insecticides and their effect on soil water and air, soil fertility – different approaches for soil fertility evaluation. Methods of soil testing – chemical methods, critical levels of different nutrients in soil.

# Semester II

## GE/CC2.1. Plant Kingdom Part II (Flowering Plants)

Contact Hour per Week:  4

Credits:  4

Examination duration:  3 Hours

Maximum marks :70 (Terminal- 50, Sessional- 20)

### Unit -1 . Evolution of Flowering plants

Preliminary idea, Evolution of Angiosperms: Euanthial theory,Pseudanthial theory(including herbaceous origin hypothesis),Gonophyll theory.

### Unit-2. Gymnosperms:

General characteristics, Classification (up to class), morphology, anatomy and reproduction of *Cycas* and *Pinus*. (Developmental details not to be included).

### Unit-3 Morphology of Angiosperms:

Morphological description of a flowering plant-  Root: Definition, Types Modifications  with examples; Stem: Habit – Modification: Under ground, Aerial, Subaerial with examples; Leaves: Phyllotaxy: Lamina, shapes of lamina and types. Parts of Flower: Flower as a modified shoot; Inflorescence: racemose, cymose and specialised ,palynology, concepts of Pollination and Fertilization. Fruits - Types, classification with examples; Seed structure - dicot and monocot -albuminous and exalbuminous, - types and adaptations.

### Unit-4 Concepts of Fossil Plants :

Fossilization Process, Types of Fossils, Applied Paleobotany

**GE/CC2.2: Practical**

Contact Hour Per Week: 2

Examination duration: 3 Hours

Maximum marks: 30 (Expt. 20, Viva-5, Record-5)

- Gymnosperms: Morphology (vegetative and reproductive structures) and anatomy of the following taxa through temporary preparations and permanent slides: *Cycas* and *Pinus*

- Angiosperms :Morphology of different types of Leaves, stems, inflorescence, flowers,pollens and fruitts.

- Study of different types of fossils.

REFERENCES:

1.Sporne, K. R. 1965. Morphology of Gymnosperms.Hutchinson Co., Ltd., London.
2.Vashishta, P. C., Sinha, A. K. and Kumar A. 2006. Botany for Degree Students: Gymnosperms. S. Chand & Company Ltd, New Delhi.

3) Takhtajan, A. L. 1969. Flowering Plants: Origin and Dispersal. Smithsonian Institution Press, University of Michigan.
4) Meyen, S.V.1987.Fundamentals of Paleobotany.Chapman & Hall,New York

**GE/CC 2.1: Animal Diversity (Chordata)**

| | | |
|---|---|---|
| Contact Hour per Week | : | 4 |
| Credits | : | 4 |
| Examination duration | : | 3 Hours |
| Maximum marks | : | 70 (Terminal - 50, Sessional - 20) |

### Unit 1:

**Chordate Organization and Lower Chordates**

- Body plan of Chordates.
- Invertebrate Chordate (Hemichordates) – Anatomical peculiarities and affinities of *Balanoglossus*.

  Lower Chordates – Anatomical peculiarities and affinities of Amphioxus and Ascidia; Retrogressive metamorphosis in Ascidia.

### Unit 2:

**Cyclostomata and Pisces**

- General characters and classification of Cyclostomata and Pisces up to living orders with examples.
- Anatomical peculiarities of *Petromyzon* and Amocoetes larva; Affinities and phylogenetic status of *Petromyzon*.
- Distribution, anatomical peculiarities, systematic position of Dipnoi.
- Accessory respiratory organs in bony fishes.

### Unit 3:

**Amphibia and Reptilia**

- General characters and classification of Amphibia and Reptilia up to living orders with examples (particularly, Indian species).
- Neoteny and paedogenesis in Amphibia (with reference to Axolotl larva and *Ambystoma*).
- Poisonous and non-poisonous snakes: Types and composition of venoms; Poison apparatus and biting mechanism.
- Anatomical peculiarities, affinities and phylogeny of *Sphenodon*.

### Unit 4:

**Aves and Mammalia**

- General characters and classification of Aves up to subclass and Mammalia up to orders with examples.
- Respiration in Birds.
- *Archaeopteryx* as connective link between Reptilia and Birds.
- Anatomical peculiarities and affinities of Prototheria and Metatheria.
- Echolocation in Bats.

## GE/CC 2.2: Practical

Contact Hour per Week : 2
Examination duration : 3 Hours
Maximum marks: 30 (Expt. 20, Viva-5, Record-5)

- Study of museum specimens (Invertebrate chordates and lower chordates): Balanoglossus, Amphioxus, Petromyzon, Myxine.
- Study of museum specimens (Pisces and Amphibia): Pristis, Torpedo, Ophiocephalus, Hippocampus, Exocoetus, Ichthyophis, Rachophorus, Axolotl larva, Triton;
- Mounting of placoid, ctenoid and cycloid scales of Fish.
- Study of museum specimens (Reptilia, Aves and Mammalia): Calotes, Chamaleon, Draco, Cobra, Kingfisher, Parrot, Owl, Duck, Koel, Bat, Rat.
- Osteology: Study of skull and vertebrae, limb bones and girdle bones of Columba and Cavia.
- Study of feathers; Study of photographs of avian beaks and legs.
- Sessional activities.

**Reference Books:**
1. Kardong, K. V. Vertebrates: Comparative Anatomy, Function and Evolution. 4th Edition. McGraw-Hill.
2. Kent, G. C. and Carr, R. K. Comparative Anatomy of the Vertebrates. 9th Edition. McGraw-Hill.
3. Young, J. Z. The Life of Vertebrates. 3rd Edition. Oxford University Press.
4. Grimmet, R., Inskipp, C. and Inskipp, T. Birds of Indian Subcontinent, 2nd Edition. Oxford University Press.

### GE/ CC2.1: 2D & 3D Geometry and Differential Equation-I

| | | |
|---|---|---|
| Contact Hours per Week | : | 4 |
| Credit | : | 4 |
| Examination Duration | : | 3 Hours |
| Maximum Marks | : | 70 (Terminal-50, Sessional-20) |

**Unit1:**

Rotation of axes and second degree equations, classification of conics using the discriminant, tangent and normal, polar equations of conics.

Introduction to three dimensional geometry, Cartesian plane, Co-ordinate planes and straight lines. Sphere: Plane section of a sphere, intersection of two spheres, sphere with a given diameter, Equation of a sphere through a given circle.

**Unit2 :**

Cones and Cylinders: Definition, Equation of a cone with a conic as guiding curve, the right circular cone, its definition and equation. Definition and equation of cylinder, Definition and equation of right circular cylinder. Conicoid: General equation of conicoid, shapes of some surfaces.

**Differential Equation-I**

**Unit3 :**

Basic concepts of DifferentialEquations.Existence and uniqueness of solutions.( only statement ) First order and first degree ordinary differential equations : variables separable, homogeneous, exact, non-exact, linear and reducible to linear. Applications of first order differential equations(Growth, Decay and Chemical Reactions, Heat flow, Oxygen debt, Economics). Equations of first order but of higher degree.

**Unit4 :**

Second order linear equations with constant coefficients (Homogeneous and Non Homogeneous), solution by method of undetermined coefficient and by method of variation of parameters. Equations reducibleto linear equations with constant coefficients. Euler-Cauchy differential equation, Linear differential equation with variable coefficient.

## GE/CC 2.2 : PRACTICAL

Contact Hours Per Week     :     2
Examination Duration     :     3 Hours
Maximum Marks     :     30 ( Expt-20, Viva-5, Record-5)

Activity oriented problem solving/ experiments based on the content studied in theory.

**Reference books:**

1. Shanti Narayan and P. K. Mittal, Analytical Solid geometry, S. Chand and Co.

2. M. D. Raisinghania, Ordinary and Partial Differential equation, S. Chand & Co. Ltd., Revised Edition 2014.

3. Ghosh and Chakraborty : Analytical Geometry ( U N Dhar & Co. )

4. Robert J. T. Bell : Co-ordinate Geometry of Three Dimensions.
5. Smith, Solid Analytic Geometry.
6. P K Mittal & Shanti Narayan, Differential Calculus, S.Chand and Co.
7. Calculus & Analytic Geometry by Thomas, Dorling Kindersley Pvt. Ltd..
8. Schaum's Outline of Calculus, 6th Edition.
9. Arup Mukherjee and Naba Kumar Bej, Analytical Geometry of 2 and 3 Dimensions.

# GE-1.2 Courses

| Course Paper | Subject | Paper Name | Page No. |
|---|---|---|---|
| **GE-1.2**<br><br>(Course / Paper from same subject selected as GE-1 in Sem.-1) | Physics | Same as CC-2 Physics Paper | 52 |
| | Chemistry | Same as CC-2 Chemistry Paper | 54 |
| | Botany | Same as CC-2 Botany Paper | 57 |
| | Zoology | Same as CC-2 Zoology Paper | 59 |
| | Mathematics | Same as CC-2 Mathematics Paper | 61 |

# GE-2.2 Courses

| Course Paper | Subject | Paper Name | Page No. |
|---|---|---|---|
| **GE-2.2**<br><br>(Course / Paper from same subject selected as GE-2 in Sem.-1) | Physics | Same as CC-2 Physics Paper | 52 |
| | Chemistry | Same as CC-2 Chemistry Paper | 54 |
| | Botany | Same as CC-2 Botany Paper | 57 |
| | Zoology | Same as CC-2 Zoology Paper | 59 |
| | Mathematics | Same as CC-2 Mathematics Paper | 61 |

## SEC 1.1: Basic Instrumental Skill

Contact Hours per Week : 2
Credit : 2
Examination Duration : 3 Hours
Maximum Marks : 50 (Terminal-30, Sessional-20)

**Unit- 1: Network Theorem and Basic measuring instruments:**

**Network Theorem:** Ideal Constant-voltage and Constant-current Sources. Network
Theorems: Thevenin theorem, Norton theorem, Superposition theorem, Reciprocity theorem, Maximum Power Transfer theorem.

**Basic of Measurement:** Instruments accuracy, precision, sensitivity, resolution

Range etc. Errors in measurements and loading effects.

**Multimeter:** Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance. Specifications of a multimeter and their significance.

**Electronic Voltmeter:** Advantage over conventional multimeter for voltage

Measurement with respect to input impedance and sensitivity. Principles of voltage, measurement (block diagram only). Specifications of an electronic Voltmeter/ Multimeter and their significance.

**Cathode Ray Oscilloscope:** Block diagram of basic CRO. Construction of CRT, Electron gun, electrostatic focusing and acceleration (Explanation only– no mathematical treatment), brief discussion on screen phosphor, visual persistence & chemical composition.Time base operation, synchronization.
Front panel controls. Specifications of a CRO and their significance.
Use of CRO for the measurement of voltage (dc and ac frequency, time period. Special features of dual trace, introduction to digital oscilloscope, probes.

**Unit-2: Signal Generators and Digital instruments:**

**Signal Generators and Analysis Instruments:** Block diagram, explanation and specifications of low frequency signal generators. pulse generator, and function generator. Brief idea for testing, specifications.Distortion factor meter, wave analysis.

**Digital Instruments:** Principle and working of digital meters. Comparison of analog & digital instruments.Characteristics of a digital meter.Working principles of digital voltmeter.

**Digital Multimeter:** Block diagram and working of a digital multimeter. Working principle of time interval, frequency and period measurement using universal counter/ frequency counter, time- base stability, accuracy and resolution.

## SEC 1.2 : Practicals

Contact Hours Per Week   :   2
Examination Duration   :   3 Hours
Maximum Marks   :   50 ( Expt-25, Viva-15, Record-10)

1. Use of an oscilloscope. CRO as a versatile measuring device.
2. To observe the limitations of a multimeter for measuring high frequency voltage and currents.
3. To measure Q of a coil and its dependence on frequency, using a Q- meter.
4. Measurement of voltage, frequency, time period and phase angle using CRO.
5. Measurement of time period, frequency, average period using universal counter/frequency counter.
6. Measurement of rise, fall and delay times using a CRO.
7. Measurement of distortion of a RF signal generator using distortion factor meter.
8. Measurement of R, L and C using a LCR bridge/ universal bridge.
9. To verify the Thevenin and Norton theorems.
10. To verify the Superposition, and Maximum power transfer theorems.

### Suggested Books:

1. A text book in Electrical Technology - B L Theraja - S Chand and Co.
2. Performance and Design of AC machines - M G Say ELBS Edn.
3. Digital Circuits and Systems, Venugopal, 2011, Tata McGraw Hill.
4. Digital Electronics, SubrataGhoshal, 2012, Cengage Learning.
5. Electronic Devices and Circuits, S. Salivahanan& N.S. Kumar, 3rd Ed., 2012, Tata Mc-GrawHill.

## SEC 1.1 : SOIL CHEMISTRY

Contact Hours per Week : 2
Credit : 2
Examination Duration : 3 Hours
Maximum Marks : 50 (Terminal-30, Sessional-20)

### Unit 1:

**Introduction to Soil science** : Components of Soil, Soil Profile, Soil Physical properties, Soil Texture, Textural classes, particle size analysis, soil structure, classification, soil aggregates, significance, bulk density and particle density of soils and porosity, their significance and manipulation, soil compaction, soil color, elementary knowledge of soil classification of India, retention and potentials, soil moisture constants, soil colloids, properties, types and significance, adsorption of ions, ion exchange, CEC & AEC, factors influencing ion exchange and it's significance. Soil organic matter, composition, decomposability, Humus, fractionations of organic matter, carbon cycle, C:N ratio.

### Unit 2:

**Soil Chemistry, Soil fertility, nutrient management** : Soil as a source of plant nutrients, essential and beneficial elements, criteria of essentiality, forms of nutrients in soil, problem soils – Acid, salt affected and calcareous soils, characteristics, nutrient availabilities, reclamation – mechanical, chemical and biological methods. Fertilizers and insecticides and their effect on soil water and air, soil fertility – different approaches for soil fertility evaluation. Methods of soil testing – chemical methods, critical levels of different nutrients in soil.

**SEC 1.2 : Practicals**

| | | |
|---|---|---|
| Contact Hours Per Week | : | 2 |
| Credit | : | 2 |
| Examination Duration | : | 3 Hours |
| Maximum Marks | : | 50 ( Expt-25, Viva-15, Record-10) |

1. Determination of bulk denisity and particle density, water holding capacity
2. Soil texture and mechanical analysis – Soil temperature, collection and processing of soil for analysis.
3. Estimation of available N, P, K, S and Zn in soils, organic carbon, pH, EC, Soluble cations and anions in soil water extracts.

**Reference Books :**

1. Basic Concepts of Soil Science (2$^{nd}$ Edition)- A.K. Kolay, New Age International Publisher
2. Text Book of Soil Science- Biswas T.D and Mukherjee. S.K. Tata McGrawHill Pubilshing company, New Delhi.
3. The nature and propoperties of soil – N. C. Brady & Ray R. Well.
4. Chemistry of the soils - Firman Bear.
5. Soil and soil fertility – C.M. Thomson & F.R. Troesh.
6. Soild Fertiility, Theory & Practice – J. S. Kanwar.
7. Soil fertility and fertilizers – S. L. Tisdale, W. L. Nelson, J. D. Benton & J. L. Harlin.
8. Fundamentals of soil science - Indian Society of soil science.

## SEC 1.1: Biofertilizers and Mushroom Cultivation

Contact Hours per Week: 4

Credit: 4

Examination Duration: 3 Hours

Maximum Marks: 50 (Terminal-30, Sessional-20)

### Unit 1: General account about the microbes used as biofertilizer isolation and cultivation –

*Rhizobium* ,*Azospirillum* & Phosphate solubilizing microbes ,Cyanobacteria (blue green algae) as biofertilizer, , *Azolla* and *Anabaena azollae* association, Mycorrhizal association; colonization of VAM – isolation and inoculum production of VAM, and its influence on growth and yield of crop plants; Organic farming – Green manuring and organic fertilizers, Recycling of biodegradable municipal, agricultural and Industrial wastes – biocompost making methods, types and method of vermicomposting – field Application.

### Unit 2: Basic concept of Mushroom cultivation

Practicals –i. Isolation and culturing microbes and cyanobacteria .

ii.Basics of Mushroom cultivation

### Suggested Readings:

1.Marimuthu, T., Krishnamoorthy, A.S., Sivaprakasam, K. and Jayarajan, R. 1991. Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.

2. Tewari, Kapoor P., S.C., 1988. Mushroom cultivation, Mittal Publications, Delhi.

3. Bahl N. 1984-1988. Hand book of Mushrooms, II Edition, Vol. I & Vol. II.

## SEC 1.2 : Practicals

Contact Hours Per Week   :  2
Examination Duration      :  3 Hours
Maximum Marks           :  50 ( Expt-25, Viva-15, Record-10)

1. Preparation of nursery bed and polybag filling.
2. Preparation of potting mixture – Potting and repotting.
3. Field work in cutting, grafting, budding, layering.
4. Identification and use of garden tools and implements.
5. Laying out drip irrigation, sprinklers.
6. Topiary and pruning.
7. Preparation of vermicompost.
8. Propogation of the medicinal plants through pot culture.
9. Identification and agronomic aspects of medicinal plants in the botanical garden.

## SEC 1.1: Aquaculture

Contact Hours per Week :  2
Credit                 :  2
Examination Duration   :  2 Hours
Maximum Marks: 50 (Terminal - 30, Sessional - 20)

### Unit 1:
### Aquaculture: concept and diversity

- Aquaculture: basic concept, resources and production potential in India.
- Aquaculture practice: Food fish (inland, cage culture, pen culture), Ornamental fish, Pearl, Sea weed (*Chlorella*).
- Types of nets and hapa commonly used in aquaculture.
- Design and construction of fish farm.
- Management of fish firm (physicochemical parameters; plankton and productivity of ponds; liming, fertilizers and manuring) and Marketing of fish.

### Unit 2:
### Freshwater aquaculture

- Characteristic features for common cultivable fishes (major and minor carps).
- Culture of magur (*Clarias batrachus*): seed stocking, feeding, predation control, water management.
- Grow-out culture of freshwater prawn (*Macrobrachium rosenbergii*): pond preparation, stocking of juveniles, food and feed management and harvest.


- Principles of induced breeding and seed production in Indian major carps.
- Common diseases of carps (Gill and fin rot, epizootic ulcerative syndrome, Argulosis) and remedial measures.
- Methods and formulation of fish-feed for carps.

## SEC 1.2: Aquaculture (Practical)

| | | |
|---|---|---|
| Contact Hours per Week | : | 2 |
| Examination Duration | : | 3 Hours |
| Maximum Marks | : | 50 |
| | | (Expt. 25, Viva-15, Record-10) |

- Identification of freshwater and brackish water fishes.
- Analysis of physicochemical parameters of fish ponds, estimation of nutrients (nitrite, silicon-silicate).
- Demonstration, dissection and extraction of pituitary gland for induced breeding.
- Identification and counting of planktons.
- Visit to freshwater aquaculture centres and preparation of field-report of aquaculture.
- Sessional activities.

### Reference Books:

1. Jhingran, V. G. Fish and Fisheries in India (Vols. 1 and 2). Hindustan Publishing Corporation, New Delhi.
2. Pillay, T. V. R. and Kutty, M. N. Aquaculture: Principles and Practices, 2nd Edition. Blackwell Oxford.
3. Sukla, G. S. and Upadhyaya, V. B. Economic Zoology (latest edition). Rastogi Publishers, Meerut.
4. Srivastava, K. P. Textbook of Applied Entomology (latest edition). Kalyani Publishers, Ludhiana.
5. Jaiswal, V. and Jaiswal, K. K. Economic Zoology (2014). Prentice-Hall India

## SEC 1.1: DISCRETE MATHEMATICS AND GRAPH THEORY

Contact Hours per Week  :   2
Credit                         :   2
Examination Duration    :   2 Hours
Maximum Marks           :   50 (Terminal-30, Sessional-20)

### Unit 1:

Relations and their properties, n-array relations and their applications, Boolean functions and their representation.

### Unit 2 :

Partial orderings, Hassediagramme, Maximal and minimal elements, Lattice, Distributive Lattice and Boolean algebra, Boolean functions, Application of Boolean algebra, Minimization problems - Karnaugh map and Quine – McClusky's methods.

Propositional equivalence, predicates and quantifiers, Nested quantifiers, Valid arguments, methods of proof.

### Unit 3 :

The basic counting, The Pigeon-hole principle, Generalized permutations and combinations. Recurrence relations and their solutions, Inclusion-exclusion and applications.

### Unit 4 :

Graphs- Introduction, Graph terminology, Representing graphs and Graph isomorphism, connectivity, Euler and Hamiltonian path.Digraph representations of relations.

### Reference Books :

1.  K. H. Rosen, Discrete Mathematics and its Applications( TMH).
2.   Thomas Koshy : Discrete Mathematics with Applications ( Academic Press )

## SEC 1.2 : PRACTICAL

Contact Hours Per Week    :    2
Examination Duration      :    3 Hours
Maximum Marks             :    50 (Expt-25, Viva-15, Record-10)

1. Truth table of relations, Boolean functions
2. Representation of Boolean function and n-array relations.
3. Generalized permutations and combinations with counter examples.
4. Graph and its representations.

## PE 2: Childhood and Growing Up

| Semester-II | Credits-4 |
|---|---|
| Total Marks:100 | Contact Hours: |
| (Internal: 30, External: 70) | 4 hours per week |

### Introduction

Human being develops through layers of multiple complex processes starting even before birth. All minute phases of growth and development present interesting avenues of learning. This course introduces student teachers to the study of childhood, child development and adolescence. The main focus in this course is to enable student teachers to have an understanding about childhood as constructed within socio-cultural realities existing in their lived contexts; family, schools, neighborhood and community. The student teachers will learn about concept of adolescence in realistic and contextual frames, theories of child development, childhood and adolescence as developed at different socio-economic and cultural settings and will also learn to situate. The course also highlights why it is essential for every teacher to understand human development at different phases.

### Objectives

The course will enable the student teachers to:

- Understand the concept of growth and development and stages of development with special reference to the stage of adolescence.
- Know about the developmental characteristics.
- Be aware of influence of heredity, environment including socio cultural factors on developmental process.
- Develop the skills of applying the principles of development in improving the teaching learning process.
- Know about various aspects related to development.
- Acquainted with theories, types and factors of motivation, attention and interest.
- Understand the nature of intelligence and know various theories related to it.
- Develop skills for identifying and nurturing creativity.

### Unit I: Growth and developmental pattern of the children:

- Concept of growth and development.
- General characteristics of Growth and Development.

- Stages and sequence of Growth and Development.
- Social factors that affect growth and development-poverty, lack of opportunities, deprivation, disrupted family, poor neighborhood, poor housing.

### Unit II: Stages of development:

- Different stages of development- infancy, childhood, adolescence, Adulthood.
- Adolescence- Physical development, Emotional development, Cognitive development.
- Needs and problems of adolescents, their guidance and counseling.

## Unit III: Different types of Development and their educational implications:

- Cognitive development- Piaget's theory and its educational implications.
- Psycho-sexual development – Freud's Theory.
- Psycho social development – Erikson's theory of psychosocial development.
- Moral and pro social development- Kohlberg's theory.
- Development of self-concept and personal identity.
- Communication and speech development- paralinguistic and linguistic stages of development.

## Unit-IV: Motivation, Intelligence, Attention and Interest as well as Creativity during Growth and Development:

- Motivation: Meaning and definition, nature of motivation; classification of motivation; Theories of Motivation- Maslow, Weiner and McClelland; Factors influencing motivation.
- Intelligence: Concept and nature; Definition and its distribution across population; Factor Theories of Intelligence – Guilford, Thurston and Gardner's theory of multiple intelligence; Measurement of Intelligence (Verbal and non-verbal tests of intelligence), intelligence quotient and education.
- Attention and Interest: Concept of attention, determinants of attention and their classroom implication, attention span and its fluctuation, distraction, educational implication of attention, Interest- nature, characteristics, factors, types, educational provisions, relation between attention and interest.
- Creativity: Concept and meaning of creativity, nature and characteristics, components and process; Identification and nurturance of creativity.

## Unit V: Individual Difference, Development of Personality and Various aspects related to development:

- Individual differences: Role of heredity, environment including physical and socio cultural factors, Nutrition, Child rearing practices and Family.
- Development of personality: Concept of Personality,types and traits of personality, Trait theories ( Eysenck and Cattell's 16 factor, Five factor), Measurement of personality (Self-report and projective techniques).
- Various aspects related to development: Instincts and Emotions, Emotional Intelligence, Spiritual Intelligence, Attitude and attachment, Memory and transfer of learning.

## Suggested Activities:

1. Observe the various age group children (Early childhood, Later childhood, Adolescent) in various situations like in the classroom, playground, at home, with parents, friends, siblings and list down the characteristics of them in physical, social, emotional and intellectual domain.

2. List down different maladjusted behaviours of adolescents which you could identify from the classroom and out-side classroom. Take interview of a few and try to understand the factors that may be responsible for their behaviour.

3. Visit a school (Practice Teaching) and find out the different measures/activities taken by school or teachers for healthy mental health of the children by interviewing school teachers.

4. Development of Question Box activities (can be carried out by student trainees during practice teaching).

   (a)To provide authentic information on physical, physiological and psychological changes and development during adolescence and interpersonal relationship issues pertaining to adolescents.

   (b)To list down the instances of peer pressure which may have harmful consequences for the students and the ways adopted by them to face or cope with these unfavourable situations. (Smoking, injecting drug etc.)

5. Find out the plug-in points from your school subjects and link it with the components of Adolescence Education. Also plan out supplementary co-curricular activities for the same.

6. Observe some successful individuals and list down the behavioural characteristics which impress you.

7. Take interview of five low achievers and five high achievers and find out their ways of learning.

8. Observe children during their playtime in your practicing school (or nearby school) for a week; observe their play activities, relationships, communication with their peers. On the basis of that prepare a report about understanding childhood.

9. Observe and interact with ten adolescent children living in different contexts (rural areas, urban slum, Dalit household, urban area, and working/street people) and compare their lifestyle and problems.

10. View any two movies out of the following: 1. Smile Pinky (2008), 2. Born into Brothels (2014), 3. Salaam Bombay (1988), 4. Slumdog Millionaire (2009), 5. Gippie (2013) and 6.Mehek (2007).Discuss their content, picturization, characters and messages in the context of issues and concerns of childhood/adolescence.

11. Collect five folk tale/stories/indigenous games from children told by elders from nearby community. Discuss them in your class.

12. Compile a status of Adolescence population and academic profile for the last 5(five) years and make a presentation in a seminar mode (focus area can be chosen from any specific component such as: disability, girl student, tribal, Muslim girls etc).

**Suggested Readings:**
- Bhatia, H. R. (1973). Elements of Educational Psychology, 5th edition, Orient Longman.
- Bigge, M. L. (1982). Learning Theories for Teachers, (4th edition). New York, Harper and Row Publishers, P.P. 89-90.
- Chauhan S. S. (2004). Advanced educational psychology. New Delhi :Vikas Publishing House.
- Cole, M and Cole, S (1989). *The Development of Children*, Scientific American Books, New York.
- Huslok, E.B. (2003). *Child Growth and Development*, Tata McGraw Hill
- Kakkar, S (1978). *The Inner World: A Psychoanalytic Study of Childhood and Society in India*. Oxford University Press, New Delhi.
- NCERT: Module on Adolescence Education
- Mishra, A (2007), Everyday Life in a Slum in Delhi. In D.K. Behera (Ed.0. *Childhood in South Asia*. New Delhi: Pearson Education India.

## CPS.1: Language across the Curriculum

| Semester-II | Credits-2 |
|---|---|
| Total Marks: 50 | Contact Hours: |
| (Internal: 15, External: 35) | 2 hours per week |

### Introduction

The role of languages across the curriculum is being increasingly recognized. We need to understand that language education is not confined to the language classroom. A science, social science or mathematics class is *ipso facto* a language class. Learning the subject means learning the terminology, understanding the concepts, and being able to discuss and write about them critically. Language is the medium for comprehending ideas, for reflection and thinking, as well as for expression and communication. Enhancing one's faculty in the language of instruction is thus a vital need of student-teachers, irrespective of the subject areas that they are going to teach. No matter what the subject, teaching cannot take place in a language-free environment. Assumptions about the language and literacy background of students influence classroom interactions, pedagogical decisions and the nature of students' learning. It is important to understand the language background of the students and know how oral and written language can be used in the classroom to ensure optimal learning of the subject area.

This course is visualized to create sensitivity to the language diversity that exists in the classrooms; understanding the language background of students, as first or second language users of the language used in teaching the subject. The focus is to help student-teachers understand the nature of classroom discourse and develop strategies for using oral language in the classroom in a manner that promotes learning in the subject area as well as to develop critical reading comprehension in the content areas, informational reading and developing writing in specific content areas with familiarity of different registers.

### Objectives

The course will enable the student teachers to:

*   Understand the language background of students.
*   Understand the nature of classroom discourse.

*   Understand the nature and need of communication skills including reading and writing

### Unit I: Concerns for Language in Curriculum

*   Language – Meaning and Concept; Functions of Language; Role of Language across curriculum.
*   Varied language contexts of the learners: dialect, regional varieties and standard language.
*   Understanding multilingualism in the classroom: challenges and strategies.
*   Home language and school language.

### Unit II: Language and Curriculum Transaction

*   Classroom Discourse: strategies for using oral language in the classroom.
*   Discussion as an approach for learning: mode (participatory, interactive, collaborative).
*   Questioning and classroom discussion: importance and relationship.

## Unit III: Developing Communication Competencies: Reading and Writing

- Reading school texts (Language, Social Science, Science, Mathematics): expository texts vs. narrative texts; transactional text vs. reflective texts.
- Reading strategies: scanning, skimming and reading for extracting information.
- Forms of Writing: note taking, note making, summarizing; writing with purpose.
- Analyzing students' reading and writing; developing reading and writing competencies.

## Suggested Activities:

- Preparation of a report on diversity of languages in a classroom and connect it with classroom discourse.
- Re-telling the text in one's own language from different points of view and narrating / describing a related account from one's life experience.
- Choose a few words from different texts of content areas and give examples how similar word / language can be used in different context to convey the meaning.
- Critical reading for attending to 'framing' of the article, point(s) of view presented, possible biases or slants (small group discussion).
- Writing articles/reports on topics related to content areas and current issues.

## Suggested Readings:

- Anderson, R.C. (1984). Role of the Reader's Schema in Comprehension, Learning and Memory. In R.C. Anderson, J. Osbon& R.J. Tierney (ed) *Learning to Read in American schools: Based Readers and content texts*. Hillsdole, Lawrance Erlbaum Associates: New Jersey.
- Applying a Vygotskian Model of Learning and Development in B. Spodek (ed.) *Handbook of research on the education of young children*. Macmillan: New York.
- Armbruster, Bonnie B. (1984) The Problem of "Inconsiderate Text" In Duffy, G. G. (ed.) *Comprehension Instruction, Perspectives and Suggestions*. Longman: New York.
- Butler, A. and J. Turnbill, (1984) *Towards Reading-Writing Classroom* Primary English Teaching Association Cornell University: New York.
- Freedman S. W. and A. H. Dyson (2003) Writing in Flood J. et. al. Handbook of Research on Teaching English Language Arts:.Lawrence Erlbaum Associates Inc: New Jersey, USA..

- Kumar Krishna (2007) *The Child's Language and the Teacher*. National Book Trust: new Delhi.
- Labov, W. (1972) The logic of Non- Standard English. In *Language in Education*. Prepared by Language and Learning course Team. Routledge: London.
- Martin, Jr. B. (1987) The Making of a Reader: A Personal Narrative. In Bernice E. Cullinan, *Children's Literature in the Reading Programme*. International Reading Association: Michigan..
- Mason, J. M. and S. Sinha (1992) Emerging Literacy in the Early Childhood Years.

- Monson, R. J. (1991) Charting a New Course with Whole Language. *Edn. Leadership.*
- Pinnell, G.S. (1985) Ways to Look at the Functions of Children's Language. In A. Jaggar, M. Trika and Smith-Burke (ed.) *Observing the language learner.* International Reading Association: Newark, DE.
- Purves, Alan C. (1988). The Aesthetic Mind of Louise Rosenblatt. *Reader 20.*
- Rhodes, L. K. and N. L. Shanklin (1993) *Windows into Literacy.* Heinemann, The University of Michigan: UK.
- Rothleen, L. and A. M. Meinbach (1991) *The Literature Connection: Using Children's Books in Classroom.* Good Year Books: Tucson, USA.
- Sinha, S. (2000) Acquiring Literacy in Schools. *Redesigning Curricula:* A symposium on working a framework for School education *Seminar.*
- Sinha, Shobha. (2009). Rosenblatt's Theory of Reading: Exploring Literature. *Contemporary Education Dialogue.*
- Teals, W. and E. Sulzby (1986) Introduction: Emergent Literacy as a perspective for Examining how young Children Become Writers and Readers. In W. Teals, E. Sulzby (ed.) *Emergent Literacy: Writing and Reading.* Norwood: New Jersey.

# Semester-III

(B.Sc. B.Ed.)
Semester Structure & Title of Papers

| Sl. No. | Course Paper | Subject | Paper Name | Marks | Page No. |
|---------|-------------|---------|-----------|-------|----------|
| 1 | **CC-3**<br>(Course / Paper from same subject selected as CC subject in Sem.-1) | Physics | Waves and Optics | 100 | 81 |
| | | Chemistry | Inorganic and physical Chemistry | | 83 |
| | | Botany | Fundamentals of Plant Physiology | | 86 |
| | | Zoology | Histology, Developmental Biology and Basic Ethology | | 88 |
| | | Mathematics | Real Analysis-I | | 90 |
| 2 | **GE-1.3**<br>(Course / Paper from same subject selected as GE-1 in Sem.-1) | Physics | Same as CC-3 Physics Paper | 100 | 81 |
| | | Chemistry | Same as CC-3 Chemistry Paper | | 83 |
| | | Botany | Same as CC-3 Botany Paper | | 86 |
| | | Zoology | Same as CC-3 Zoology Paper | | 88 |
| | | Mathematics | Same as CC-3 Mathematics Paper | | 90 |
| 3 | **GE-2.3**<br>(Course / Paper from same subject selected as GE-2 in Sem.-1) | Physics | Same as CC-3 Physics Paper | 100 | 81 |
| | | Chemistry | Same as CC-3 Chemistry Paper | | 83 |
| | | Botany | Same as CC-3 Botany Paper | | 86 |
| | | Zoology | Same as CC-3 Zoology Paper | | 88 |
| | | Mathematics | Same as CC-3 Mathematics Paper | | 90 |
| 4 | **AECC-2** | Compulsory | Environmental Studies | 100 | 94 |
| 5 | **PE-3** | Education | Learning & Teaching | 100 | 96 |
| | **PE-4** | | Schooling, Socialization & Identity | 100 | 100 |
| **Total** | | | | **600** | |

**GE/CC 3.1: Waves and Optics**

Contact Hours per Week : 4
Credit : 4
Examination Duration : 3 Hours
Maximum Marks : 70 (Terminal-50, Sessional-20)

## Unit-1: Geometrical optics:

Fermat's principle and its application to plane and curved surfaces, Matrix method in paraxial optics and its applications, Seidel and chromatic aberrations – elementary discussions.

## Unit-2: Wave Optics and Interference of Light: Electromagnetic nature of light.
Definition and Properties of wave front. Huygens Principle.

### Interference:

Interference: Division of amplitude and division of wavefront. Fresnel's Biprism. Interference in Thin Films: parallel and wedge-shaped films. Newton's Rings: measurement of wavelength and refractive index.

Michelson's Interferometer: Idea of form of fringes (no theory needed), Determination of wavelength, Wavelength difference, Refractive index and Visibility of fringes. Fabry-Perot Interferometer.

## Unit-3: Diffraction of Light:

Fresnel and Fraunhofer diffraction, Huygens-Fresnel theory, Zone plate, Different apertures, Fraunhofer diffraction due to a single slit, double slit, transmission grating, Resolving power of optical systems.

## Unit-4: Polarization of Light:

Unpolarized and partially polarized light, State of polarization, Polarization by reflection and scattering, Brewster's angle.Polaroid and Malus' law.Optical anisotropy, Wave equation in anisotropic media, birefringence, o- and e-rays, double refraction, Polarizing beamsplitters and waveplates.

## Suggested Books:

1. Waves: Berkeley Physics Course, vol. 3, Francis Crawford, 2007, Tata McGraw-Hill.
2. Fundamentals of Optics, F.A. Jenkins and H.E. White, 1981, McGraw-Hill
3. Principles of Optics, Max Born and Emil Wolf, 7th Edn., 1999, Pergamon Press.
4. Optics, AjoyGhatak, 2008, Tata McGraw Hill
5. The Physics of Vibrations and Waves, H. J. Pain, 2013, John Wiley and Sons.
6. The Physics of Waves and Oscillations, N.K. Bajaj, 1998, Tata McGraw Hill.
7. Optics – Brijlal&Subramaniam- (S. Chand Publication) 2014.
8. Geometrical and Physical Optics –R.S. Longhurst, Orient Blackswan, 01-Jan-1986
9. Vibrations and Waves -- A. P. French, (CBS) Indian print 2003
10. Optics, E. Hecht (Pearson India).

## GE/CC 3.2: Practical

Contact Hours Per Week : 2
Examination Duration : 3 Hours
Maximum Marks : 30 ( Expt-20, Viva-5, Record-5)

1. To determine refractive index of the Material of a prism using sodium source.
2. To determine the dispersive power and Cauchy constants of the material of a prism using mercury source.
3. To determine the wavelength of sodium source using Michelson's interferometer.

4. To determine wavelength of sodium light using Fresnel Biprism.
5. To determine wavelength of sodium light using Newton's Rings.
6. To determine the thickness of a thin paper by measuring the width of the interference fringes produced by a wedge-shaped Film.
7. To determine wavelength of (1) Na source and (2) spectral lines of Hg source using plane diffraction grating.
8. To determine dispersive power and resolving power of a plane diffraction grating.

### Suggested Books:

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
2. A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11th Ed., 2011, Kitab Mahal.
3. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
4. A Complete Course in Degree Practical Physics, B. B. Swain, Kalyani Publishers (2016)
5. A Laboratory Manual of Physics for undergraduate classes, D.P.Khandelwal, 1985, Vani
6. Advanced Practical Physics: Vol-I &II, B. Ghosh and K.G. Mazumdar, 2004, Sreedhar Publishers, Kolkata.
7. Advanced Course in Practical Physics, D. Chattopadhyay and P.C. Rakshit, 2015, Central, Kolkata.
8. Advanced Practical Physics for Students, B. L. Flint and H.T. Worsnop, 1971, Asia Publishing House.

## Semester III

**GE/CC3.1: Inorganic and Physical Chemistry**

| | | |
|---|---|---|
| Contact Hours per Week | : | 4 |
| Credit | : | 4 |
| Examination Duration | : | 3 Hours |
| Maximum Marks | : | 70 (Terminal-50, Sessional-20) |

**Unit 1:**

a) **General principles of Metallurgy**: Chief modes of occurrence of metals based on standard electrode potentials. Ellingham diagrams for reduction of metal oxides using carbon as reducing agent. Hydrometallurgy, Methods of purification of metals (Al, Pb, Ti, Fe, Cu, Ni, Zn): electrolytic, oxidative refining, Kroll process, Parting process, van Arkel-de Boer process and Mond's process.

b) **Chemistry of s- and p-Block Elements**

Allotropy in C, S, and P, and catenation. Oxidation states with reference to elements in unusual and rare oxidation states (like carbides and nitrides), and their relative stability inert pair effect, diagonal relationship and anomalous behaviour of first member of each group.

**Unit 2:**

**Chemistry of Transition metals-I**

General group trends with special reference to electronic configuration, colour, variable valency, magnetic and catalytic properties, ability to form complexes.

Stability of various oxidation states and e.m.f. (Latimer & Frost-Ebsworth diagrams).Difference between the first, second and third transition series.

**Unit 3:**

**First law of Thermodynamics**

Definition of thermodynamic terms: system, surrounding 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 Thermodynamic: Statement, definition of internal energy and enthalpy.Heat capacity, heat capacity at constant volume and pressure and their relationship. Calculation of w, q, dU &dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process.

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

**Unit 4:**

**a) Colligative properties**

Dilute solutions; lowering of vapour pressure, Raoult's and Henry's Laws and their applications. Excess thermodynamic functions. Thermodynamic derivation using chemical potential to derive relations between the four colligative properties [(i) relative lowering of vapour pressure, (ii) elevation of boiling point, (iii) Depression of freezing point, (iv) osmotic pressure] and amount of solute. Applications in calculating molar masses of normal, dissociated and associated solutes in solution.

**b) Conductance-I**

Arrhenius theory of electrolytic dissociation. Conductivity, equivalent and molar conductivity aɪ weak electrolytes, (ii) ionic product of water (iii) solubility and solubility product of sparingly soluble salts, (iv) conductometric titrations, and (v) hydrolysis constants of salts.

**GE/CC 3.2: Practical**

Conctact Hours Per Week   :   2
Examination Duration   :   3 Hours
Maximum Marks   :   30 ( Expt-20, Viva-5, Record-5)

. **Objectives**

On completion of course, students will be able to

- Calibrate fractional weights, pipettes,
- Prepare standard solution
- To estimate various metal in their sample solutions

**Inorganic Chemistry:**

i) Preparation of solution in ppm by dilution

ii) Preparation of standard solution of solid and liquid compounds and dilution of 0.1 M to 0.001 M

iii) Determination of alkali content of antacid tablets using HCl

iv) Estimation of calcium content in chalk as calcium oxalate by permanganometry

iv) Estimation of hardness of water by EDTA/$Mg^{2+}$ estimation by EDTA

v) Estimation of ferrous and ferric by dichromate method

GE/CC 3.1 :   Fundamentals of Plant Physiology

        Contact Hour per Week  :   4
        Credits  :   4
        Examination duration  :   3 Hours
        Maximum marks  :   70 (Terminal- 50, Sessional- 20)

**Unit 1:**
**Plant-water relations:**

Importance of water, water potential and its components; Transpiration and its significance; Factors affecting transpiration; Root pressure and guttation. **Mineral nutrition:** Essential elements, macro and micronutrients; Role of essential elements; Transport of ions across cell membrane, active and passive transport, carriers, channels and pumps, mineral deficiency symptoms, chelating agents.Translocation in phloem: Composition of phloem sap, girdling experiment; Pressure flow model; Phloem loading and unloading.

**Unit 2:**
**Photosynthesis:**

Photosynthetic Pigments (Chl a, b, xanthophylls, carotene); Photosystem I and II, reaction center, antenna molecules; Electron transport and mechanism of ATP synthesis; C3, C4 and CAM pathways of carbon fixation; Photorespiration.

**Unit 3:**
**Respiration:**

Respiration : EMP pathway, regulation and its anabolic role , Conversion of Pyruvic acid to Acetyl CoA, TCA-cycle and its amphibolic role ,Oxidative pentose phosphate pathway and its significance, ß-oxidation of fatty acids and significance, Mitochondrial electron transport system, uncouplers, Oxidation of cytosolic NADH+H+ Stoichiometry of glucose oxidation (aerobic).

**Unit 4:**
**Enzymes:** Structure of enzyme: holoenzyme, apoenzyme, cofactors,coenzymes and prosthetic group; Classification of enzymes; Features of active site, substrate specificity, mechanism of action (activation energy,lock and key hypothesis, induced - fit theory), Michaelis–Menten equation,enzyme inhibition and factors affecting enzyme activity.

**Practical**

    i.    Chemical separation of photosynthetic pigments.
    ii.   Determination of osmotic potential of plant cell sap by plasmolytic method.

iii. Determination of water [potential of given tissue (potato tuber)by weight method.

iv. To study the effect of light intensity on the rate of photosynthesis.

v. Effect of carbon dioxide on the rate of photosynthesis.

vi. To compare the rate of respiration in different parts of a plant.

**Reference Books :**

1. Taiz, L., Zeiger, E., Muller, I.M. and Murphy, A. 2015. Plant Physiology and Development.SinauerAssociates Inc. USA. 6th edition.
2. Bajracharya, D. 1999. Experiments in Plant Physiology-A Laboratory Manual. Narosa PublishingHouse, New Delhi.
3. Harborne, J.B. 1973. Phytochemical Methods. John Wiley & Sons. New York.

### GE/CC 3.1: Histology, Developmental Biology and Basic Ethology

| | | |
|---|---|---|
| Contact Hour per Week | : | 4 |
| Credits | : | 4 |
| Examination duration | : | 3 Hours |
| Maximum marks | : | 70 (Terminal - 50, Sessional - 20) |

#### Unit 1:
**Histology**

- Tissues: types, structure and functions of connective, nervous and muscular tissues; specialized tissue components: goblet cells, pancreatic acinar cells, mast cells, Sertoli cells, Kupffer cells.
- Cell adhesion molecules: characteristics, types, functions.
- Histology of organs: liver, kidney, pituitary, thyroid, pancreas, testis and ovary.

#### Unit 2:
**Developmental Biology (1)**

- Gametes: ultra-structure of sperm, spermatogenesis and its regulation; oogenesis with reference to vitellogenesis; structure and types of eggs and egg-membranes; regulation of oogenesis.
  - Fertilization: types, mechanism and significance; polyspermy and its prevention; metabolic activation of egg.
  - Cleavage: salient features, types, patterns and planes of cleavage; role of yolk in cleavage; cleavage in frog and chick.

#### Unit 3:
**Developmental Biology (2)**

- Blastulation: mechanism in frog and chick; morphogenetic movements.
- Gastrulation: comparative account in frog and chick.
- Fate map: techniques with reference to frog.
- Development of extra embryonic membranes in chick.
- Placenta in mammals: structure, types and functions.

#### Unit 4:
**Ethology**

- Innate and learning behaviour, orientation, reflexes, foraging and territoriality.
- Altruism and group living: cost and benefit.
- Fixed action pattern (FAP).
- Social behaviour in honey bee and bee dances.

## GE/CC 3.2: Practical

Contact Hour per Week : 2
Examination duration : 3 Hours
Maximum marks: 30 (Expt. 20, Viva-5, Record-5)

- Preparation and study of permanent histological slides: T. S. of mammalian lung, kidney, liver, pancreas, thyroid, intestine, testis and ovary.
- Mounting and staining of human buccal epithelial cells.
- Study of development of chick embryo (24, 48, 72 and 96 hours of incubation).
- Study of life-cycle stages of honey bee.
- Sessional activities.

**Reference Books:**

1. Ross, M. H. Histology: A Text and Atlas, with Correlated Cell and Molecular Biology, 7th Edition. Sadler.
2. Fawcett, D. W. Bloom & Fawcett Textbook of Histology (1998). Taylor and Francis.
3. Balinsky, B. I. An Introduction to Embryology. 5th Edition. Cengage Learning.
4. Patten, B. M. and Carlson, B. M. (1981). Tata MaGraw-Hill.
5. Gilbert, S. F. Developmental Biology (2016). Sinauer.
6. Wolpert, L., Tickle, C. and Arias, A. M. Principles of Development. 5th Edition. Oxford University Press.

**GE/CC3.1: Real Analysis-I**

Contact Hours per Week : 4
Credit : 4
Examination Duration : 3 Hours
Maximum Marks : 70 (Terminal-50, Sessional-20)

**Real Analysis-I**

**Unit1 :**

Algebra of Real numbers, Order, Upper and Lower bounds, Least upper bound (LUB) and Greatest lower bound (GLB), Order-completeness, Density, Decimal representations of real numbers, Cardinality of sets, Countability, Higher order cardinals and cardinality of power sets.

**Unit2 :**

Analytical properties of R, Open sets, Closed sets, Limit points(Accumulation points), Closure, interior and boundary of sets, Compactness, Bolzano-Weierstrass theorem, Cantor's theorem, Heine-Borel theorem.

**Unit3 :**

Sequences, Convergence of sequences, Subsequences and Bolzano-Weierstrass theorem for sequences, monotonic sequence, Weierstrass completeness principle, Cauchy's general principle of convergence, Limit superior and Limit inferior. Limits of some important sequences, e.g. $\{n^{1/n}\}$, $\{x^{1/n}\}$, etc.

**Unit4 :**

Infinite series: Convergence series, Series of positive terms, Tests for convergence of series (comparison test, condensation test, Cauchy's root test, D'Alembert's ratio test), Absolute convergence, Rearrangement of terms of a series, Conditionally convergent series, Power series.

## GE/CC 3.2 : PRACTICAL

| | |
|---|---|
| Contact Hours Per Week | : | 2 |
| Examination Duration | : | 3 Hours |
| Maximum Marks | : | 30 ( Expt-20, Viva-5, Record-5) |

1. Computations of upper bounds and lower bounds, LUB, GLB of sets.
2. Computing the value of $\pi$, e.
3. Read Fibonacci series, binomial series.
4. Computing limit superior, limit inferior of a given sequence.

### Reference Books :

1. G. Das and S. Pattanayak, Fundamentals of Mathematical Analysis, TMH Publishing Co.
2. R.G. Bartle and D. R. Sherbert, Introduction to Real Analysis, 3rd Ed., John Wiley and Sons(Asia) Pvt. Ltd., Singapore, 2002.
3. Gerald G. Bilodeau , Paul R. Thie, G.E. Keough, An Introduction to Analysis, 2nd Ed., Jones &Bartlett, 2010.
4. Brian S. Thomson, Andrew. M. Bruckner and Judith B. Bruckner, Elementary Real Analysis,Prentice Hall, 2001.
5. S.L. Gupta and Nisha Rani-Real Analysis, Vikas Publishing House Pvt. Ltd., New Delhi.
6. S.C. Mallik and S. Arora-Mathematical Analysis, New Age International Publications.
7. T. Apostol : Mathematical Analysis (Narosa )
8. A. N. Kolmogorov and S. V. Fomin, Introduction to Real Analysis.
9. W. Rudin : Principles of Mathematical Analysis ( Tata – McGraw Hill )

# GE-1.3 Courses

| Course Paper | Subject | Paper Name | Page No. |
|---|---|---|---|
| **GE-1.3**<br><br>(Course / Paper from same subject selected as GE-1 in Sem.-1) | Physics | Same as CC-3 Physics Paper | 81 |
| | Chemistry | Same as CC-3 Chemistry Paper | 83 |
| | Botany | Same as CC-3 Botany Paper | 86 |
| | Zoology | Same as CC-3 Zoology Paper | 88 |
| | Mathematics | Same as CC-3 Mathematics Paper | 90 |

# GE-2.3 Courses

| Course Paper | Subject | Paper Name | Page No. |
|---|---|---|---|
| **GE-2.3**<br><br>(Course / Paper from same subject selected as GE-2 in Sem.-1) | Physics | Same as CC-3 Physics Paper | 81 |
| | Chemistry | Same as CC-3 Chemistry Paper | 83 |
| | Botany | Same as CC-3 Botany Paper | 86 |
| | Zoology | Same as CC-3 Zoology Paper | 88 |
| | Mathematics | Same as CC-3 Mathematics Paper | 90 |

Contact Hour per Week: 4 per weeks
Credits: 4
Examination duration: 3 Hours
Maximum marks: 100 (Terminal- 80, Sessional- 20)

## Objectives
On completion of this course, the student-teachers shall be able to

- Understand environment as an integral part of what they are learning and doing
- Develop sensitivity to and appreciation of the tremendous diversity in the natural and human world, as adding richness to every aspects of life and learning
- Understand the structure and functions of different ecosystems and the principle of cycling associated with it.
- Conserve natural resources and use it judicially.
- Follow eco-friendly practices and work for environmental sustainability
- Understand environmental laws and associated legislations.
- Participate in environmental protection and its improvement
- Attend the skills for solving environmental problems.
- Acquire the social values including strong feelings of concern for the environment and motivating for actively participating in its protection and improvement.

### Unit 1: Environment and Environmental Education:
Environment and its importance (Atmosphere, Hydrosphere, Lithosphere and Biosphere).

Environmental Education; Definition, Multidisciplinary nature, Environmental education with special reference to Indian view of Life.

Basic Environmental Concept, Ecology and Environmental Crises:

Ecosystem and its structure species and community, Major ecosystems, Energy flow in ecosystem, Food chain, Food web, Ecological pyramid). Biogeochemical Cycles, Factors affecting Environment.

Environmental Crisis: Pollution, Soil erosion, Green house effect (Global warming), Acid rain, Extinction of Species. Energy crises.

### Unit 2 : Biodiversity and Natural Resources, Environmental Movements, Laws and Acts in India
Concept of Biodiversity (Types, Importance, Threats and Conservation of Biodiversity).

Natural Resources; Classification and Management of Natural Resources, Conservation of Forest and Wild life, Urbanization and its effect on Society; Communicable diseases; Transmission; Non-communicable diseases. Natural Disasters and Management, Sustainable Development.
Environmental movements in India, Role of women in Environmental movements,

Environmental movements in Odisha. Environmental Laws and Acts ( Central Pollution Control Board, State Pollution Control Board, Green Tribunal, Wild life Protection Act 1972, Water Act 1974, Air Act 1981, Forest Conservation Act 1980, Environmental Protection Act 1986, Biodiversity Act 2002).

## Unit 3:Curriculum, Methods and Technologies of Teaching Environment studies

Designing and Developing Strategies of Environmental Education curriculum.Evaluation for Environment Education Resource Materials

- Study Tours and Field Visits
- Role Play
- Poster Presentation
- Quiz
- Debate and Discussions
- Enquiry based method
- Project Method

## Unit 4:Promotion of Environmental Education and Value Development

- Role of Mass Media and Technology in Developing awareness about Environment and its protection.
- Role of NGOs and Government organizations in Developing Environmental Education, Ecoclubs, Museum of Natural History.
- Specially designed strategies for cleanings; "Swachh Bharat Abhiyan"
- Role of Education, Education for Sustainable Development
- Climate Change and Green Lifestyle
- Text book evaluation for context on Environmental issues
- Visit to Nature Park, Environmentally Sensitive Areas

References

- Purohit, S.S. and Ranjan, R. (2007) Ecology, Environment and Pollution. Agrobios Publication.
- Sharma, P.D. (2014) Ecology and Environment. 12th edition. Rastogi Publication.
- Hussain, M. (2014) Environment and Ecology. 3rd edition. Access Publication.
- Odum, E. (2004) Fundamentals of Ecology. 5th edition. Ceneage Learning India Pvt. Ltd.
- Kormondy, E.J. (1995) Concepts of Ecology. 4th edition. Prentice Hall Publication.
- Satapathy, M.K. (2007) Education, Environment and Sustainable Development, Shipra Publications, New Delhi.

- Smith, T.M. and Smith, R.L. (2015) Elements of Ecology 9th edition. Pearson.
- Dash, D. and Satapathy, M.K. (2013) People Who Make A Change: Men and Women in Environmental Movement. Kunal Publication, New Delhi.
- Dash, M. and Dash, S. (2009). Fundamentals of Ecology 3rd edition. McGraw Hill Education

## PE 3: Learning and Teaching

| Semester-III | Credits-4 |
|---|---|
| Total Marks:100 | Contact Hours: |
| (Internal: 30, External: 70) | 4 hours per week |

### Introduction

This course brings together the perspectives from many other courses and draws upon theoretical understanding from psychology, philosophy, sociology and language learning. It provides an opportunity to student teachers to reflect on and critically analyze notions of learning and teaching on the basis of their own experiences and to move beyond them. Student teachers will understand various theories of learning. They will engage theoretically and through observation with the notion of learning as construction of knowledge. The student teachers will also critically analyze and discuss complex nature of teaching. They will analyze teaching as a profession and will reflect on how to teach effectively in a diverse classroom.

### Objectives

The course will enable the student teachers to:

- Develop an understanding about the differential learning needs of the learners with regard to abilities, learning styles, socio-cultural differences, language, and learning difficulties.

- Differentiate learning as transmission and reception Vs. learning as construction.
- Understand different theoretical perspectives of learning including the constructivist perspective.
- Understand nature and strategy of meaningful and concept learning, role of multiple intelligence in it.
- Develop understanding about teaching as profession.

### Unit I: Understanding Learning and Memory

- Learning: Meaning and nature;learning as process and outcome.
- Understanding learning styles of students at elementary and secondary levels; its implications for teachers.
- Different viewpoints on learning perspective: Behaviourist (Skinner), Cognitivist (Piaget), Humanist (Roger) and Constructivist (Piaget and Vygotsky) and their classroom implications
- Factors affecting learning: individual differences, conditions of learning and methods.
- Types of learning: factual, associations, conceptual, procedural, generalizations; Principles and rules, Gagne's hierarchy of Learning.
- Memory: Meaning, Types; Sensory, factors, LTM, STM. Causes of forgetting working and long term, strategy for developing memory.
- Remembering and Forgetting: Factors of remembering - encoding, storage and retrieval. Information processing approach-; Causes of forgetting; Strategies for effective memorization.

## Unit II: Learning Paradigms:

- Different viewpoints on learning perspective: Paradigms of Learning Theories: Behaviourism, Cognitivism, Constructivism and Humanism and their classroom implications.
- Behavioristic Learning– Concept of connectionism (Thorndike) and conditioning (Pavlov & Skinner) and their educational implications.
- Cognitive Learning – Concept of Gestalt and its educational implications, Discovery learning (Bruner).
- Social Cognitive Learning – Concept (Bandura), nature and implications. Teacher as role model.
- Cognitive Constructivist Learning (Piaget), Social Constructivist Learning– Concept of Vygotsky, nature and implications.
- Humanistic Viewpoint of Learning- Carl Rogers (Self Concept Theory)

## Unit III: Learning in 'Constructivist' Perspective

- Learning as 'construction of knowledge' and learning as 'transmission and reception of knowledge'-differences.
- Understanding processes facilitating 'construction of knowledge': Experiential learning and Reflection, Social mediation, Cognitive negotiation, Situated learning and Cognitive apprenticeship, Meta-cognition.
- Facilitative learning environment: teachers' attitude and expectation- enhancing motivation, positive emotion, self-efficacy, collaborative and self-regulated learning.

## Unit IV: Meaningful and Concept Learning

- Meaningful learning: Nature and characteristics, Views of Ausubel, Facilitating meaningful learning in and outside school- strategies and role of teacher; Implications for meaningful learning.

- Learning as meaning-making: concept, process, learner as meaning maker, characteristics of the learner, role of inquiry in meaning making.
- Concept Learning: Meaning, and Characteristics, prototypes and exemplars, strategies for teaching concepts-concept map.
- Transfer of Learning:Concept, Importance, Nature and Types; Theories of Transfer of Learning; Methods of enhancing Transfer of Learning.
- Role of teacher in addressing various factors influencing learning; a few strategies – cooperative learning, peer tutoring, collaborative learning.

## Unit-V: Understanding Teaching and Learning

- Teaching: Meaning,nature, characteristics and function; 'Teaching as Instructing' Vs. 'Teaching as facilitating learning';teaching as empowering learners; Role of teacher in effective teaching.
- Teaching: Concepts, definition, nature, function and characteristics.
- Relation between Teaching, Training and Instruction.
- Maxims of teaching. Role of teacher in effective teaching.
- Phases of teaching- pre-active, interactive and post-active; Levels of teaching-memory, understanding and reflective; Mode of teaching- Face to face, distance, and digital; individualized and group based modular approach.
- Micro Teaching, Simulated Teaching & Team Teaching
- Bruner's model of teaching for meaningful learning-process and implications for classroom instructions.

## Unit-VI: Teaching as a Profession

- Teaching as a profession-importance and characteristics.
- Characteristics of effective and good teachers: content knowledge, pedagogical knowledge and technological knowledge, professional attitude, reflective practice.
- Teacher preparation- Need and modes at different levels; Continuing Professional development of teachers- concept, process and strategies; Teacher's professional ethics and accountability.
- Continuing Professional development of teachers: concept, process and strategies.
- Teacher's professional ethics and accountability-meaning, importance and dimensions; recommendations of NPE 1986/92, RTE Act 2009; strategies for ensuring teacher accountability.

### Suggested Activities:

- Go to nearby schools (at least four different schools). Observe teaching learning process in some classrooms for few days. Make records and prepare a presentation highlighting various kinds of learning and teaching which you observed there.
- Observe a class in your practising school for few days and prepare a note highlighting how teachers addressed the learning needs of different learners. Give examples with respect to gender, inclusion, culture and language.
- Prepare concept maps on pedagogy subject, teach in school and write a reflective note on how it helps learner.
- Read few diaries written by teachers, analyse their text in the context of teaching activities.
- Interact with your peers and few teachers. Discuss whether teaching is a profession and prepare a report on the basis of their perception.
- Interact with few teachers in a nearby school and discuss with them the relevance of training they received with respect to the classroom teaching.

### Suggested Readings:

- Bhutt, H. *The dairy of a school teacher*: An AzimPremji University publications, www.arvindguptatoys.com/arvindgupta/diary - school teacher-eng.pdf.
- Burden, Paul R; Byrd, David. M. (1999). *Methods for Effective Teaching* (Sec Edition), Allyn and Bacon.
- Carr, D (2005), *Making sense of education: An introduction to the philosophy and theory of education and teaching*, Routledge.
- Delpit, L (2006). *Other people's children, cultural conflict in the classroom*. The New press.
- Dhar,T.N. (Ed). 1996.*Professional status of Teachers*, NCTE, New Delhi.
- Kauchak, D. P and Eggen, P. D (1998). *Learning and Teaching,: Research based methods*, Boston: Allyn and Bocan
- Ladsen – Billings, G (1995). Toward a theory of culturally relevant pedagogy. *American Educational Research Journal*, 32 (3), 465-491.
- Lampert, M. (2001). *Teaching problems and the problems of teaching*. Yale University press.
- Mohalik, R. (2010). *In-service Teacher Education*. Mahamaya Publishing House, New Delhi.

- NCERT (2005). *National Curriculum Framework*, New Delhi
- Olson, D.R. & Bruner, J.S. (1996). "Folk Psychology and Folk Pedagogy". In D.R. Olson & N. Torrance (Eds.). *The Handbook of Education and Human Development* (PP.9-27).Blackwell.
- Piaget, J. (1997). "Development and Learning", In M. Gauvain& M. Cole (Eds.), *Reading on the Development of Children*. New York: WH Freeman & Company.
- Rogeff, B; Baker-Sennatt, T., Lacasa, P. and Goldsmith, D. (1995). Development through participation in socio-cultural activity, *New Directions for child and adolescent development*, 1995 (67), 45-65.
- Sethy, R. (2014). *Style and Strategy of In-service Teacher Education*. LAP Publication, Germany.
- Shulman,L.S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher*, 4-14.
- Vygotsky, L. (1997). "Interaction between Learning and Development", In M. Gauvain& M. Cole (Eds.) *Reading on the Development of Children*, New York: WH Freeman & Company.
- Woolfolk, A. (2008). Educational Psychology. Pearson Education.

## PE.4: Schooling, Socialization and Identity

| Semester-III | Credits-4 |
|---|---|
| Total Marks:100 (Internal: 30, External: 70) | Contact Hours: 4 hours per week |

### Introduction:

Schools, apart from transmitting curricular knowledge and skills, serve as crucial sites for processes of socialization and transmission of value frameworks that are more often than not, unexamined. Schooling may thus be seen as a key ingredient in the socialization of the young. This socialization ultimately contributes to and results in the formation of identity. However, children who attend school have, already, been socialized into certain value frame by the time they enter school. The value-frame, sense of self, and identity imbibed by the child at home and in the wider society, interacts in complex ways with school and its socialization processes, more often than not being in conflict. This is furthermore also true of adult learners who join teacher education. Therefore, this course, precisely, intends to analyze and critique the way self and its identities are constructed through socialization process within as well as outside the school. In the process of analyzing the self and identity critically, the course deliberately brings in the social categories such as, caste, class, gender, religion, as well as other factors that are at work in constructing the self and identity of individuals and collectives. Gender is a social construct that impacts attitudes, roles, responsibilities and behaviour patterns of an individual in societies. Gender relations vary from society to society. Gender determines power relations in multicultural societies like India. It deals with human concerns encompassing diversities and differences. It has been the most visible form of discrimination operating across cultures in developing societies.

Further, the course intends to provide opportunities to contest the value frame emanating from these processes of socialization. An understanding of the multiple processes that form the self and identity ought to result in a capacity to reflect on one's own self and identity, putting this under critical scrutiny. In becoming conscious of the many factors that influence identity and self, the student-teachers should become more sensitively aware of these and begin to 'free' themselves from limiting conceptions of self and identity, thus becoming proactive in shaping their own identities as 'teachers' and 'professionals'.

### Objectives

The course will enable the student teachers to:

- Reflect critically on factors that shape identity formation and influence sense of self of the growing 'student' as well as 'teacher' in school as well as in out of school situations.
- Understand the processes that have shaped/continue to shape one's own sense of identity as 'student' and a 'person' located in multiple social contexts and roles.
- Develop basic understanding and familiarity with key concepts-gender, gender bias, gender stereotype, empowerment, gender parity, equity and equality, patriarchy and feminism and transgender.

- Understand the need to address gender based violence in all social spaces and evolve strategies for addressing it.
- Critically aware of 'self' and 'identity' and 'free' oneself through self-understanding, from tendencies that lead to crystallizing and limiting of one's identity as a teacher and a human being.
- Reflect on one's aspirations and possibilities in order to develop a growing sense of agency as a 'teacher', a 'professional', as well as a 'human being'.

### Unit I: Socialization and Development of Self
- Socialisation: Meaning, nature and process.
- Role of social institutions: Family- impact of parenting style/child rearing practices, family culture and values; Community-neighbourhood, extended family, religious groups and their socialization functions; School- School as a social institution, value formation in the context of schooling.
- Interface between family, community and school; inter-linkages within wider socio-cultural context.
- Development of self: Meaning of self; dimensions and impact of socialization.

### Unit II: Emergence of 'Person' and 'Identity'
- Understanding 'identity formation': emergence of multiple identities in the formation of a person placed in various social and institutional contexts; the need for inner coherence; managing conflicting 'identities'.

- Determinants of identity formation in individuals and groups: Social categories such as caste, class, gender and religion.
- The influence of peer group, media, technology, and globalization on identity formation in contemporary society.

### Unit III: Socialization Processes: Gender, School and Society
- Concept of gender including LGBTIQ, Difference between gender and sex.
- Gender Bias, Gender Stereotyping and Empowerment of women.
- Equity and Equality in Relation with Caste, Class, Religion, Ethnicity, Disability and Region.
- Gender Identities and Socialization Practices in different types of families in India.
- Role of Teacher in eliminating Gender bias in school.

### Unit IV: Coping with Social Complexities
- Expanding human activities and relations; increasing complexity, homogenization of culture vs. preservation of distinctive identities; competition, uncertainty and insecurities and the resultant identity conflicts.
- Assertion of identities, oppression, conflict and violence – relevance of education for peace.
- Addressing sexual abuse in Family, Neighbourhood and School and in other formal and informal institutions.
- Agencies Perpetuating Violence: Family, School, Workplace and Media (Print and Electronic).

## Unit V: Evolving Identity as a Teacher

- Teacher's professional identity; Meaning and various dimensions.
- Choosing to be a teacher: Role of family, communityand schooling.
- Teacher identity formation: Role of pre-service and in-service teacher education programmes.
- The impact of one's own socialization processes; awareness of one's own shifting identities as 'student', 'adult' and 'student-teacher', and influences that have acted/continue to act on oneself.
- Reflections on one's own aspirations and efforts in becoming a 'teacher'.

## Suggested Activities:

- Group work and discussion on the influence of peer group, media message, technology, and globalization on identity formation in contemporary society.
- Group work and discussion on the factors that contribute positively and negatively in the  development of teacher identity.
- Organize Debates on Equity and Equality cutting across Gender, Class, Caste, Religion, Ethnicity Disability and Region.
- Prepare a project on Issues and Concerns of Transgender.
- Collection of Folklores reflecting Socialization Processes and its Influence on Identity formation.
- Project on Women Role Models in various fields with Emphasis on Women in Unconventional Roles.
- Visit to organizations connected with peace and inter cultural harmony and aesthetic appreciation to experience peace as reality and submission of report.
- Developing action plan for peace in self, home, school and community.

## Suggested Readings:

- AmalenduMisra, (2004). Identity and Religion Foundations of Anti-Islamism in India. Sage Publications, New Delhi.
- Butler, J. (1990). *Gender Trouble: Feminism and the subversion of Identity.* New York; Routledge.
- Chap. 6: Parents and Teachers.
- Desai, Neera and Thakkar, Usha. (2001). Women in Indian Society. National Book Trust, New Delhi.
- Dipankar Gupta (Ed.) (2004). Caste in question Identity or Hierarchy. Sage Publications, New Delhi.
- Dunne, M. et al. (2003). Gender and Violence in Schools. UNESCO.
- Kamala Ganesh &UshaThakkar (Ed.) (2005). Culture and Making of Identity in India, Sage Publications, New Delhi.
- Kirk Jackie e.d. , (2008), Women Teaching in South Asia, SAGE, New Delhi
- Krishnamurti, J., Education and the Significance of Life, KFI Publications
- Kumar Krishna (2004), What is Worth Teaching? 3$^{rd}$ edition, Orient Longman
- Kumar, K.(2001) *Prejudice and Pride: School Histories of the Freedom Struggle.* New Delhi: Viking/Penguin.
- Leach, Fiona. (2003). Practising Gender Analysis in Education, Oxfam
- National Curriculum Framework 2005: Position Paper, National Focus Group on Gender Issues in Education, 3.2, NCERT, 2006.

- Nayar, Sushila and MankekarKamla (ed.) 2007, 'Women Pioneers in India's Renaissance, National Book Trust, New Delhi, India.
- NCERT (2014). SchollingSocialisation and Identity. NCERT, New Delhi.
- Pathak, Avijit (2002), Social Implications of Schooling, Rainbow Publishers, Delhi
- Saraswati, T.S. (Ed.) (1999). Culture, Socialization and Human Development. Theory: Research and Applications in India, Sage Publication, New Delhi.
- SenAmartya (2006). Identity and Violence. The Illusion of Destiny. Allen and Lane: Penguin Books India Pvt. Ltd. New Delhi.
- Sharma, R &E. Annamalai. (2003). *Indian Diaspora: In Search of Identity.* Mysore: CIIL.
- ShashiTharoor (2007). The Elephant, the Tiger &the Cell phone. (Particularly part two of the book).Penguin Viking, New Delhi.
- Sherwani, Azim. (1998). the girl child in crisis. Indian Social Institute, New Delhi.
- Srinivas M.N., (1986). Social Changes in Modern India, Allied Publishers, Bombay.
- SrivastavaGouri, (2012), Gender and Peace in Textbooks and Schooling Processes, Concept Publishing Company Pvt. Ltd, New Delhi
- UNICEF (2005). 2005 and Beyond – Accelerating Girls' Education in South Asia. Meeting Report.
- Unterhalter, Elaine. (2007). Gender, Schooling and Global Social Justice, Routledge.
- Vidyanathan, T.G. (1989), 'Authority and Identity in India', in 'Another India' Daedalus, Fall, 118 (H): 147-69.

# Semester-IV

## (B.Sc. B.Ed.)
## Semester Structure & Title of Papers

| Sl. No. | Course Paper | Subject | Paper Name | Marks | Page No. |
|---------|--------------|---------|------------|-------|----------|
| 1 | **CC-4** (Course / Paper from same subject selected as CC subject in Sem.-1) | Physics | Electricity and Magnetism | 100 | 105 |
| | | Chemistry | Organic and Physical Chemistry | | 107 |
| | | Botany | Plant Anatomy, Classification and Nomenclature | | 109 |
| | | Zoology | Human Physiology and Comparative Anatomy | | 110 |
| | | Mathematics | Real Analysis-II | | 112 |
| 2 | **GE-1.4** (Course / Paper from same subject selected as GE-1 in Sem.-1) | Physics | Same as CC-4 Physics Paper | 100 | 105 |
| | | Chemistry | Same as CC-4 Chemistry Paper | | 107 |
| | | Botany | Same as CC-4 Botany Paper | | 109 |
| | | Zoology | Same as CC-4 Zoology Paper | | 110 |
| | | Mathematics | Same as CC-4 Mathematics Paper | | 112 |
| 3 | **GE-2.4** (Course / Paper from same subject selected as GE-2 in Sem.-1) | Physics | Same as CC-4 Physics Paper | 100 | 105 |
| | | Chemistry | Same as CC-4 Chemistry Paper | | 107 |
| | | Botany | Same as CC-4 Botany Paper | | 109 |
| | | Zoology | Same as CC-4 Zoology Paper | | 110 |
| | | Mathematics | Same as CC-4 Mathematics Paper | | 112 |
| 4 | DSE-1 (From same subject selected as CC subject in Sem.-1) | Physics | Computation Physics Or Nano Materials and Applications | 75+25 =100 | 116 |
| | | Chemistry | Green Chemistry or Polymer Chemistry | | 120 |
| | | Botany | Home Gardening and Herbal Technology Or Economic Botany and Biotechnology | | 128 |
| | | Zoology | Economic and Applied Zoology Or Animal Behavior | | 132 |
| | | Mathematics | Number Theory Or Mathematical Modelling | | 136 |
| 5 | **PE-5** | Education | Assessment for Learning | 100 | 139 |
| | **PE-6** | | Creating an Inclusive Classroom | 50 | 142 |
| **Total** | | | | **550** | |

## Semester IV:

### GE/CC 4.1: Electricity and Magnetism

Contact Hours per Week : 4
Credit : 4
Examination Duration : 3 Hours
Maximum Marks : 70 (Terminal-50, Sessional-20)

**Unit 1:Electrostatics:**

Coulomb's law, Superposition principle, Intensity & potential.Potential and field due to different charge distribution.Gauss law and its application.Earnshaw's theorem.

Potential.and field due to a dipole, Force & torque on a dipole in an external field. Dipole-dipole interaction, Multipole Expansion for bounded charge distribution.

**Unit 2: Microscopic Theory of Dielectrics:**

Polarization and charge density.Molecular polarizablility.Electric displacement vector.Electric field in cavities of dielectrics.Electrostatic energy.

Possion and Laplace equation, Boundary conditions, Uniqueness Theorem. Boundary value problems with the help of Electrical images.

**Unit 3:Magnetostatics and Magnetic Properties of Matter:**

The Concept of magnetic induction; force on linear current carrying element; Biot-Savart's law, Ampere's circuital law. Magnetic vector potential;

Calculation of vector potential, The magnetic field of a distant circuit, The magnetic scalar potential, magnetic flux.

Magnetization, the magnetic field produced by a magnetic material. Source of magnetic field, magnetic intensity.The field equations. Boundary conditions on the field vectors, Boundary value problems involving magnetic materials.

**Unit 4: Electromagnetic induction and magnetic energy:**

Electromagnetic induction, self-inductance, mutual inductance, the Neumann formula, induction in series and parallel.

Magnetic energy of coupled circuits, energy density in the magnetic field, forces and torques on rigid circuits.Hysteresis loss.

**Suggested Books:**

1. Fundamentals of Electromagnetic Theory, J.R. Reitz, F.J. Milford and R.W. Christy, 1998, Narosa Publishing House, New Delhi.
2. Introduction to Electrodynamics, D.J. Griffiths, 3rd Ed., 1998, Benjamin Cummings.
3. Elements of Electromagnetics, M.N.O. Sadiku, 2001, Oxford University Press.
4. Introduction to Electromagnetic Theory, T.L. Chow, 2006, Jones & Bartlett Learning.

**GE/CC 4.2    : Practical**

Contact Hours Per Week     : 2
Examination Duration       : 3 Hours
Maximum Marks              : 30 ( Expt-20, Viva-5, Record-5)

1. Measurement of field strength B and its variation in a solenoid (determine dB/dx)
2. To determine self inductance of a coil by Anderson's bridge.
3. To study response curve of a Series LCR circuit and determine its (a) Resonant frequency, (b) Impedance at resonance, (c) Quality factor Q, & (d) Band width.
4. To study the response curve of a parallel LCR circuit and determine its (a) Anti- resonant frequency and (b) Quality factor Q.
5. To determine self-inductance of a coil by Rayleigh's method.
7. To determine the mutual inductance of two coils by Absolute method.

**Suggested Books:**

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, AsiaPublishing House
2. A Text Book of Practical Physics, I.Prakash& Ramakrishna, 11$^{th}$ Ed., 2011, Kitab Mahal
3. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4$^{th}$Edition,reprinted 1985, Heinemann Educational Publishers
4. A Complete Course in Degree Practical Physics, B. B. Swain, Kalyani Publishers (2016).
5. Advanced Practical Physics: Vol-I &II, B. Ghosh and K.G. Mazumdar, 2004, Sreedhar Publishers, Kolkata.
6. Advanced Course in Practical Physics, D. Chattopadhyay and P.C. Rakshit, 2015, Central, Kolkata.
7. Advanced Practical Physics for Students, B. L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
8. A Laboratory Manual of Physics for undergraduate classes, D.P. Khandelwal, 1985, Vani Publishing.

**GE/CC 4.1: Inorganic, Organic and Physical Chemistry**

| | |
|---|---|
| Contact Hours per Week | : 4 |
| Credit | :4 |
| Examination Duration | :3 Hours |
| Maximum Marks | :70 (Terminal-50, Sessional-20) |

**Unit 1:**

### Coordination Chemistry:

Werner's theory, IUPAC nomenclature of coordination compounds, isomerism in coordination compounds. Stereochemistry of complexes with 4 and 6 coordination numbers.Valence bond theory (inner and outer orbital complexes), electroneutrality principle and back bonding. Crystal field theory (CFSE)in weak and strong fields, pairing energies, factors affecting the magnitude of 10 Dq in Octahedral and tetrahedral complexes, tetragonal distortions from octahedral geometry Jahn-Teller theorem, square planar geometry. Qualitative aspect of Ligand field and MO Theory.

**Unit 2:**

### Aldehydes and Ketones (Aliphatic and Aromatic):

Structure, reactivity and preparation;

Nucleophilic additions, Nucleophilic addition-elimination reactions with ammonia derivatives with mechanism; Mechanisms of Aldol and Benzoin condensation, Knoevenagel condensation, Claisan-Schmidt, Perkin, Cannizzaro and Wittig reaction,Benzil-Benzilic acid rearrangements,α haloform reaction and Baeyer Villiger oxidation, - substitution reactions, oxidations and reductions (Clemmensen, Wolff-Kishner);

Addition reactions of unsaturated carbonyl compounds: Michael addition.

**Unit 3:**

### a) Carboxylic acids and their derivatives

Preparation, physical properties and reactions of monocarboxylic acids: Typical reactions of dicarboxylic acids, hydroxy acids and unsaturated acids (succinic and phthalic, lactic, malic, tartaric, citric, maleic and fumaric acids)

Preparation and reactions of acid chlorides, anhydrides, esters and amides; Comparative study of nucleophilic sustitution at acyl group -Mechanism of acidic and alkaline hydrolysis of esters, Claisen condensation, Dieckmann and Reformatsky reactions, Hofmann-bromamide degradation and Curtius rearrangement..

### b) Sulphur containing compounds

Preparation and reactions of thiols, thioethers and sulphonic acids.

# Unit 4:

### Chemical kinetics-I

The concept of reaction rates.Effect of temperature, pressure, catalyst and other factors on reaction rates.Order and molecularity of a reaction.Derivation of integrated rate equations for zero, first and second order reactions (both for equal and unequal concentrations of reactants).Half–life of a reaction.General methods for determination of order of a reaction (differential method, integration method, method of half life period and isolation method).Concept of activation energy and its calculation from Arrhenius equation.

Theories of Reaction Rates: Collision theory based on hard-sphere model. Transiton State Theory theory of bimolecular reactions steady state approximation.Comparison of the two theories (qualitative treatment only).

### GE/CC 4.2: Practical

| | | |
|---|---|---|
| Conctact Hours Per Week | : | 2 |
| Examination Duration | : | 3 Hours |
| Maximum Marks | : | 30 ( Expt-20, Viva-5, Record-5) |

1. Identification of organic compounds (containing single functional group) through functional group analysis, determination of boiling point/melting point.

## Semester IV

### GE/CC4.1: Plant anatomy, Classification and Nomenclature

| | | |
|---|---|---|
| Contact Hour per Week | : | 4 |
| Credits | : | 4 |
| Examination duration | : | 3 Hours |
| Maximum marks | : | 70 (Terminal- 50, Sessional- 20) |

### Unit 1

**Primary Structures:**

**Stem:** Organization of shoot apex (Apical cell theory, Histogen theory, Tunica Corpus theory, continuing meristematic residue, cytohistological zonation); Types of vascular bundles; Structure of dicot and monocot stem.
**Leaf:** Structure of dicots and monocot leaf, Kranz anatomy.

**Root:** Organization of root apex (Apical cell theory, Histogen theory, Corpus-Kappa theory); Quiescent centre; Root cap; Structure of dicot and monocot root; Endodermis, exodermis and origin of lateral root.

### Unit 2

Secondary growth, Wood and Anomalous growth-Vascular cambium and wood. Anomalous growth of different plants

### Unit 3

Concepts of Classification of flowering plants: Brief history, types of classifications, classification systems of Linnaeus (up to class), Bentham & Hooker (up to series), Takhtajan (up to subclass), Brief idea about APG classification system

### Unit 4

Botanical Nomenclature: Brief history, ICN (ICBN) –Latest code, contents, principle, rank of Taxa, Typification, Principle of Priority (Limitation of Principle of Priority - brief idea), Names of taxa according to their ranks, Effective publication, Valid publication, author's citation, Rejection of names .

### GE/CC 4.2: Practical:

Anatomical features of root, stem and leaves (both monocot and dicot)

### Reference Books

Gangulee, H.C. and Kar, A.K. College Botany Vol.II, New Central Book Agency, Calcutta.

## GE/CC 4.1: Human Physiology and Comparative Anatomy

Contact Hour per Week    :    4
Credits                  :    4
Examination duration     :    3 Hours
Maximum marks            :    70 (Terminal- 50, Sessional- 20)

### Unit 1:
### Human Physiology (Digestion and Excretion)
- Digestion, absorption and assimilation of carbohydrates, proteins and fats.
- Importance of minerals and vitamins in human health; nutritional disorders.
- Mechanism of urine formation and its regulation, counter-current mechanism of concentrating urinary filtrate, normal and abnormal constituents of urine.

### Unit 2:
### Human Physiology (Respiration and Circulation)
- Mechanism and regulation of breathing; lung volumes; structure of hemoglobin, transport of $O_2$ and $CO_2$, CO poisoning.
- Blood coagulation: mechanism, bleeding time (BT) and clotting time (CT).
- Cardiac output, cardiac cycle, blood pressure.

### Unit 3:
### Human Physiology (Nervous system and Endocrinology)
- Generation and propagation of nerve impulse.
- Reflex action and types.
- Mechanism of hormone actions through fixed and mobile pathways: GPCR, PLC, PTK and estrogen receptor pathways.
- Hypothalamo-hypophyseal-gonadal axis and feedback control by hormones.

### Unit 4:
### Comparative Anatomy
- Comparative account in Vertebrates on: heart, aortic arches, kidney.

## GE/CC 4.2: Practical

Contact Hour per Week : 2
Examination duration : 3 Hours
Maximum marks: 30 (Expt. 20, Viva-5, Record-5)

- Staining of blood film and identification of blood cells.
- Total count of RBC and WBC by haemocytometer.
- Determination of blood haemoglobin level.
- Determination of blood group.
- Use of sphygmomanometer.
- Skull of *Chelonia, Columba, Canis, Cavia.*
- Sessional activities.

Books for reference

1. Guyton, A. C. and Hall, J. E. (2006). Textbook of Medical Physiology. 11th Edition. Hercourt Asia PTE Ltd.
2. Tortora, G. J. and Grabowski, S. (2006). Principles of Anatomy & Physiology. 11th Edition, John Wiley & Sons, Inc.
3. Eroschenkon, V. P. (2008). di Fiore's Atlas of Histology with Functional Correlations. 12th Edition. Lipinocot & Wilkins.
4. Arey, L. B. (1974). Human Histology, 4th Edition. WB Saunders.
5. Chatterjee, C. C. (2008) Human Physiology (Vols. I and II). 11th Edition. Medical Allied Agency, Kolkata.
6. Kent, G. C. and Carr, R. K. (2000). Comparative Anatomy of Vertebrates. 9th Edition. McGraw-Hill, New York.
7. Lodish, H., Berk, A. and Kaiser, C. A. (2007). Molecular Cell Biology. 6th Edition. W. H. Freeman, New York.

## GE/CC 4.1: REAL ANALYSIS-II

Contact Hours per Week    : 4
Credit    :4
Examination Duration    :3 Hours
Maximum Marks    :70 (Terminal-50, Sessional-20)

### Unit 1:

Rolle's theorem ,Generalized mean value theorem, Lagrange's Mean Value Theorem and applications, Darboux's theorem, Indeterminate forms, Higher order derivatives, Taylor's theorem.

### Unit 2 :

Maxima and Minima, Taylor's theorem with different forms of remainders, Maclaurin's theorem, Deduction of Taylor's theorem from Mean Value Theorem, Taylor's and Maclaurin's infinite series, Taylor's series and Maclaurin's series expansions of exponential and trigonometric $\ln(1 + x)$, $1/(ax + b)$ and $(1 + x)^n$

### Unit3 :

Limits and continuity of function of several variables, partial derivatives, homogeneous functions, change of variables, Mean value theorem, Maclaurin's theorem.

### Unit 4:

Maxima and minima of functions of two and three variables, Lagrange's multiplier, Multiple integral, Change of variables. Vector definition, Gradient, Curl, Line integral, Surface and volume integrals, Statements of Gauss, Stoke's and Green's theorems (without proof).

## GE/CC 4.2: PRACTICAL:

Contact Hours Per Week    :    2
Examination Duration      :    3 Hours
Maximum Marks             :    30 ( Expt-20, Viva-5, Record-5)

1. Problems related to Mean Value Theorem
2. Maxima & Minima : Practical Problems

### Reference books:

1.    1.S.C.Malik and S.Arora : Mathematical Analysis    (New Age International)
2.    M. D. Raisinghania, Advanced differential equation, S. Chand & Co. Ltd., Revised Edition 2013.
3.    J. K. Goyal & K.P. Gupta, Integrated Transform, Pragati Publication, 10th Edition 2002.
4.    J. Sinha Roy and S. Padhy, A Course of Ordinary and Partial Differential Equations, Kalyani Publishers, New Delhi. (Chapters:7(7.1 to7.3,7.3.1, 7.4 ,7.4.1,7.4.2)
5.    R.G. Bartle and D. R. Sherbert, Introduction to Real Analysis, 3rd Ed., John Wiley and Sons
6.    Gerald G. Bilodeau , Paul R. Thie, G.E. Keough, An Introduction to Analysis, 2nd Ed., Jones & Bartlett, 2010.
7.    Brian S. Thomson, Andrew. M. Bruckner and Judith B. Bruckner, Elementary Real Analysis,
8.    Prasun Kr. Nayak : Vector Algebra and Analysis with Applications (University Press, ISBN 978 – 93 – 86235 -15 - 2
9.    S.K. Berberian, A First Course in Real Analysis, Springer Verlag, New York, 1994.

# GE-1.4 Courses

| Course Paper | Subject | Paper Name | Page No. |
|---|---|---|---|
| **GE-1.4**<br><br>(Course / Paper from same subject selected as GE-1 in Sem.-1) | Physics | Same as CC-4 Physics Paper | 105 |
| | Chemistry | Same as CC-4 Chemistry Paper | 107 |
| | Botany | Same as CC-4 Botany Paper | 109 |
| | Zoology | Same as CC-4 Zoology Paper | 110 |
| | Mathematics | Same as CC-4 Mathematics Paper | 112 |

# GE-2.4 Courses

| Course Paper | Subject | Paper Name | Page No. |
|---|---|---|---|
| **GE-2.4**<br><br>(Course / Paper from same subject selected as GE-2 in Sem.-1) | Physics | Same as CC-4 Physics Paper | 105 |
| | Chemistry | Same as CC-4 Chemistry Paper | 107 |
| | Botany | Same as CC-4 Botany Paper | 109 |
| | Zoology | Same as CC-4 Zoology Paper | 110 |
| | Mathematics | Same as CC-4 Mathematics Paper | 112 |

**DSE: Opt any one from the following:**

**DSE-1 (Choice 1) I.1.1: Computation Physics**

Contact Hours per Week : 4
Credit : 4
Examination Duration : 3 Hours
Maximum Marks : 75 (Terminal-60, Sessional-15)

## Unit 1: Algorithms and Flowcharts:

Algorithm: Definition, properties and development. Flowchart: Concept of flowchart, symbols, guidelines, types. Examples: Cartesian to Spherical Polar Coordinates, Roots of Quadratic Equation, Sum of two matrices, Sum and Product of a finite series, calculation of sin(x) as a series, algorithm for plotting (1) lissajous figures and (2) trajectory of a projectile thrown at an angle with the horizontal.

## Unit 2 : Scientific Programming:

Some fundamental Linux Commands (Internal and External commands). Operators: Arithmetic, Relational, Logical and Assignment Operators. Expressions: Arithmetic, Relational, Logical, Character and Assignment Expressions. Fortran Statements: I/O Statements (unformatted/formatted), Executable and Non-Executable Statements.

## Unit3 : Control Statements:

Types of Logic (Sequential, Selection, Repetition), Branching Statements (Logical IF, Arithmetic IF, Block IF, Nested Block IF, SELECT CASE and ELSE IF Ladder statements), Looping Statements (DO-CONTINUE, DO-ENDDO, DOWHILE, Implied and Nested DO Loops), Jumping Statements (Unconditional GOTO, Computed GOTO, Assigned GOTO) Subscripted Variables (Arrays: Types of Arrays, DIMENSION Statement, Reading and Writing Arrays), Functions and Subroutines (Arithmetic Statement Function, Function Subprogram and Subroutine), RETURN, CALL, COMMON and EQUIVALENCE Statements), Structure, Disk I/O Statements.

## Unit 4 : Development of FORTRAN Program :

Basic elements of FORTRAN: Character Set, Constants and their types, Variables and their types, Keywords, Variable Declaration and concept of instruction and program. Layout of Fortran Program, Format of writing Program and concept of coding, Initialization and Replacement Logic. Open a file, writing in a file, reading from a file. Examples from physics problems.

DSE-I (Choice-1) 1.1.2 :   **Practical**

Contact Hours per Week  :   2
Credit                  :   2
Examination Duration    :   3 Hours
Maximum Marks           :   25 (Expt. -15, Viva- 5, Record-5)

## Practical/Programming:

1. Exercises on syntax on usage of FORTRAN.
2. To print out all natural even/ odd numbers between given limits.
3. To find maximum, minimum and range of a given set of numbers.
4. To find a set of prime numbers and Fibonacci series.

5. Write programming of differential equation applicable in physical system, Heat-plugs, SHM.
6. Sorting numbers from 1 to N using Bubble short algorithm.
7. Matrix solution (Inverse).
8. Finding the root of an equation using Newton method.

## Suggested Books:

1. Introduction to Numerical Analysis, S.S. Sastry, 5th Edn., 2012, PHI Learning Pvt. Ltd.
2. Computer Programming in Fortran 77. V. Rajaraman (Publisher: PHI).
3. Schaum's Outline of Theory and Problems of Programming with Fortran, S. Lipsdutz and A. Poe, 1986Mc-Graw Hill Book Co.
4. Computational Physics: An Introduction, R.C. Verma, et al. New Age International Publishers, New Delhi(1999)
5. Elementary Numerical Analysis, K.E. Atkinson, 3rdEdn., 2007, Wiley India Edition.
6. A Complete Course in Degree Practical Physics, B.B. Swain & P.K. Jena, Kalyani Publishers (2017)

**OR**

**DSE-1 (Choice-2) I.1.1 : Nano Materials and Applications**

Contact Hours per Week : 4
Credit : 4
Examination Duration : 3 Hours
Maximum Marks : 75 (Terminal-60, Sessional-15)

### Unit 1: Nanoscale Systems:

Length scales in physics, Nanostructures: 1D, 2D and 3D nanostructures (nanodots, thin films, nanowires, nanorods), Band structure and density of states of materials at nanoscale, Size Effects in nano systems.

### Unit 2: Nano Materials:

Structure, properties and importance of the following Nanomaterials - Metallic nanoparticles - Semiconductor quantum dots, core-shell nanoparticles - carbon based nanomaterials - fullerenes, carbon nanotubes (single walled and multi walled) and graphene.

### Unit 3: Fundamentals of Microscopic techniques:

Scanning electron microscopy (SEM - Transmission electron microscopy (TEM) - Scanning probe microscopy (STM and AFM) - Spectroscopy-Characterization of nanomaterials by absorption spectroscopy (UV-Vis, IR) and Raman spectroscopy.

### Unit 4: Applications:

Applications of nanoparticles, quantum dots, nanowires and thin films for photonic devices (LED, solar cells).Single electron devices (no derivation). CNT based transistors.

### Suggested Books:

1. C.P. Poole, Jr. Frank J. Owens, Introduction to Nanotechnology (Wiley India Pvt. Ltd.).
2. Gabor L. Hornyak, Joy Deep Dutta, Harry F. Tibbals and Hail K. Rao, Introduction to Nanoscience, New York, CRC press, 2008
3. Pradeep T, Nano: The Essentials: Understanding Nanoscience and Nanotecnology, New Delhi, Tata McGraw-Hill Publishing Company Limited, 2008.
4. Peter M. Martin, Handbook of deposition technologies for films and coatings science, application and technology, USA, Elsevier, 2010.
5. W.R. Fahrner (Ed.), Nanotechnology and Nanoelectronics, materials, devices, measurement techniques, Springer- Verlag Berlin Heidelberg, 2005.

**DSE-I (Choice-2) 1.1.2 Practical**

Contact Hours per Week : 2
Credit : 2
Examination Duration : 3 Hours
Maximum Marks : 25 (Expt. -15, Viva- 5, Record-5)

1. Preparation of nanomaterials (such as ZnO) by solgel or, CVD method.
2. Determination of particle size by XRD method.
3. Study of surface profile of nanomaterials by AFM
4. Measurement of Transmission and Reflectance spectra of nanomaterials.
5. Dielectric conductivity measurement by LCR Bridge.

**Suggested Books:**

1. C.P. Poole, Jr. Frank J. Owens, Introduction to Nanotechnology (Wiley India Pvt. Ltd.).
2. Peter M. Martin, Handbook of deposition technologies for films and coatings science, application and technology, USA, Elsevier, 2010.

Opt any one among Choice-1 and Choice-2

**DSE-1 (Choice-1) I.1.1 :Green Chemistry**

Contact Hours per Week  :  4
Credit                  :  4
Examination Duration    :  3 Hours
Maximum Marks           :  75 (Terminal-60, Sessional-15)

**Unit 1 :**

a) **Introduction to Green Chemistry**

What is Green Chemistry? Need for Green Chemistry.Goals of Green Chemistry.Limitations/ Obstacles in the pursuit of the goals of Green Chemistry.

b) **Future Trends in Green Chemistry**

Oxidation reagents and catalysts; Biomimetic, multifunctional reagents; Combinatorial green chemistry; Proliferation of solventless reactions; oncovalent derivatization; Green chemistry in sustainable development.

**Unit 2 :**

**Principles of Green Chemistry and Designing a Chemical synthesis**

Twelve principles of Green Chemistry with their explanations and examples; Designing a Green Synthesis using these principles; Prevention of Waste/ byproducts; maximum incorporation of the materials used in the process into the final products (Atom Economy); prevention/ minimization of hazardous/ toxic products; designing safer chemicals – different basic approaches to do so; selection of appropriate auxiliary substances (solvents, separation agents), green solvents, solventless processes, immobilized solvents and ionic liquids; energy requirements for reactions - use of microwaves, ultrasonic energy; selection of starting materials; avoidance of unnecessary derivatization – careful use of blocking/protecting groups; use of catalytic reagents (wherever possible) in preference to stoichiometric reagents; designing of biodegradable products; prevention of chemical accidents;

strengthening/ development of analytical techniques to prevent and minimize the generation of hazardous substances in chemical processes.

**Unit 3 :**

**Examples of Green Synthesis/ Reactions-I**

1. Green Synthesis of the following compounds: adipic acid, catechol, BHT, methyl methacrylate, urethane, aromatic amines (4-aminodiphenylamine), benzyl bromide, acetaldehyde, disodium iminodiacetate (alternative to Strecker synthesis), citral, ibuprofen, paracetamol, furfural.

2. Microwave assisted reactions in water: Hofmann Elimination, Hydrolysis (of benzyl chloride, benzamide, n-phenyl benzamide, methylbenzoate to benzole acid), Oxidation (of toluene, alcohols).

   Microwave assisted reactions in organic solvents: Esterification, Fries rearrangement, Orthoester Claisen Rearrangement, Diels-Alder Reaction, Decarboxylation

Microwave assisted solid state reactions: Deacetylation, Deprotection. Saponification of esters, Alkylation of reactive methylene compounds, reductions, synthesis of nitriles from aldehydes; anhydrides from dicarboxylic acid; pyrimidine and pyridine derivatives; 1,2-dihydrotriazine derivatives; benzimidazoles.

3. Ultrasound assisted reactions: Esterification, saponification, substitution reactions, Alkylations, oxidation, reduction, coupling reaction, Cannizaro reaction, Strecker synthesis, Reformatsky reaction.

## Unit 4 :

### Examples of Green Synthesis/ Reactions-II

Selective methylation of active methylene group using dimethylcarbonate: Solid-state polymerization of amorphous polymers using diphenylcarbonate; Use of "Clayan", a nonmetallic oxidative reagent for various reactions; Free Radical Bromination; Role of Tellurium in organic syntheses; Biocatalysis in organic syntheses.

**DSE-1 (Choice-1)- I.1.2 : Practicals**

| | |
|---|---|
| Conctact Hours Per Week | 2 |
| Examination Duration | 3 Hours |
| Maximum Marks | 25 ( Expt-15, Viva-5, Record-5) |

1. **Safer starting materials**

   The Vitamin C clock reaction using Vitamin C tablets, tincture of iodine, hydrogen peroxide and liquid laundry starch.

   Effect of concentration on clock reaction

   Effect of temperature on clock reaction. (if possible)

2. **Avoiding waste**
   - Acetylation of primary amine (Acetanilide)
   - Base catalysed aldol condensation (Synthesis of diebenzal propanol)
   - Halogen addition to C=C (Bromination of trans-stilbene)
   - Rearrangement reaction(Benzyl-benzilic acid rearrangement)

3. **Use of enzymes as catalysts**

   Benzoin condensation using Thiamine Hydrochloride as a catalyst instead of cyanide

   **Alternative Green solvents**

4. **Diels Alder reaction in water**

   Reaction between furan and maleic acid in water and at room temperature rather than in benzene and reflux.

   **Alternative sources of energy**

5. Solvent free, microwave assisted one pot synthesis of phthalocyanine complex of copper (II).

6. Photoreduction of benzophenone to benzopinacol in the presence of sunlight.

**Reference Books :**

1. V.K. Ahluwalia & M.R. Kidwai: New Trends in Green Chemistry,

2. P.T. Anastas & J.K. Warner: Oxford Green Chemistry- Theory and Practical, University Press (1998).

3. A.S. Matlack: Introduction to Green Chemistry, Marcel Dekker (2001).

4. M.C. Cann & M.E. Connely: Real-World cases in Green Chemistry, American Chemical Society, Washington (2000).

5. M.A. Ryan & M. Tinnesand, Introduction to Green Chemistry, American Chemical Society, Washington (2002).

6. Anastas, P.T & Warner, J.C. *Green Chemistry: Theory and Practice,* Oxford University Press (1998).

7. Kirchoff, M. & Ryan, M.A. *Greener approaches to undergraduate chemistry experiment.* American Chemical Society, Washington DC (2002).

8. Ryan, M.A. *Introduction to Green Chemistry*, Tinnesand; (Ed), American Chemical Society, Washington DC (2002).

9. Sharma, R.K.; Sidhwani, I.T. & Chaudhari, M.K. I.K. *Green Chemistry Experiment: A monograph International Publishing House Pvt Ltd. New Delhi*. Bangalore CISBN 978-93-81141-55-7 (2013).

10. Cann, M.C. & Connelly, M. E. *Real world cases in Green Chemistry*, American Chemical Society (2008).

11. Cann, M. C. & Thomas, P. *Real world cases in Green Chemistry*, American Chemical Society (2008

**OR**

**DSE-1 (Choice-2)- 1.I.2 : Polymer Chemistry**

Contact Hours per Week : 4
Credit : 4
Examination Duration : 3 Hours
Maximum Marks : 75 (Terminal-60, Sessional-15)

## Unit 1: Nature and Structure

Different schemes of classification of polymers, Polymer nomenclature, Molecular forces andchemical bonding in polymers, Texture of Polymers. Structure Property relationships.Criteria for synthetic polymer formation, classification of polymerization processes. Relationships between functionality, extent of reaction and degree of polymerization. Bifunctionalsystems, Poly-functional systems.

## Unit 2:

### (a) Properties of polymers (Physical, thermal, Flow & Mechanical Properties)

Brief introduction to preparation, structure, properties and application of the following polymers: polyolefins, polystyrene and styrene copolymers, poly(vinyl chloride) and related polymers, poly(vinyl acetate) and related polymers, acrylic polymers, fluoro polymers, polyamides and related polymers. Phenol' formaldehyde resins (Bakelite, Novalac), polyurethanes, silicone polymers, polydienes, Polycarbonates, Conducting Polymers, [polyacetylene, polyaniline, poly(p-phenylenesulphide polypyrrole, polythiophene)].

### (b) Kinetics of polymerization

Mechanism and kinetics of step growth, radical chain growth, ionic chain (both cationic andanionic) and coordination polymerizations, Mechanism and kinetics of copolymerization, polymerization techniques.

## Unit 3 : Polymer solution

Criteria for polymer solubility, Solubility parameter, Thermodynamicsof polymer solutions, entropy, enthalpy, and free energy change of mixing of polymerssolutions, Flory- Huggins theory, Lower and Upper critical solution temperatures.Determination of molecular weight of polymers($Mn$, $Mw$, etc): by end group analysis,viscometry, light scattering and osmotic pressure methods. Molecular weight distribution and its significance.Polydispersity index.

**Unit 4:**

(a) **Crystallisation and crystallinity:** Determination of crystalline melting point and degree of crystallinity, Morphology of crystalline polymers, Factors affecting crystalline melting point.

(b) **Glass transition Temperature:** Free volume theory, WLF equation, Factors affecting glass transition temperature (Tg)

**DSE-1 (Choice-2) I.1.2 : Practicals**

Conctact Hours Per Week    2
Examination Duration        3 Hours
Maximum Marks               25 ( Expt-15, Viva-5, Record-5)

## Polymer synthesis

1. Free radical solution polymerization of styrene (St) / Methyl Methacrylate (MMA) /Methyl Acrylate (MA) / Acrylic acid (AA).

   a. Purification of monomer

   b. Polymerization using benzoyl peroxide (BPO) / 2,2'-azo-bis-isobutylonitrile (AIBN)

2. Preparation of nylon 66/6

1. Interfacial polymerization, preparation of polyester from isophthaloyl chloride (IPC) and phenolphthalein

   a. Preparation of IPC

   b. Purification of IPC

   c. Interfacial polymerization

3. Redox polymerization of acrylamide

4. Precipitation polymerization of acrylonitrile

5. Preparation of urea-formaldehyde resin

6. Preparations of novalac resin/resold resin.

7. Microscale Emulsion Polymerization of Poly(methylacrylate).

## Polymer characterization

1. Determination of molecular weight by viscometry:

   (a) Polyacrylamide-aq.NaNO2 solution

   (b) (Poly vinyl proplylidine (PVP) in water

2. Determination of the viscosity-average molecular weight of poly(vinyl alcohol)(PVOH) and the fraction of "head-to-head" monomer linkages in the polymer.

3. Determination of molecular weight by end group analysis: Polyethylene glycol (PEG) (OH group).

4. Testing of mechanical properties of polymers.

5. Determination of hydroxyl number of a polymer using colorimetric method.

## Polymer analysis

1. Estimation of the amount of HCHO in the given solution by sodium sulphite method

2. Instrumental Techniques

3. IR studies of polymers

4. DSC analysis of polymers

5. Preparation of polyacrylamide and its electrophoresis

*at least 7 experiments to be carried out.

**Reference Books :**

1. Billmeyer, F. W. *Textbook of Polymer Science*, John Wiley & Sons, Inc.
2. Gowariker, V. R.; Viswanathan, N. V. & Sreedhar, J. *Polymer Science*, New Age International (P) Ltd. Pub.
3. *Seymour's Polymer Chemistry*, Marcel Dekker, Inc.
4. G. Odian: Principles of Polymerization, John Wiley.
5. F.W. Billmeyer: Text Book of Polymer Science, John Wiley.
6. P. Ghosh: Polymer Science & Technology, Tata Mcgraw-Hill.
7. R.W. Lenz: Organic Chemistry of Synthetic High Polymers.

**DSE-I (Choice 1) -1.1.1 Home gardening and Herbal technology (Opt any one from the following )**

Contact Hours per Week: 4
Credit:                4
Examination Duration:    3 Hours
Maximum Marks: 75 (Terminal-60, Sessional-15)

### Unit 1: Introduction of gardening

Gardening: definition, objectives and scope - Garden tools and implements different types of gardening , Herbal Gardening; Planting, propagation, soils, plant nutrition, and container growing. Plant identification, plant names, general characteristics of herbs, herb resources (nurseries, seeds, clubs, etc) Growing Herbs to Harvest. Herb products, setting up a herb farm, making compost.

### Unit 2: Maintenance of herbal garden

(a) Indoor gardening – Selection of indoor plants, care and maintenance of indoor plants, Bonsai – Principle, Creating the bonsai.(b) Outdoor gardening.(1) Floriculture: Factors affecting flower production; Production and packaging of cut flowers; Flower arrangements; Methods to prolong vase life; Cultivation of Important cut flowers Aster, Dahlia, Gerbera, Gladiolous, Marigold,Rose, Lilium, Orchid, Cultivation of Rose, *Jasminum, Chrysanthemum,* Orchids, *Anthurium.*

### Unit 3: Cultivation and propagation of herbals

Scope and importance of traditional medicine Plants in primary health care: study of selected Common medicinal plants – Tinospora cordifolia), Oscimum sanctum, Piper longum, Terminalia chebula , Aloe vera , Curcuma longa.Brahmi (Phyllanthus emblica, Coleus, Catheranthus, Adathoda, Rauwolfia, Mentha,. Withania somnifera,Rauvolfia serpentin, Phyllanthus amarus and , Phyllanthus emblica.

### Unit 4: Extraction of herbal products

Extraction of crude extract using different solvents and purification by chromatographic methods

## DSE I (Choice-1) 1.I.2 : Practical.

Contact Hours Per Week : 2
Credit                 : 2
Examination Duration   : 3 Hours
Maximum Marks          : 25 ( Expt-25, Viva-5, Record-5)

Extraction of different compounds from different medicinal plants using different solvents

### Reference Books:

1. Andiance and Brison 1971. Propagation Horticultural Plants.Rekha Sarin. The Art of Flower Arrangement, UBS Publishers, New Delhi.

2.Katyal, S.C. Vegetable growing in India, Oxford, New York.

4.Chanda, K.L. and Choudhury, B. Ornamental Horticulture in India:Premchand, Agriculture and Forest Pest and their Management, Oxford Publication.

5. Acquaah G. Horticulture: Principles and Practices. Pearson Education, Delhi.

7. Prasad, S., and Kumar, U. Green house Management for Horticultural Crops, Agrobios, Jodhpur.

8. Kolay, A.K. Basic Concepts of Soil Science. New Age International Publishers, Delhi.

9.Hudson, T. Hartmann, D., Kester, K., Davies F.T., Geneve R.L. Plant Propagation,Principles and Practices.

OR

### DSE-I (Choice-2)- 1.I.1 : Horticulture

Contact Hours per Week : 4
Credit : 4
Examination Duration : 3 Hours
Maximum Marks : 75 (Terminal-60, Sessional-15)

### Unit - I
### Definition of Horticulture:

Importance of horticulture in terms of economy, production, employment. generation, environmental protection and human resource development , Divisions of horticulture with suitable examples and their importance, Classification of horticulture crops based on soil and climatic requirements.

### Unit – II
### Concept of nursery:

Definition of a nursery, Different types of nursery beds – flat beds, raised beds and sunken beds, their merits and demerits, Different nursery techniques and their management. 2.4 Vegetable gardens, nutrition and kitchen garden, truck garden, Vegetable forcing, market gardens and roof gardens , Different s systems of planting orchards - Calculation of planting densities in different systems of planting.

### Unit – III
### Pruning, ,Mannures and Fertilizers:

Definition, objectives, Principles and methods of pruning of fruit crops.
Irrigation: definition, different methods of irrigation followed in horticultural crops, their merits and demerits
Manures and fertilizers: Definition, different methods of application of manures and fertilizers to horticultural crops.

### Unit – IV
### Cropping systems:

Inter cropping and multi – tier cropping, their merits and demerits with suitable examples. Propagation: propagation by cuttings: Definition of cutting, Different methods of cuttings, propagation by layering: Definition of layering and layer; Types of layering , propagation by grafting: methods of grafting.

**DSE I (Choice-2) -1.I.2 : Practical**

Contact Hours Per Week : 2
Credit : 2
Examination Duration : 3 Hours
Maximum Marks : 25 ( Expt-25, Viva-5, Record-5)

1. Study of tools and implements in horticulture.

2. Layout of different planting systems.

3. Preparation of nursery beds for sowing of vegetable seeds.

4. Preparation of fertilizer mixtures and field application.

5. Study and practicing of different propagation methods by cutting, grafting and budding.

**Reference Books:**

- Edmond, J.B., Sen, T.L., Andrews, F.S and Halfacre, R.G. 1963. Fundamentals of Horticulture, Tata McGraw Hill Publishing Co., New Delhi.
- Kumar, N. 1990. Introduction to Horticulture, Rajyalakshmi Publications, Nagarcoil, Tamilnadu.
- Sing, Jitendra. 2002. Basic Horticulture, Kalyani Publishers, Hyderabad.
- Garner, V. R., Bradford, F. C. and Hooker, Jr. H. D. 1957. Fundamentals of Fruit Production, McGraw Hill Book Co., New York.
- Hartman, H.T. and Kester, D.E. 1976 Plant Propagation. Principles and Practices, Prentice Hall of India Pvt. Ltd. Bombay.
- Sadhu, M.K. 1996. Plant Propagation. New Age International Publishers, New Delhi.
- Mukherjee, S.K. and Majumdar, P.K. 1973. Propagation of Fruit Crops, ICAR, New Delhi.
- Ganner, R.J. and Choudari, S.A. 1972. Propagation of Tropical Fruit Trees, Oxford & IBH Publishing Co., New Delhi.
- Sarma, R.R. 2002. Propagation of Horticultural Crops: Principles and Practices, Kalyani Publishers, New Delhi.

## DSE-1 (Choice 1) I.1.1: Economic and Applied Zoology

Contact Hours per Week : 4
Credit : 4
Examination Duration: 3 Hours
Maximum Marks: 75 (Terminal - 60, Sessional - 15)

### Unit 1:

#### Parasite and Diseases

- Protozoan parasites and human diseases (*Plasmodium* and *Leishmania*).
- Nematode parasites and human diseases (*Ascaris*, *Ancylostoma* and *Wuchereria*).
- Non communicable diseases: cardiovascular disease (CVD).
- Communicable diseases: AIDS, Dengue, Flu.
- Drug misuse.

### Unit 2:

#### Economic Zoology

- Apiculture; Sericulture; Lac culture; Vermiculture and vermicomposting.
- Integrated Pest management (IPM).

### Unit 3:

#### Pisciculture

- Fish and fisheries: general concept, preparation and management of fish farms.
- Induced breeding.
- Fish diseases.
- Fish nutrition.
- Value-added fishery by-products.
- Pearl culture.
- Prawn culture.
- Preparation and maintenance of fish aquarium.

### Unit 4:

#### Animal Husbandry

- Dairy farming: cattle management, exotic cattle breeds, dairy products.
- Poultry farm construction and management; different breeds of fowl, their origin, characteristics and advantages.
- Goatery: feeding and breeding of goats, goat products.
- Piggery: different breeds of pig, advantage of pig farming, pig products.
- Pharmaceuticals from animals.

**DSE-1 (Choice-1)- 1.I.2: Economic and Applied Zoology (Practical)**

| | | |
|---|---|---|
| Contact Hours per Week | : | 2 |
| Examination Duration | : | 3 Hours |
| Maximum Marks | : | 25 (Expt. – 15, Viva Voce – 5, Lab Note Book/Records - 5) |

- Study of different castes of bees (queen, drone, worker).
- Study of different types of silk moths and their cocoons.
- Identification of locally available fishes (Rohu, Mrigal, Catla, Bata, Singhi, Magur, Tangra, Koi, Tilapia, Hilsa, Pabda, Bhetki)
- Submission of report on visit to any one of following: Apiculture unit, dairy farm, poultry farm, prawn farm.
- Preparation of album of edible and ornamental fishes.

**Reference Books:**
1. Park, K. (2007). Preventive and Social Medicine. 23rd Edition. B. B. Publisher, Jabalpur.
2. Jhingran, V. G. Fish and Fisheries in India (Vols. 1 and 2). Hindustan Publishing Corporation, New Delhi.
3. Pillay, T. V. R. and Kutty, M. N. Aquaculture: Principles and Practices, 2nd Edition. Blackwell Oxford.
4. Arora, D. R and Arora, B. (2001). Medical Parasitology. 2nd Edition. CBS Publications and Distributers.
5. Chaudhury, S. K. (1996). Practice of Fertility Control, A Comprehensive Textbook. Churchill Livingston, India.
6. Hafez, E. S. E. (1962). Reproduction in Farm Animals. Lea & Fabiger Publisher.
7. Atwal, A. S. (1993). Agricultural Pests of India and South East Asia. Kalyani Publishers, New Delhi.
8. Pradhan, S. (1983). Insect Pests of Crops. National Book Trust, India.
9. Prost, P. J. (1962). Apiculture. Oxford and IBH, New Delhi.
10. Knobil, E. and Neill, J. D. (2006). The Physiology of Reproduction, Vol. 2. Elsevier.
11. Srivastava, C. B. L. (1999). Fishery Science and Indian Fisheries. Kitab Mahal Publications, India.
12. Dunham, R. A. (2004). Aquaculture and Fisheries Biotechnology: Genetic Approaches. CABI Publication, UK.

## DSE-1 (Choice-2)- I.2.1: Animal Behaviour

Contact Hours per Week:     4
Credit:     4
Examination Duration:     3 Hours
Maximum Marks: 75 (Terminal-60, Sessional-15)

### Unit 1:

#### Introduction and Mechanism of Behaviour:

Origin and History of Ethology; Brief profiles of Kari von Frisch, Ivan Pavlov, Konrad Lorenz, Niko Tinbergen; Proximate and ultimate behaviour; Objective of behaviour, Behaviour as a basis of evolution; Behaviour as a discipline of science; Innate behaviour, Instinct, Stimulus filtering, Sign stimuli and Code breakers, learning and imprinting.

### Unit 2:

#### Patterns of Behaviour

Reflexes: Types of reflex, reflex path, characteristics of reflex (latency, after discharge, summation, fatigue, inhibition) and its comparison with complex behaviour.

Orientation: Primary and secondary orientation; kinesis-orthokinesis, klinokinesis; taxis: tropotaxis and klinotaxis and menotaxis (light-compass orientation) and mnemotaxis.

Learning: Associative learning, classical and operant conditioning; habituation and imprinting.

Biological clocks (circadian rhythm, tidal rhythm, lunar rhythm, advantages of biological clocks, jet lag and entertainment).

### Unit 3:

#### Social Behaviour

Insects' society: honey bee (society organization, polytheism, foraging, round dance, waggle dance, experiments to prove distance and direction component of dance, learning ability in honey bee, formation of new hive/queen); reciprocal altruism; Hamilton's rule.

### Unit 4:

#### Sexual Behaviour

Asymmetry of sex, sexual dimorphism, mate choice, intra-sexual selection (male rivalry), inter-sexual selection (female choice), infanticide, consequences of mate choice for female fitness, sexual conflict for male versus female parental care, courtship behaviours in three spine stickleback.

### DSE-I (Choiuce-2) I.2.2: Animal Behaviour (Practical)

Contact Hours Per Week : 2
Examination Duration : 3 Hours
Maximum Marks : 25 Expt. – 15, Viva Voce – 5, Lab note Book/Records - 5)

- Study of different types of animal behaviour from videos/movies; reporting.
- Study of nests and nesting habits of birds and social insects.
- Study of geotactic behaviour in earthworm.
- Study of the phototactic behaviour in mosquito larvae.
- Visit to Forest/Wild life Sanctuary/Biodiversity Park/Zoological Park to study behavioral activities of animals, preparation of report.

**Reference Books:**
1. Alcock, J. (2013). Animal Behavior: An Evolutionary Approach. 4th Edition. Oxford University Press.
2. Drickamer, L. C., Vessey, S. H. and Meikle, D. (1998). Animal Behavior: Mechanisms, Ecology and Evolution. 4th Edition. W. C. Brown Publishers.
3. Dugatkin, L. A. (2013). Principles of Animal Behavior. 3rd Edition. W. W. Norton & Co.
4. David McF. (2001). Animal Behaviour. 7th Edition. Pitman Publishing Ltd, London.
5. John, A. (2001). Animal Behaviour. 7th Edition. Sinauer Associate, Inc., USA.
6. Manning, A. and Dawkins, M. S. (2012). An Introduction of Animal Behaviour. 6th Edition. Cambridge University Press, USA.
7. Paul, W. S. and John, A. (2013). Exploring Animal Behaviour. 6th Edition. Sinauer Associate, Inc., USA.
8. Mathur, R. (2012). Animal Behaviour. 2nd Edition. Rastogi Publications, Meerut.
9. Agarwal, V. K. (2013). Animal Behaviour, S. Chand, New Delhi.

**DSE: Opt any one from the following**

**DSE-1 (Choice-1) 1.I.1: Number Theory**

| | |
|---|---|
| Contact Hours per Week | :4 |
| Credit | :4 |
| Examination Duration | :3 Hours |
| Maximum Marks | :75 (Terminal-60, Sessional-15) |

**Unit 1 :**

Divisibility, Primes and their distribution, the binomial theorem.

**Unit 2 :**

Congruences .Definition and properties, Euler's phi function, Fermat's Theorem, Euler's Theorem, Wilson's Theorem, Solutions of Congruences, The Chinese Remainder Theorem.

**Unit 3 :**

Quadratic reciprocity and quadratic forms-Quadratic residues, quadratic reciprocity, The Jacobi symbol, The Fermat conjecture-The famous ``Last Theorem".

**Unit 4 :**

Some functions of number theory-Greatest integer function, Arithmetic functions, The Mobius inversion formula, Recurrence functions, Some Diophantine equations.

**Reference Books :**

1. Niven Ivan, Number Theory.
2. David M. Burton, Elementary Number Theory
3. Neville Robinns, Beginning to Number Theory.
4. Gareth A Jones and J. Mary Jones, Elementary Number Theory.
5. Hall and Knight : Higher Algebra

**DSE-1 (Choice-1) -1.I.2 : PRACTICAL**

| | | |
|---|---|---|
| Contact Hours Per Week | : | 2 |
| Credit | : | 2 |
| Examination Duration | : | 3 Hours |
| Maximum Marks | : | 25 (Expt. 15, Viva-5, Record-5) |

1. Application of divisibility and prime numbers.
2. Application of Euler's phi function, Fermat's, Euler's, Wilson's and The Chinese Remainder Theorem.
3. Quadratic reciprocity.
4. Application of Greatest integer function, Arithmetic functions

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OR

### DSE-1 (Choice-2) I.1.1 Mathematical Modeling

| | |
|---|---|
| Contact Hours per Week | :4 |
| Credit | :4 |
| Examination Duration | :3 Hours |
| Maximum Marks | :75 (Terminal-60, Sessional-15} |

**Unit 1 :**

Simple Situations Requiring Mathematical Modeling. The Technique of Mathematical Modeling, Mathematical Modeling through differential equations. Linear growth and Decay Models, Non-linear growth and decay models, compartment models, mathematical modeling of geometrical problems through ordinary differential equations of first order.

**Unit 2 :**

Mathematical modeling in population dynamics, mathematical modeling of epidemics through systems of ordinary differential equations of first order, compartment models through systems of- ordinary differential equations, Mathematical modeling in economics through systems of ordinary differential equations of first order. Mathematical models in Medicine, Arms Race, Battles and International Trade in terms of systems of ordinary differential equations

**Unit 3 :**

Mathematical modeling of Planetary Motions, Mathematical modeling of circular motion and motion of satellites. Mathematical modeling through linear differential equations of second order.

**Unit 4 :**

Situations that can be modeled through graphs. Mathematical models in terms of directed graphs, Optimization principles and techniques. Mathematical modeling through calculus of variations.

**Reference Books :**

1. Mathematical Modeling—J.N. Kapur

**DSE-1 (Choice-2) I.1.2 : PRACTICAL**

Contact Hours Per Week   :   2
Credit     :   2
Examination Duration   :   3 Hours
Maximum Marks     :   25 (Expt. 15, Viva-5, Record-5)

1. Development of the model for the Linear and Non-linear growth and decay models
2. Development of the model for thepopulation dynamics and epidemics.
3. Development of the model for the Planetary and Circular Motions.
4. Mathematical modeling of variational problems and graph.

**References**

1. T. Padmanabhan, Theoretical Astrophysics, vols. 1-3, Cambridge University Press, 2002.
2. B.Basu, T.Chattopadhyay and S.N.Biswas, An Introduction to Astrophysics, Prentice Hall of India, 2010.
3. Textbook on Spherical Astronomy, W.M. Smart , Cambridge University Press.
4. A Text Book on Astronomy, K.K. De, Books Syndicate (P) Ltd. 2013

**PE 5: Assessment for Learning**

| Semester-IV | Credits-4 |
|---|---|
| Total Marks:100 | Contact Hours: |
| (Internal: 30, External: 70) | 4 hours per week |

### Introduction

This Course – as its title suggests - proposes that teacher-learners become conscious of the distinction between assessment *for* learning and assessment *of* learning. Whereas both have their place in school education, a constructivist paradigm indicates a shift in emphasis towards the former. The course intends to enlarge current perspectives on assessment and evaluation, and enable teacher-learners to view student learning along multiple dimensions. It brings a specific focus on assessment of subject-based learning, as well as processes of feedback and reporting, which are among the core competencies needed by teachers. A critical review of the examination system and the assessment practices that derive from this is also felt to be a necessary component of the course; so that teacher-learners may learn to evolve more flexible and richer forms of assessment, even as they respond to current examination practices.

Assessment (and evaluation) is integral to school education and more specifically to teaching-learning. Since education in schools presupposes certain aims and objectives, it is crucial for teachers to be aware of how the progress and growth of students is to be assessed. This in turn implies that teachers become cognizant of what dimensions of growth or learning are to be assessed, what means are available to them for this purpose, and what effects are likely to flow from various kinds of assessment.

### Objectives

The course will enable the student teachers to:

- Get basic knowledge of assessment for learning.
- Know the process of evaluation and it uses.
- Write educational objectives.
- Know different techniques of evaluation, tools of evaluation and their uses.
- Know different characteristics of instruments of evaluation.
- Know different types of teacher made tests and will construct them.
- Compute simple statistics to assess the learning.

- Understand different aspects of the complexities of the learning system.
- Know various school records designed for specific purposes.
- Understand the relationship between school and the community.
- Acquire knowledge about physical, infrastructural and human resources available in the schools.
- Understand the curricular process in the school.
- Evaluate the school effectiveness and other functional aspects of the schools.
- Explore the students support services available and achievements of the schools.

### Unit-I: Concept of Assessment, Evaluation and Learning:

- Meaning of Test, Measurement, Assessment and Evaluation.
- Distinguish among Measurement, Assessment and Evaluation.
- Nature and purpose of Evaluation.

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- Assessment and Evaluation: Meaning, Purpose of assessment (improving learning and teaching); purpose of evaluation (placement, diagnosis, promotion, certification, providing feedback); Interrelationship between assessment and evaluation.
- Continuous and Comprehensive Assessment (CCA): Meaning, Importance and Scope; Learning and Assessment: Assessment of Learning, Assessment for Learning, and Assessment as Learning; CCA vs. CCE.

### Unit-II: Approaches and Techniques of Evaluation, Criteria of Assessment Procedure and Psychological Test:

- Approaches-Formative and Summative; NRT and CRT.
- Techniques- observational, self-reporting, psychological and Educational tests.
- Validity- Meaning, Types and Measurement.
- Reliability - Meaning, Types and Measurement.
- Norm and Usability.
- Psychological Test: Meaning and concept, Preliminary idea about – Intelligence test, Aptitude test, Interest Inventory, Attitude test, Creativity and Personality, Achievement test- meaning, characteristics, steps for construction and uses, Diagnostic and prognostic test, Types of Tests; Written Test, Oral Test, NRT, CRT, Summative Test, Formative Test, Diagnostic Test.

### Unit-III: Elementary Statistics in Evaluation and Problem- learner:

- Use of Statistics in Education: Scoring and Grading, Analysis of Score and Its Interpretation
    a) Raw score, Tabulation and Frequency of data.
    b) Graphical representation of data (Histogram, frequency Polygon).
    c) Measures of Central Tendency (Mean, Median Mode), dispersion (range, quartile deviation and standard deviation) and their uses in evaluation.
    d) Standard scores: T score, Z score, percentile and their uses.
    e) Correlation: Meaning, types (product moment and rank difference), calculation and uses.
- Problem – Learner: Problem – Learner; Concept and Types, Identification of Problem – Learner; Observation, Case Study, Socio-Metric & Testing (Educational and Psychological) Techniques, Remedial Measures – Guidance & Counseling, Life-Skill Training.

### Unit-IV: Assessment for Learning System – Infrastructural Facilities, Human Resource and Management and Record Maintenance:

- Infrastructural facilities: Rooms (types and numbers), Classroom furniture, Sanitation facility, Drinking water, Playground and Library.
- Human Resource: Teaching staff (Full Time + Part Time + Para teacher), Non – Teaching staff, Students:- Boys / Girls / SC / ST /OBC / Minority / Special Needs Children and Teacher-student Ratio.
- Management & Record Maintenance: Managing Committee, Committees for Academic Purposes, Different Committees, Fee Structure, Number of units/ School hour/ time table / periods, Students participation – student Self – Government, Records: Accounts related, Staff related, Student related and Curriculum related.

### Unit-V: School Community Relationship and Special Service Provided:
- School Community relationship: Community involvement in decision making, Community Contribution to school, Meeting with community members and School response to parents.

- Special Service Provided: Mid-Day Meal, Book bank for poor students, Tutorial for weaker students, Remedial teaching, Parent Teacher Association, Staff Welfare Service, Health Programme, Conducting Talent Search Examination and Providing Scholarship.

**Suggested Activities:**

- Writing educational objectives, learning experience and corresponding evaluation techniques, General and specific objectives.
- Framing measurable and non-measurable learning outcomes.
- Determining the objectivity given an answer key.
- Determining the objectivity of a tool.
- Finding out the content validity of the given question paper.
- Designing Rating scale, Questionnaire, Interview Schedule in a given a topic.
- Preparation of Blue Print and a question paper.
- Prepare graphs and use statistics for analysis of test result.
- Preparation of 50 objective-based items, at least 5 from each type of test items in any school subject.
- Construction of an achievement test on any topic (carrying25marks), its administration and interpretation of the results.
- Preparation of a plan for CCA activities for any class during an academic session.
- Appraisal of current CCA practices in the secondary schools.
- Analysis of examination marks obtained by the students in any subject in a class and preparation of a report for sharing.

**Suggested Readings:**

- Anderson,L.W.(2003).*Classroom assessment: Enhancing the quality of teacher decision making.* Mahwah,NewJersey: Lawrence ErlbaumAssociates.
- Burke,K.(2005).*How to assess authentic learning*(4th Ed.).Thousand Oaks,CA: Corwin.
- Cooper,D.(2007).*Talkaboutassessment:Strategiesandtoolstoimprovelearning.*Toronto,Ontario: ThomsonNelson.
- Danielson,C.(2002).*Enhancing student achievement: A framework for school improvement.*Alexandria,VA:Association for Supervisionand Curriculum Development.
- Garrett,H.E.(1973).*Statistics in psychology and education*(6thEd.).Bombay:Vakils, Feffers& Simon.
- Gronlund,N.E.&Linn,R.L.(2009).Measurementandassessmentinteaching(10thEdn).UpperSaddle River,NJ:PearsonEducation, Inc.
- Newman,F.M.(1996).*Authentic achievement: Restructuring schools for intellectual quality.*SanFrancisco,CA: Jossey-Bass.
- Nitko,A.J.(2001).*Educational assessment of students*(3rd Ed.).UpperSaddleRiver, NJ: Prentice Hall.
- Panda,M. & Bisawas,R.(2016). Assessment for Learning. Aaheli Publishers:Kolkata.
- Popham,W.J.(1993). *Modern educational measurement.*Englewood Cliffs, N.J.: Prentice Hall.
- Popham,W.J.(2010).*Classroom assessment: What teachers need to know*(6th ed.).New York: Prentice Hall.
- Shepard, L.A.(2000). The role of assessment in learning culture. *EducationalResearcher,*4-14.
- Stiggins,R.(2005).*Student-involved classroom assessment.* (4thEd.). Columbus,

## PE 6: Creating an Inclusive School

| Semester-IV | Credits-2 |
|---|---|
| Total Marks: 50 | Contact Hours: |
| (Internal: 15, External: 35) | 2 hours per week |

### Introduction

The diversity in society is a fact and the reflection of it in the school is natural. Traditionally these diversities were considered as inability of the individual to be able to meet the requirement of the school/classroom. Now diversities are considered as imposed by the hurdles created by the society. Similarly the difficulties of students to learn in the classroom are due to the expectation of the system, architecture of the building and classroom, design of teaching and many other related factors. The philosophy underlying this course is that every student is unique and each one has the potentiality to learn. The management of individual difference is a social responsibility which a school has to accept. Creating a learning environment to provide opportunity to participate fully in the process of learning is the task for a teacher. This is an effort with an intention to develop a mindset in the teacher which results in accepting 'all' children in the class as his/her responsibility. This is a small beginning to a teacher towards a major shift towards change in the system and society. With this course it is expected that the teacher will understand student who is 'different' in the class as 'unique' who needs the input and attention like other students. The modalities of transaction will Include case studies and interactions with eminent speaker, group discussions, book reviews, self-learning, ICT based teaching learning, visits to various schools (special, integrated and inclusive) and institutions (national and regional centers), viewing relevant documentaries and films, critical analysis and reflections.

### Objectives

The course will enable the student teachers to:
- Understand the meaning and significance of Inclusive education.
- Gain knowledge on Policy and legislative frameworks promoting inclusion.
- Learn to create inclusive classrooms using inclusive pedagogy (teaching strategies, CCE).
- Understand the linkages and collaborations for resource mobilization.

### Unit I: Understanding Inclusion in Education

- Concept & History of Special education, Integrated education and Inclusive Education & their relations; paradigm shift from segregation to inclusion.
- Philosophical, Sociological, Economical and Humanitarian dimensions of inclusive education.
- Advantages of inclusive education for the individual and society, Factors affecting inclusion.
- Concept of inclusion in education: need and importance;
- Inclusive school: concept and characteristics.
- Policy perspectives: Initiatives to promote inclusive education- equity and equality.
- Policy perspectives-International Focus: Salamanca Statement,1994; UNCRPD,2006; EFA (MDG), 1990, 2000.

- Policy perspectives-National Focus: Constitutional obligations for education of diverse groups, RTE 2009, NPE, 1986-92, PWD Act 1995 and revised PWD Bill 2012, NCF 2005 and NFG papers, SSA, RMSA, National Commission on Minority Education Institutions(NCMEI), National Commission for Education of SC, ST.
- Educational concessions, facilities and provisions.

## Unit II: Understanding Diversity for Inclusive Education
- Diversity due to disability (Nature, Characteristic and Needs).
- Special needs of children with sensory disabilities.
- Special needs of children with cognitive disabilities.
- Special needs of children with physical disabilities.
- Girls with disabilities, multiples disabilities.
- Diversity due to socio-cultural and economic factors, Special needs of children arising due to language difference, gender, class, caste, religion and other factors.

## Unit III: Addressing Diversities in Inclusive Set Up

### Defining learners with special needs:
- Understanding differently abled learners – concepts, definitions, characteristics, classification, causes and preventive measures of V.I, H.I, SLD, LI
- Preparation for inclusive education – School's readiness for addressing learner with diverse needs
- Case history taking, Assessment of children with diverse needs (MDPS, BASIC-MR, FACP, VSMS, DDST, UPANAYAN and related others) to know their profile and to develop individualized Education Programme (IEP / ITP)
- Identification and overcoming barriers for educational and social inclusion

- Curricular Issues: Content, Relevance and contextualization; Curricular process; managing inclusive classroom; Assessment.
- Promoting gender equality through education.
- Learning and learners: support/assistive and adaptive devices, ICT use; Universal Design for Learning (UDL).

## Unit IV: Addressing Diversities in Inclusive Set Up
- Preparation for inclusive education: concept and characteristics of Inclusive school; classroom organization and management; development of suitable TLM.
- Curricular Issues: Content, Relevance and contextualization; curricular process; curricular adaptations; assessment.
- Learning and learners: Pedagogical strategies- Cooperative and Collaborative learning strategies, peer tutoring, team teaching, reflective teaching, multisensory teaching; Universal Design for Learning (UDL).
- Technological Advancement and its applications: ICT use, Adaptive and Assistive devices.
- Skills and competencies of teachers and teacher educators for education in inclusive settings; Professional development of teachers – their Attitude & Accountability.
- Identification and overcoming barriers for educational and social inclusion.

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**Suggested Activities:**

- During the field visit, observe the teaching learning processes, infrastructure available and assess the nature of inclusive indicator/practices. List the existing challenges and factors that promote inclusive practices. Please give justifications.
- Prepare the need profile of all children in a class. Critically analyze the profile prepared for establishing relation between students' needs and their abilities/disabilities. Identify relationship between students' needs and their socio-economic and educational status.
- Adapt at least one pedagogical practice studied in the pedagogy course and suggest ways to make it appropriate for addressing the needs of all learners in the class.
- Study the assessment and evaluation practices being followed in a school. Critically reflect on the practices in the context of inclusive education.
- Review the characterization of challenged persons/children in the popular media. If possible draw correlations between popular myths and current beliefs and media representations.
- Visit a nearby special, inclusive and regular school. Make observations in terms of time table, teaching learning activities, infrastructure, child to child interaction and parental support. Compare the practices.
- Carry out interaction with the regular teachers and ascertain the current challenges for promoting inclusive education. Try to collect their opinion on the subject. Talk to at least 25 teachers.
- Is inclusion a new concept? Find evidence of inclusion in Vedic era and trace the journey to modern times. Think. Reflect and Discuss.

**Suggested Readings:**

- Ainscow,M. and Booth, T *(2002)* *Index for Inclusion: Developing Learning and*
- *Participation in Schools. Bristol: CSIE.*
- Ainscow, M., Dyson, A. and Booth, T. (2006) Improving Schools, Developing Inclusion, London: Routledge.
- Hegarty, S. and MithuAlur (2002) *Education and Children with Special Educational Needs- Segregation to Inclusion, New Delhi: Sage Publication India Pvt. Ltd*
- *Julka. A, Index of Incusion (2012) NCERT, New Delhi.*
- *Jha.M.( 2002) Inclusive Education for All: Schools Without Walls, Heinemann Educational publishers, Multivista Global Ltd, Chennai.*
- *Julka, A (2006) Meeting special needs in schools" A manual, NCERT, New Delhi*
- *UNICEF(2003) Examples of Inclusive Education, UNICEF ROSA, Kathmandu*
- *World Bank (2003 )Inclusive Education: Achieving Education for All including those with Disabilities and Special Educational Needs.*
- *Ysseldyke, J.E. and Algozzine,B. (1998) Special Education A Practical approach for Teachers,New Delhi: Kanishka Publishers Distributors.*
- *Julka,A.(2014) Including Children with Special Needs: Primary Stage*
- *Julka,A.(2015) Including Children with Special Needs: Upper Primary Stage*
- *Julka,A. (2014) Teachers Creating Inclusive Classrooms: Issues and Challenges – A Research Study*
- *NCERT(2006), Position Paper : National Focus Group on Education of children with Special Needs, NCERT;DEGSN, New Delhi*
- *NCERT(2006), Position Paper: National Focus Group on Problems of Scheduled Castes and Scheduled Tribe Children NCERT, DEGSN, New Delhi.*

- *MHRD (2009), The Right of Children to Free and Compulsory Education Act, 2009. Ministry of Human Resource Development, New Delhi*

# Semester-V

(B.Sc. B.Ed.)
Semester Structure & Title of Papers

| Sl. No. | Course Paper | Subject | Paper Name | Marks | Page No. |
|---|---|---|---|---|---|
| 1 | **CC-5**<br><br>(Course / Paper from same subject selected as CC subject in Sem.-1) | Physics | Mathematical Physics | 100 | 146 |
| | | Chemistry | Inorganic Chemistry | | 148 |
| | | Botany | Taxonomy of Angiosperms | | 151 |
| | | Zoology | Cell Biology | | 153 |
| | | Mathematics | Differential Equation-II and Mechanics-I | | 155 |
| 2 | **CC-6**<br><br>(Course / Paper from same subject selected as CC subject in Sem.-1) | Physics | Classical Mechanics | 100 | 157 |
| | | Chemistry | Physical Chemistry | | 159 |
| | | Botany | Economic Botany | | 162 |
| | | Zoology | Genetics | | 164 |
| | | Mathematics | Abstract Algebra | | 166 |
| 3 | **CC-7**<br><br>(Course / Paper from same subject selected as CC subject in Sem.-1) | Physics | Thermal Physics | 100 | 168 |
| | | Chemistry | Organic Chemistry | | 171 |
| | | Botany | Biomolecules and Plant Molecular Biology | | 173 |
| | | Zoology | Comparative Anatomy, Evolution, Distribution and Taxonomy | | 174 |
| | | Mathematics | Partial Differential Equation & Systems of Ordinary Differential Equation | | 176 |
| 4 | **CC-8**<br><br>(Course / Paper from same subject selected as CC subject in Sem.-1) | Physics | Quantum Mechanics and Applications | 100 | 178 |
| | | Chemistry | Inorganic & Organic Chemistry | | 182 |
| | | Botany | Plant Tissue Organization and Embryology | | 184 |
| | | Zoology | Biochemistry | | 186 |
| | | Mathematics | Object Oriented Programme C++ and Mechanics-II | | 188 |
| 5 | **CPS-2.1** | Education | Pedagogy of School Subject-1; Part-1; (Mathematics / Life Science) (Any one) | 100 | 190 |
| | **CPS-3.1** | | Pedagogy of School Subject-2; Part-1; Physical Science | 100 | 198 |
| | **EPC-2** | | Learning to Function as a Teacher | 50 | 201 |
| **Total** | | | | **650** | |

## Semester V:

### CC 5.1: Mathematical Physics-II

Contact Hours per Week : 4
Credit : 4
Examination Duration : 3 Hours
Maximum Marks : 70 (Terminal-50, Sessional-20)

### Unit 1: Fourier Series:

Periodic functions. Orthogonality of sine and cosine functions, Dirichlet Conditions (Statement only). Expansion of periodic functions in a series of sine and cosine functions and determination of Fourier coefficients. Expansion of functions with arbitrary period. Expansion of non-periodic functions over an interval. Even and odd functions and their Fourier expansions. Summing of Infinite Series. Term-by-Term differentiation and integration of Fourier Series. Parseval Identity. Complex representation of Fourier seriesGeneralized Fourier Series and the Dirac Delta function and its properties.

### Unit 2: Special Functions in Mathematical Physics:

Singular Points of Second Order Linear Differential Equations and their importance. Frobenius method and its applications to differential equations. Legendre, Bessel, Hermite and Laguerre Differential Equations. Properties of Legendre Polynomials: Rodrigues Formula, Generating Function, Orthogonality. Simple recurrence relations. Expansion of function in a series of Legendre Polynomials. Bessel Functions of the First Kind: Generating Function, simple recurrence relations. Zeros of Bessel Functions $(J_0(x)$ and $J_1(x))$ and Orthogonality. Hermite functions.

### Unit 3: Some Special Integrals:

Beta and Gamma Functions and Relation between them. Expression of Integrals in terms of Gamma Functions.

### Unit 4: Partial Differential Equations:

Classification of PDEs. Some examples of PDEs. Solution of PDEs with separation of variables and eigenfunctions. Boundary and initial conditions – vibration of a string. Laplace's equation and its solution in Cartesian, spherical polar with axially symmetric coordinate system and cylindrical polar with infinite cylinder coordinate system. Solution of 1- D and 2 –D wave equations. Solution of heat conduction equation in 1-D.

### Suggested Books:

1. Mathematical Methods for Physicists, G.B. Arfken, H.J. Weber, F.E. Harris, 2013,7thEd., Elsevier.
2. An introduction to ordinary differential equations, E.A. Coddington, 2009, PHI learning.
3. Differential Equations, George F. Simmons, 2007, McGraw Hill.
4. Mathematical methods for Scientists and Engineers, D.A. Mc Quarrie, 2003, Viva Book.
5. Advanced Engineering Mathematics, Erwin Kreyszig, 2008, Wiley India.
6. Essential Mathematical Methods, K.F.Riley&M.P.Hobson, 2011, Cambridge Univ. Press.
7. Mathematical Physics –C. Harper, (Prentice Hall India) 2006.
8. Mathematical Method for Physical Sciences - M. L. Boas (Wiley India) 200

**CC 5.2: Practical**

| | | |
|---|---|---|
| Contact Hours Per Week | : | 2 |
| Examination Duration | : | 3 Hours |
| Maximum Marks | : | 30 ( Expt-20, Viva-5, Record-5) |

The aim of this Lab is not just to teach computer programming and numerical analysis but to emphasize its role in solving problems in Physics. FORTRAN, C, $C^{++}$ or Python may be used for the analysis.

1. Solution of differential (ODE) using Euler's method
2. Solution of differential (ODE) using $4^{th}$ order Runge-Kutta method
3. Solution of differential (ODE) using $4^{th}$ order Runge-Kutta method for initial value problem.
4. Solution of differential (ODE) using Finite difference method
5. Solution of wave equation: $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$, with initial conditions $u(x,0) = \sin\frac{\pi x}{2}, u_t(x,0) = \cos\frac{\pi x}{2}$, and boundary conditions $u(0,t) = t, u(5,t) = 2t + 0.5$.
6. Solution of Poisson equation: $\nabla^2 u = 5x^2 + y^2$, with boundary conditions $u(0,y) = y^2 + 2, u(1,y) = y - 3, u(x,0) = 2x, u(x,2) = x + 5$, taking $h = 0.10, k = 0.5$.
7. Determination of eigenvalue of a 2x2 matrix. $A = \begin{pmatrix} 2 & 3 \\ 0 & 1 \end{pmatrix}$

**Suggested Books:**

1. Introduction to Numerical Analysis, S.S. Sastry, $5^{th}$Edn. , 2012, PHI Learning Pvt. Ltd.
2. Schaum's Outline of Programming with C++. J. Hubbard, 2000, McGraw-Hill Pub.
3. Numerical Recipes in C: The Art of Scientific Computing, W.H. Pressetal, $3^{rd}$Edn.2007, Cambridge University Press.
4. A first course in Numerical Methods, U.M. Ascher & C. Greif, 2012, PHI Learning.
5. Elementary Numerical Analysis, K.E. Atkinson, $3^{rd}$Edn., 2007, Wiley India Edition.
6. Numerical Methods for Scientists & Engineers, R.W. Hamming, 1973, Courier Dover Pub.
7. An Introduction to computational Physics, T. Pang, $2^{nd}$ Edn., 2006, Cambridge Univ. Press.

## CC 5.1: Inorganic Chemistry

Contact Hours per Week : 4
Credit : 4
Examination Duration : 3 Hours
Maximum Marks : 70 (Terminal-50, Sessional-20)

## CC 5.1: Inorganic Chemistry

### Unit 1:

#### Compounds of s and p Block Elements

Complex formation tendency of s and p block elements. Hydrides and their classification-ionic, covalent and interstitial. Basic beryllium acetate and nitrate.

Study of the following compounds with emphasis on structure, bonding, preparation, properties and uses.

Boric acid and borates, boron nitrides, borohydrides (diborane) carboranes and graphitic compounds, silanes, Oxides and oxyacids of nitrogen. interhalogen compounds, polyhalide ions, pseudohalogens and basic properties of halogens.

Structure, bonding and their important properties like oxidation/reduction, acidic/basic nature of the following compounds and their applications in industrial, organic and environmental chemistry.

Hydrides of nitrogen ($NH_3$, $N_2H_4$, $N_3H$, $NH_2OH$)

Oxoacids of P, S and Cl.

Halides and oxyhalides: $PCl_3$, $PCl_5$, $SOCl_2$ and $SO_2Cl_2$.

### Unit 2:

#### Chemical bonding-II:

a) Covalent bonding, valence bond and molecular orbital approaches, LCAO-MO treatment of $H_2^+$. Qualitative extension to $H_2$. Comparison of LCAO-MO and VB treatments of $H_2$ (only wavefunctions, detailed solution not required) and their limitations. Refinements of the two approaches (Configuration Interaction for MO, ionic terms in VB). Qualitative description of LCAO-MO treatment of heteronuclear diatomic molecules (HF, LiH, CO, NO and $NO^+$). Localised and non-localised molecular orbitals treatment of triatomic ($BeH_2$, $H_2O$) molecules. Qualitative MO theory and its application to $AH_2$ type molecules.

b) i) Metallic Bond: Electron-gas thory, valency bond theory and band theory. Semiconductors and insulators, defects in solids.

   ii) Weak Chemical Forces: van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions. Repulsive forces, Hydrogen bonding (theories of hydrogen bonding, valence bond treatment) Effects of chemical force, melting and boiling points, solubility energetics of dissolution process.

**Unit 3:**

### Chemistry of transition metals- II

Chemistry of Ti (+2 and +4), V (+3 and +5), Cr, Mn (+2, +4 and +7), Fe (+2 and +3)and Co in various oxidation states (excluding their metallurgy)

**Unit 4:**

a) **Chemistry of Lanthanides and Actinides:** Electronic configuration, oxidation states, colour, spectral and magnetic properties, lanthanide contraction, separation of lanthanides (ion-exchange method only).

b) **Noble gases:** Occurrence and uses, rationalization of inertness of noble gases, Clathrates; preparation and properties of $XeF_2$, $XeF_4$ and $XeF_6$; Nature of bonding in noble gas compounds (Valence bond treatment and MO treatment for $XeF_2$). Molecular shapes of noble gas compounds (VSEPR theory).

CC 5.2: Practical

Conctact Hours Per Week     :    2
Examination Duration        :    3 Hours
MaximumMarks                :    30 ( Expt-20, Viva-5, Record-5)

A)    Iodometry and Iodimetry
      i)     Estimation of available chlorine in bleaching powder iodometrically.
      ii)    Estimation of copper using thiosulphate.

B)    Inorganic preparations
      i)     Cuprous Chloride, $Cu_2Cl_2/Cu_2I_2$

      ii)    Preparation of Manganese(III) phosphate, $MnPO_4.H_2O$
      iii)   Preparation of Aluminium potassium sulphate $K_2SO_4Al_2(SO_4)2.24H_2O$
             (Potash alum).
      iv)    Pot. Trioxalate Chromate (III)
      v)     Tetracupric ammonium sulphate
      vi)    Preparation of cis and trans $[Co(en)_2Cl_2]^+$

## Semester V

### CC 5.1 Taxonomy of Angiosperms

Contact Hour Per Week: 4
Credits: 4
Examination duration: 3 Hours
Maximum marks: 70 (Terminal- 50, Sessional- 20)

### Unit I

Concepts of Taxonomy: Definition of classical, formal, α- & β- taxonomy, orthodox; phases of taxonomy .Characters: Synthetic, Analytical, Good/Bad, Qualitative, Quantitative characters, Morphological characters [habit, habitat, root, stem, leaves (2 periods)], and Reproductive characters of plants [inflorescence types, flowers: calyx, corolla, androecium, gynoecium, fruits, seeds (8 periods)].

### Unit II

Plant Families -Systematic position, salient features and economic importance of the following families Magnoliaceae, Ranunculaceae, Cruciferae, Leguminosae (including 3 subfamilies), Cucurbitaceae, Umbelliferae, Rubiaceae, Compositae, Apocynaceae, Solanaceae, Acanthaceae ,

Scrophulariaceae, Labiatae, Verbenaceae, Amaranthaceae, Euphorbiaceae, Orchidaceae, Musaceae, Zingiberaceae, Liliaceae, Palmae, Gramineae.

### Unit III

Herbarium and Botanic Garden:

Plant collection, drying, mounting, poisoning, preservation, importance of herbarium in taxonomic study. Important herbaria in India and World .Importance of Botanic Garden in taxonomic study; Name of some important Botanic Gardens of India and World;Data sources for taxonomic works:Anatomy, Palynology, Plant chemistry, Cytology, Molecular data (over view)

### Unit IV

Phenetics: Principle, Method (OTUs, attributes, cluster data analysis, dendrogram, phenon).

## CC 5.2: PRACTICAL

Contact Hour Per Week: 2
Examination duration: 3 Hours
Maximum marks: 30 (Exp. 20, Viva-5, Record-5)

- Study of vegetative and floral characters of the following families (Description, V.S.flower, section of ovary, floral diagram/s, floral formula/e and systematic position according to Bentham & Hooker's system of classification):
- Brassicaceae - *Brassica*
- Umbelliferae - *Coriandrum /Anethum / Foeniculum*
- Solanaceae - *Solanum nigrum*
- Lamiaceae - *Leucas*
- Euphorbiaceae - *Euphorbia hirta/E.milii, Jatropha*
- Poaceae - *Triticum/Hordeum/Avena*
- Alismataceae- *Satittaria/Alisma*
- Field visit (local) – Subject to grant of funds from the university.
- Mounting of a properly dried and pressed specimen of any wild plant with herbarium label(to be submitted in the record book)

### Reference Books

1) Datta, S. C. 1988. Systematic Botany. Wiley Eastern Limited, New Delhi.
2) Davis, P. H. and Heywood, V. H. 1963. Principles of Angiosperm Taxonomy. Princeton, NJ: Van Nostrand.
3) Judd, W. S., Campbell, C. S., Kellogg, E. A., Stevens, P. F., Donoghue, M. J. 2008. Plant Systematics – A Phylogenetic Approach. Sinauer Assoociates, Inc., Sunderland, Massachusetts USA.
4) Lawrence, G. H. M. 1964. Taxonomy of Vascular Plants. Oxford & IBH Publishers, Calcutta.
5) Naik, V. N. 1984. Taxonomy of Angiosperms. Tata McGraw-Hill Publishing Company Limited, New Delhi.
6) Radford, A. E. 1986. Fundamentals of Plant Systematics. Harper & Row, London.
7) Simpson, M. G. 2010. Plant Systematics. Elsevier Academic Press, Amsterdam.
8) Singh, G. 2012. Plant Systematics – Theory and Practice. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
9) Stuessy, T. F. 2008. Plant Taxonomy – The Systematic Evaluation of Comparative Data. Columbia University press, New York.

## CC 5.1: Cell biology

Contact Hour per Week : 4
Credits : 4
Examination duration : 3 Hours
Maximum marks : 70 (Terminal- 50, Sessional- 20)

### Unit 1:

### Cell, types and membrane transport

- Gene creatures: Cell - types, structure and examples.
- Plasma membrane: composition and structural organization.
- Types of trans-membrane transport of ions and small molecules, role of different proteins.
- Cell junctions and cell adhesion molecules.

### Unit 2:

### Cell organelles

- Endo-membrane system (endoplasmic reticulum, Golgi apparatus, lysosome).
- Structure and function of mitochondria: oxidative phosphorylation.
- Peroxisome, ribosome and plastid: structure, types and function.

### Unit 3:

### Cytoskeleton and chromosomes

- Cytoskeleton: microtubules, microfilaments and intermediate filaments.
- Chromosomes of *E. coli and* eukaryotes: ultrastructure, types, chemical composition.
- Euchromatin and heterochromatin.

### Unit 4:

### Cell Division and cell death

- Cell cycle: regulation and checkpoints.
- Biology of Cancer: types, causes annd role of different genes in oncogenesis.
- Types of cell death with special emphasis on apoptosis.

**CC 5.2: Practical**

| | | |
|---|---|---|
| Contact Hour Per Week | : | 2 |
| Examination duration | : | 3 Hours |
| Maximum marks | : | 30 |

- Study of various stages of meiosis of grasshopper (in permanent slides).

- Temporary squash preparation of grasshopper testis.
- Study of Barr body in human squamous epithelial cells from buccal cavity.
- Gram staining technique for visualization of prokaryotic cells.
- Preparation of metaphase plate from rat bone marrow.
- Sessional activities.

**Reference Books (names only):**

1. Cell and Molecular Biology: Concepts and Experiments by Karp, 7th edition.
2. The cell: A Molecular Approach by Cooper and Hausman, 5th edition.
3. The World of Cell by Becker et al., 8th edition.
4. Molecular Cell biology by Lodish et al., 8th edition.
5. Molecular Biology of the Cell by Alberts et al., 5th edition.
6. Lewin's Cells by Plopper et al., 3rd edition.

## Semester - V

### CC 5.1: Differential equation-II and Mechanics I

| | |
|---|---|
| Contact Hours per Week | : 4 |
| Credit | : 4 |
| Examination Duration | : 3 Hours |
| Maximum Marks | : 70 (Terminal-50, Sessional-20) |

**Unit 1 :**

Power series solutions of second order differential equations. Legendre Equation and Legendre Polynomial, Power series solution about regular singular points by Frobenius method, Bessel's equation and Bessel function. Properties of Bessel function.

**Unit 2 :**

Laplace transforms, Inverse Laplace transform, Convolution theorem. Its applications to the solutions of ordinary differential equations.

**Unit3:Kinematics of a particle :**

Velocity, acceleration, angular velocity, linear and angular momentum. Relative velocity and acceleration. Expressions for velocity and acceleration in case of rectilinear motion and planar motion - in Cartesian and polar co-ordinates, tangential and normal components. Uniform circular motion.

**Newton laws of motion and law of gravitation :**

Space, time, mass, force, inertial reference frame, principle of equivalence and g. Vector equation of motion.

Work, power, kinetic energy, conservative forces - potential energy. Existence of potential energy func-tion. Energy conservation in a conservative field. Stable equilibrium and small oscillations: Approximate equation of motion for small oscillation. Impulsive forces

**Unit-4:Problems in particle dynamics :**

Rectilinear motion in a given force field - vertical motion under uniform gravity, inverse square field, constrained rectilinear motion, vertical motion under gravity in a resisting medium, simple harmonic motion, Damped and forced oscillations, resonance of an oscillating system, motion of elastic strings and springs.

**Planar motion of a particle :**

Motion of a projectile in a resisting medium under gravity, orbits in a central force field, Stability of nearly circular orbits. Motion under the attractive inverse square law, Kepler's laws on planetary motion.

## CC 5.2: PRACTICAL

Contact Hours Per Week    :    2
Examination Duration      :    3 Hours
Maximum Marks             :    30 ( Expt-20, Viva-5, Record-5)

Application of Laplace transforms.

Use of Legendre Polynomials / Bessel functions,
Simple Harmonic Oscillations in real situations, damped, forced vibration, resonance.

### Reference books:

1. D A Murray : Introductory Course in Differential Equations ( Orient Longman )
2. G F Simmons : Differential Equation (Tata – McGrow Hill )
3. H T H Piaggio : Elementary Treatise in DE ( C B S )
4. Gregory R D : Classical Mechanics
5. Synge J L & Griffith B A : Principle of Mechanics ( McGraw Hill )
6. Loney S L : An elementary treatise on dynamics of particl ( Loney Press )

## CC 6.1: Classical Mechanics

Contact Hours per Week : 4
Credit : 4
Examination Duration : 3 Hours
Maximum Marks : 70 (Terminal-50, Sessional-20)

### Unit 1 : Rotating Frame system:

Rotating frame of reference, Inertial & Coriolis force, Mechanics of a system of Particle, Conservation of linear momemtum, angular momentum & energy, Constraints: holonomic & non-holonomic, Degrees of Freedom, Generalised coordinates & velocities.

### Unit 2 : Lagrangian and Hamiltonian formulation:

Principle of virtual work, D'Alembert principle, & derivation of and Euler-Lagrange equation.Hamilton's Principle, Lagrangian, Cyclic coordinate & conservation theorem, Simple applications of Lagrangian formulation (Atwood machine, simple pendulum.Canonical momenta & Hamiltonian.Hamilton's equations of motion. Applications: Hamiltonian for a harmonic oscillator.

### Unit 3 : Central Force Problems:

Central force & its characteristics.Lagrangian approach to study two-body central force problem and reduction to equivalent one-body problem, Inverse square law and different forms of orbit. Deduction of Kepler's laws of planetary motion. Rutherford scattering cross section.

### Unit 4 : Special Theory of Relativity:

Postulates of Special Theory of Relativity. Lorentz Transformations.Minkowski space. The invariant interval, light cone and world lines. Space-time diagrams. Time-dilation, length contraction & twin paradox. Four-vectors: space-like, time-like &light-like. Four-velocity and acceleration.Metric and alternating tensors.Four-momentum and energy-momentum relation. Doppler effect from a four-vector perspective. Concept of four-force.Conservation of four-momentum.Relativistic kinematics.

### Suggested Books:

1. Classical Mechanics, H. Goldstein, C.P. Poole, J.L. Safko, 3$^{rd}$Edn. 2002, Pearson Education.
2. Mechanics, L. D. Landau and E. M. Lifshitz, 1976, Pergamon.
3. Classical Mechanics-J.C. Upadhyay (Himalaya Publication) 2014
4. Classical Dynamics of Particles and Systems – S.T. Thornton (Cengage Learning) 2012
5. Introduction to Classical Mechanics- R.K. Takwale, S.Puranik(Tata McGraw Hill)
6. Classical Mechanics-M. Das, P.K. Jena, M. Bhuyan, R.N. Mishra (SrikrishnaPrakashan)

## CC 6.2: Practical

Contact Hours Per Week   :   2
Examination Duration    :   3 Hours
Maximum Marks         :   30 ( Expt-20, Viva-5, Record-5)

### Use FORTRAN/C/C++/Scilab/Python for solving the following problems based on Classical Mechanics like

1. Simulate the motion of a damped harmonic oscillator and draw the phase trajectory.
2. Simulate the motion of aanharmonic oscillator.
3. Simulate the motion of a satellite using half-step method.
4. Simulate the Torsional Pendulum: $\frac{d^2\theta}{dt^2} = -\frac{C}{I}\theta$.
5. For the circular orbits, velocity of a satellite is given by $v^2 = \frac{GM}{R}$ . Develop a program to find the time period of the orbit, and check if it satisfy the Kepler's third law.
6. Study when pendulums become chaotic: Free pendulum oscillations, visualization of phase space orbits, chaos in phase space.
7. Simulate the double pendulum without small-angle approximation.

### Suggested Books:

1. Computational Physics: Problem Solving with Computers, 3<sup>rd</sup> Edition, R.H. Landau, M.J. Paez and C.C. Bordeianu, 2007, Willey-VCH Verlag GmbH & Co. KGaA.
2. Computer Simulation in Physics, 2004, R.C. Verma, Anamaya Publishers, New Delhi.

## CC 6.1: Physical Chemistry

Contact Hours per Week : 4
Credit : 4
Examination Duration : 3 Hours
Maximum Marks : 70 (Terminal-50, Sessional-20)

### Unit 1:

#### a) Second law of Thermodynamics

Second Law: Concept of entropy; thermodynamic scale of temperature, statement of the second law of thermodynamics; molecular and statistical interpretation of entropy. Calculation of entropy change for reversible and irreversible processes.

Free Energy Functions: Gibbs and Helmholtz energy; variation of S, G, A with T, V, P; Free energy change and spontaneity. Relation between Joule-Thomson coefficient and other thermodynamic parameters; inversion temperature; Gibbs-Helmholtz equation; Maxwell 17 relations; thermodynamic equation of state.

#### b) Systems of variable compositions

Partial molar quantities, dependence of thermodynamic parameters on composition; Gibbs-Duhem equation, chemical potential of ideal mixtures, change in thermodynamic functions in mixing of ideal gases. **(15 Lectures)**

### Unit 2:

#### Principle Molecular spectroscopy-I

Interaction of electromagnetic radiation with molecules and various types of spectra; Born-Oppenheimer approximation.

Rotation spectroscopy: Selection rules, intensities of spectral lines, determination of bondlengths of diatomic and linear triatomic molecules, isotopic substitution.

Vibrational spectroscopy: Classical equation of vibration, computation of force constant,amplitude of diatomic molecular vibrations, anharmonicity, Morse potential, dissociationenergies, fundamental frequencies, overtones, hot bands, degrees of freedom for polyatomicmolecules, modes of vibration, concept of group frequencies.

Vibration-rotationectroscopy: diatomic vibrating rotator, P, Q, R branches.

Raman spectroscopy: Qualitative treatment of Rotational Raman effect; Effect of nuclearspin, Vibrational Raman spectra, Stokes and anti-Stokes lines; their intensity difference, ruleof mutual exclusion.

Electronic spectroscopy: Franck-Condon principle, electronic transitions, singlet and tripletstates, fluorescence and phosphorescence, dissociation and predissociation, calculation ofelectronic transitions of polyenes using free electron model.

## Unit 3:

### Spectroscopy of Organic Molecules-I

General principles Introduction to absorption and emission spectroscopy.

*UV Spectroscopy:* Types of electronic transitions, $\lambda$ max, Chromophores and Auxochromes, Bathochromic and Hypsochromic shifts, Intensity of absorption; Application of Woodward Rules for calculation of $\lambda_{max}$ of the following compounds: Conjugated dienes: acyclic and alicyclic, homoannular and heteroannular; Extended conjugated systems (aldehydes, ketones and dienes); distinction between cis and trans isomers.

*IR Spectroscopy:* Fundamental and non-fundamental molecular vibrations; IR absorption positions of O, N and S containing functional groups; Effect of H-bonding, conjugation, resonance and ring size on IR absorptions; Fingerprint region and its significance; application in functional group analysis.

## Unit 4:

### Chemical Kinetics II

(i) Opposing reactions (ii) parallel reactions and (iii) consecutive reactions and their differential rate equations (steady-state approximation in reaction mechanisms) (iv) chain reactions.

Temperature dependence of reaction rates; Arrhenius equation; activation energy. Collision theory of reaction rates, Lindemann mechanism, qualitative treatment of the theory of absolute reaction rates.

**CC 6.2: Practical**

Conctact Hours Per Week : 2
Examination Duration : 3 Hours
Maximum Marks : 30 ( Expt-20, Viva-5, Record-5)

1. **Surface tension measurements.**

   a. Determine the surface tension by (i) drop number (ii) drop weight method.

   b. Study the variation of surface tension of detergent solutions (SDS) with concentration.

2. **Viscosity measurement using Ostwald's viscometer.**

   a. Determination of viscosity of aqueous solutions of (i) polymer (polyvinyl alcohol) (ii) ethanol and (iii) sugar at room temperature.

   b. Study the variation of viscosity of sucrose solution with the concentration of solute.

3. **pH metry**

   a. Study the effect on pH of addition of HCl/NaOH to solutions of acetic acid, sodium acetate and their mixtures.

   b. Preparation of buffer solutions of different pH. Sodium acetate-acetic acid ii. Ammonium chloride-ammonium hydroxide, (iii) Sodium dihydrogen phosphate, (iv) disodium monohydrogen phosphate)

   c. Determination of dissociation constant of a weak acid.

## CC6.1: Economic Botany

Contact Hour Per Week: 4
Credits: 4
Examination duration: 3 Hours
Maximum marks: 70 (Terminal- 50, Sessional- 20)

**Unit 1 :**

**Origin of Cultivated Plants:** Concept of Centers of Origin, their importance with reference to Vavilov's work. Examples of major plant introductions; Crop domestication and loss of genetic diversity; evolution of new crops/varieties, importance of germplasm diversity.

**Unit 2 :**

**Cereals :**Wheat and Rice (origin, morphology, processing & uses), brief account of millets.**Legumes:** General account, importance to man and ecosystem. **Sugars & Starches:** Morphology and processing of sugarcane, products and by-products of sugarcane industry. Potato – morphology, propagation & uses.

**Unit 3 :**

**Spices:** Listing of important spices, their family and part used, economic importance with specialreference to fennel, saffron, clove and black pepper. **Beverages:** Tea, Coffee (morphology, processing & uses).Drug yielding plants –*Dioscoria, Rawolfia*

**Unit 4 :**

**Timber yielding plants :**General account with special reference to teak and pine. **Tobacco:** Tobacco (Morphology, processing, uses and health hazards). **Fibres:** Classification based on the origin of fibres, Cotton and Jute (morphology, extraction and uses).

## CC6.2: Practical

Contact Hour Per Week: 2
Examination duration :  3 Hours
Maximum marks: 30 (Exp. 20, Viva-5, Record-5)

i.      Cereals: Wheat (habit sketch, study of paddy and grain, starch grains, micro-chemical tests).
ii.     Legumes: Soya bean (habit, fruit, seed structure, micro-chemical tests).
iii.    Sugars & Starches: Sugarcane (habit sketch; cane juice- micro-chemical tests),Potato(habit sketch, tuber morphology, T.S. tuber to show localization of starchgrains, w.m. starch grains, micro-chemical tests).
iv.     Spices: Black pepper, Fennel and Clove (habit and sections).
v.      Beverages: Tea (plant specimen, tea leaves), Coffee (plant specimen, beans).
vi.     Oils & Fats: Coconut- T.S. nut, Mustard—plant specimen, seeds; tests for fats incrushedseeds.
vii.    Essential oil-yielding plants: Habit sketch of*Rosa, Vetiveria, Santalum* and *Eucalyptus*(specimens/photographs).
viii.   Drug-yielding plants: Specimens of *Digitalis, Papaver*and*Cannabis.*
ix.     Tobacco: specimen and products of Tobacco.
x.      Woods: Tectona, Pinus: Specimen, Section of young stem.

xi.     Fibre-yielding plants: Cotton (specimen, whole mount of seed to show lint andfuzz;whole mount of fibre and test for cellulose), Coir (specimen, transverse sectionof stem, test for lignin on transverse section of stem and fibre).

### Reference Books :

1.      Kochhar, S.L. 2011. Economic Botany in the Tropics, MacMillan Publishers India Ltd., New Delhi.4th edition.

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## CC 6.1: Genetics

Contact Hour per Week : 4
Credits : 4
Examination duration : 3 Hours
Maximum marks : 70 (Terminal- 50, Sessional- 20)

### Unit 1:
### Mendelian and non-Mendelian inheritances

- Mendelian principles of inheritance and their exceptions.
- Monohybrid and dihybrid crosses; back cross and test cross.
- Phenomena of dominance, incomplete dominance, codominance, overdominance, pleiotropy and genetic heterogeneity.
- Principles and examples of non-Mendelian Inheritance.
- Gene interactions: epistasis, supplementary gene, duplicate gene, collaborator gene, lethal gene.
- Complementation test (with reference to Benzer's r-II locus).

### Unit 2:
### Multiple alleles and chromosomal mutation

- Multiple alleles: characteristics with examples [ABO blood groups in human and eye colour in *Drosophila*]
- Polygenic inheritance with examples.
- Mutations: classification based on different criteria, significance of mutation, detection procedures of mutations in *Drosophila*, mutagens and their classification.
- Chromosomal mutations: structural changes (deletion, duplication, inversion and translocation); numerical changes (euploidy and aneuploidy).

### Unit 3:
### Linkage and crossing over

- Linkage and crossing over: types, mechanism and significance; cytological basis of crossing over.
- Mapping of chromosome: construction of linkage map by three-point test cross; interference and coincidence, cytogenetic mapping and physical mapping.

### Unit 4:
### Sex determination and sex linked inheritance

- Sex determination [human and Drosophila]: genetic, environmental and hormonal control.
- Dosage compensation methods: hyperactivation (*Drosophila*), hypoactivation (*C. elegans*) and X-chromosome inactivation (human).
- Inheritance pattern: sex-linked; sex-influenced, sex-limited genes.
- Human genetic disorders/syndromes: due to structural and numerical aberrations of chromosomes [Turner's syndrome, Klinefelter's syndrome, Down's syndrome, Edward's syndrome, Patau's Syndrome, Cri-du-chat syndrome, Philadelphia disease (CML)].

**CC 6.2: Practical**

Contact Hour Per Week : 2
Examination duration : 3 Hours
Maximum marks : 30

- Pedigree analysis.
- Culture of *Drosophila* – study of life cycle of *Drosophila*.
- Study of mutants of *Drosophila* with reference to their various contrasting characters and comparison with normal flies.
- Temporary preparation of polytene chromosome from salivary gland of *Drosophila* larvae.
- Study of human karyotype and ideogram.
- Problems related to monohybrid, dihybrid genetic interactions, haemophilia, colour blindness.
- Sessional activities.

**Reference Books (names only):**

1. Principles of Genetics by Brooker, 5th edition.
2. Genetics by Hartwell et al., 5th edition.
3. Genetics by Hartl and Jones, 5th edition.
4. Concepts of Genetics by Klug and Cummings, 10th edition.
5. iGenetics by Russell, 3rd edition.
6. Genetics by Pierce, 5th edition.
7. Genetics by Snustad by Simmons, 7th edition.
8. Genetics by Tamarin, 7th edition.

## CC 6.1 : ABSTRACT ALGEBRA

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|---|---|
| Contact Hours per Week | : 4 |
| Credit | : 4 |
| Examination Duration | : 3 Hours |
| Maximum Marks | : 70 (Terminal-50, Sessional-20) |

**Unit1 :**

Binary operation on set, Algebraic Structure, Introduction to groups, Abelian group, Definition and general properties of with some example, Additive and multiplicative modulo m,Finite groups , Complex and subgroups- terminology and notation, Lagrange's theorem and its application.

**Unit2 :**

Cyclic groups- Properties of cyclic groups, classification of subgroups of cyclic groups; Permutation group- Definition and notation, Cycle notation, Properties of permutations, even and odd permutations; Isomorphism of groups.

**Unit3 :**

Normal Subgroup, Cosets, Quotient or Factor groups; Group homomorphisms- Definition and examples, Properties of homomorphisms; Fundamental theorem on Group homomorphisms , Cayley's theorem,

**Unit4 :**

Rings- Definition and examples of rings, Elementary properties of rings, subrings; Integral domains- Definition and examples, Fields, Characteristic of a ring; Ideals and Quotient rings- Definitions and examples, Homomorphisms

**CC 6.2 :PRACTICAL**

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|---|---|---|
| Contact Hours Per Week | : | 2 |
| Examination Duration | : | 3 Hours |
| Maximum Marks | : | 30 ( Expt-20, Viva-5, Record-5) |

1. Read permutation group, rotation group, dihedral group in details.
2. Study of group in details.
3. Rind, Field , Integral domain relation
4. Ideals and application
5. Homomorphisms and its application in group and ring

**Reference books:**

1. I.N. Herstein, Topics in Algebra, Wiley Eastern Limited, 2nd Edition
   Joseph A. Gallian, Contemporary Abstract Algebra(7th Edn.), Narosa
   Publishing House, New Delhi
2. John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.
3. M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011.
4. A Course in Abstarct Algebra, Bhambri& Khanna, Vikas Publishing House
   PVT LTD.

## CC 7.1: Thermal Physics

Contact Hours per Week : 4
Credit : 4
Examination Duration : 3 Hours
Maximum Marks : 70 (Terminal-50, Sessional-20)

### Unit 1: Introduction to Thermodynamics:

Recapitulation of Zeroth and First law of thermodynamics: Second Law of Thermodynamics: Reversible and Irreversible process with examples. Second law & Entropy, Concept of Entropy, Clausius Theorem. Clausius Inequality, Second Law of Thermodynamics in terms of Entropy. Entropy of a perfect gas. Principle of Increase of Entropy. Entropy Changes in Reversible and Irreversible processes with examples. Temperature–Entropy diagrams for Carnot's Cycle. Third Law of Thermodynamics. Unattainability of Absolute Zero.

### Unit 2: Thermodynamic Potentials and Maxwell's Thermodynamic Relations:

Extensive and Intensive Thermodynamic Variables. Thermodynamic Potentials: Internal Energy, Enthalpy, Helmholtz Free Energy, Gibb's Free Energy. Their Definitions, Properties and Applications. Magnetic Work, Cooling due to adiabatic demagnetization, first and second order Phase Transitions with examples, ClausiusClapeyron Equation and Ehrenfest equations

Derivations and applications of Maxwell's Relations, Maxwell's Relations:(1) ClausiusClapeyron equation, (2) Values of Cp-Cv, (3) Tds Equations, (4) Change of Temperature during Adiabatic Process.

### Unit 3 : Kinetic Theory of Gases:

Derivation of Maxwell's law of distribution of velocities and its experimental verification, Mean free path (Zeroth Order), Law of equipartition of energy (no derivation) and its applications to specific heat of gases; mono-atomic and diatomic gases.

**Real Gases:**

Bahaviour of Real Gases: Derivations from the Ideal Gas equation, Andrew's Experiments on $CO_2$, Critical Constants, Free Adiabatic Expansion of a perfect Gas, Joule-Thomson cooling.

### Unit 4 : Theory of Radiation:

Blackbody radiation, Spectral distribution, Concept of Energy Density, Derivation of Planck's law, Deduction of Wien's distribution law, Rayleigh-Jeans Law, Ultraviolet Catstrophe, Stefan Boltzmann Law and Wien's displacement law from Planck's law.

**Suggested Books:**

1. Heat & Thermodynamics, M.W. Zemansky, Richard Dittman, 1981, McGraw-Hill.
2. A Treatise on Heat, MeghnadSaha, and B.N. Srivastava, 1958, Indian Press
3. Thermal Physics, S. Garg, R. Bansal & Ghosh, 2nd Ed., 1993, Tata McGraw-Hill
4. Heat and Thermal Physics- Brijlal&Subramaiam (S. Chand Publication) 2014
5. Thermal Physics-- C. Kittel and H. Kroemer (McMillan Education India) 2010.

**CC 7.2: Practicals**

| | | |
|---|---|---|
| Contact Hours Per Week | : | 2 |
| Examination Duration | : | 3 Hours |
| Maximum Marks | : | 30 ( Expt-20, Viva-5, Record-5) |

1. To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method.
2. To determine the coefficient of thermal conductivity of a bad conductor by Lee and Charlton's disc method.
3. To determine the temperature co-efficient of resistance using meter bridge.
4. To study the variation of thermo-emf across two junctions of a thermocouple with temperature.
5. To calibrate Resistance Temperature Device (RTD) using Null Method/Off-Balance Bridge
6. To determine Stefan's Constant.
7. To determine the coefficient of thermal conductivity of copper by Searle's Apparatus.
8. To determine the Coefficient of Thermal Conductivity of Cu by Angstrom's Method.

**Suggested Books:**

1. Advanced Practical Physics: Vol-I &II, B. Ghosh and K.G. Mazumdar, 2004, Sreedhar Publishers, Kolkata.
2. Advanced Course in Practical Physics, D. Chattopadhyay and P.C. Rakshit, 2015, Central, Kolkata.
3. Advanced Practical Physics for Students, B. L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
4. A Complete Course in Degree Practical Physics, B.B. Swain, 2016, Kalyani Publishers.

## CC 7.1: Organic Chemistry

Contact Hours per Week : 4
Credit : 4
Examination Duration : 3 Hours
Maximum Marks : 70 (Terminal-50, Sessional-20)

### Unit 1:
### Types of organic reactions

Types of organic reactions and their mechanism (SN1 and SN2) SE- substitution, addition ($ad_N$ and $ad_E$, elimination ( $E_1$, $E_2$, $E_{1CB}$),(electrophilic and nucleophilic) reactions.Oxidation (oxidation of aldehydes, Bayer-Villiger's oxidation of ketones), reduction (MPV, $LiAlH_4$, $NaBH_4$, PDC and PCC) and rearrangement reactions with mechanism- Pinacol-pinacolon, Beckmann, Benzidine and Fries rearrangement.

### Unit 2

**a) Active methylene compounds, Dithiene and enamines**

Acidity of α-Hydrogens, synthesis of ethyl acetoacetate, Claisen condensation, Keto-enol tautomerism of ethyl acetoacetate, synthetic applications of ethyl acetoacetate and diethyl malonate.
Alkylation of 1,3-dithianes, alkylation and acylation of enamines.

**b) Alicyclic compounds**

i) Cycloalkanes, structure, method of formation, chemical reaction, Bayer-strain theory and its limitations, ring strain in small rings.
ii) cycloalkenes: method of preparation and chemical reactions of cyclo alkenes.

### Unit 3

### Nitrogen containing functional groups

Methods of preparations of nitroalkanes and nitroarenes, chemical reactions of nitroalkanes.Mechanism of nucleophilic substitution of nitroarenes and their reductions in acidic,alkaline and neutral medium. Preparation and important reactions of nitriles and isonitriles.

Structure and nomenclature of amines, Physical properties and stereochemistry of amines, structural features affecting basicity of amines, separation of a mixture of primary, secondary and tertiary amines (Hoffman method and Hinsberg method). Preparation of alkyl and aryl amines (reduction of nitrocompounds, nitriles, reductive amination of aldehyde and ketonic compounds, Gabriel Phthalimide reaction, Hoff mann exhaustive methylation, Hoffmann Bromamide reaction, Mannich rection) and nitrous acid test for distinction of primary, secondary and tertiary amines.

Diazonium salts: Preparation and their synthetic applications.

## Unit 4

### Carbohydrates

Classification and their biological importance.

Monosaccharides: Configuration of monosaccharides, structure elucidation and derivation of configurations of glucose and fructose, epimers and anomers, evidences for cyclic structure, mechanism of mutarotation,Cyclic structure of glucose and fructose, Haworth projections and conformation of D-glucose, determination of ring size of glucose, Interconversions of aldoses and ketoses; Killiani-Fischer synthesis and Ruff degradation; mechanism of osazone formation. Formation of glycosides.

Disaccharides – Structure elucidation of sucrose, lactose and maltose.

Polysaccharides – Elementary treatment of starch, cellulose and glycogen.

### CC 7.2: Practical

Conctact Hours Per Week  : 2
Examination Duration      : 3 Hours
Maximum Marks             : 30 ( Expt-20, Viva-5, Record-5)

Preparations of the following compounds
1.  Aspirin, Iodoform, Methyl orange, m-dinitrobenzene, p-nitroacetanilide
2.  Saponification value of an oil.
3.  Determination of Iodine number of an oil.
4.  Preparation of sodium polyacrylate.
5.  Preparation of urea formaldehyde.

## CC7.1: Biomolecules and Plant molecular biology

Contact Hour Per Week: 4
Credits: 4
Examination duration: 3 Hours
Maximum marks: 70 (Terminal- 50, Sessional- 20)

### Unit-1

**Biomolecules:**

Types and significance of chemical bonds; Structure andproperties of water; pH and buffers.

**Carbohydrates:** Nomenclature and classification; Role of monosaccharides(glucose, fructose, sugar alcohols-mannitol and sorbitol); Disaccharides(sucrose, maltose, lactose), Oligosaccharides and polysaccharides(structural-cellulose, hemicelluloses, pectin, chitin, mucilage; storage —starch, insulin)**Proteins:** Structure of amino acids; Peptide bonds; Levels of proteinstructure-primary, secondary, tertiary and quarternary; Isoelectric point;Protein denaturation and biological roles of proteins.

**Lipids:** Definition and major classes of storage and structural lipids. Storagelipids.Fatty acids structure and functions.Essential fatty acids. Triacylglycerols structure, functions and properties.**Nucleic acids:** Structure of nitrogenous bases; Structure and function ofnucleotides; Types of nucleic acids; Structure of A, B, Z types of DNA;Types of RNA; Structure of tRNA.

**Nucleic acids: Carriers of genetic information:** Historical perspective;DNA as the carrier of genetic information (Griffith's, Hershey & Chase,Avery, McLeod & McCarty, Fraenkel-Conrat's experiment.The Structures of DNA and RNA / Genetic Material.

### Unit 2:

**Cell wall and plasma membrane:**Chemistry, structure and function of Plant Cell Wall. Overview ofmembrane function; fluid mosaic model; Chemical composition of membranes; Membrane transport-Passive, active and facilitated transport,endocytosis and exocytosis.**Chloroplast, mitochondria and peroxisomes:** Structural organization;Function; Semiautonomous nature of mitochondria and chloroplast.Endoplasmic Reticulum, Golgi Apparatus, Lysosomes.

3. Esau, K. 1971. Anatomy of Seed Plants. John Wiley and Son, USA.
4. Maheswari, P. 1971. An Introduction to Embryology of Angiosperms. McGraw Hill Book Co., London.

## CC 7.1: Comparative anatomy, evolution, distribution and taxonomy

Contact Hour per Week : 4

Credits : 4

Examination duration : 3 Hours

Maximum marks : 70 (Terminal- 50, Sessional- 20)

### Comparative anatomy:

Unit 1:

#### Integument and circulatory system

- Integument: structure, functions and derivatives (scales, feathers and hair).
- Heart and aortic arches: structural organization and evolution.

Unit 2:

#### Respiratory, nervous and excretory systems

- Respiratory system: gills and accessory respiratory organs in fishes, air sacs in *Columba*.
- Nervous system: comparative account of brain in Amphibia and Mammalia.
- Excretory system: succession of kidney in vertebrates.

### Evolution, distribution and taxonomy:

Unit 3:

#### Evolution

- Synthetic theory of evolution.
- RNA world hypothesis, origin and evolution of life – chemogeny and biogeny.
- Origin and evolution of horse and man.
- Variation and its sources: founder effect and population bottleneck.
- Hardy-Weinberg equilibrium – calculation of allele frequency (at a single locus) and natural forces altering Hardy-Weinberg equilibrium (mutation, migration and genetic drift).
- Selection – stabilizing, directional and disruptive selections. Darwin finches.
- Fossils and fossilization: mechanism, types and radioactive dating.

Unit 4:

#### Distribution

- Zoogeographical realms – ranges, climates and distribution of major vertebrate fauna (birds and mammals).
- Geological time scale: major divisions with time duration, major events, dominant fauna and mass extinction.
- Barriers and dispersals of animals and their role in evolution: discontinuous distribution (Barring strait, corridors and Sweepstake route).
- Isolation: isolating mechanisms and their role in evolution.

Unit 5:

#### Taxonomy

- Species concept: biological and evolutionary species concepts.
- Modes of speciation: allopatric, sympatric and parapatric.
- Zoological nomenclature – type concept, law of priority, Linnaean hierarchy, role of taxonomy.

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### CC7.2: Practical

Contact Hour per Week : 2
Examination duration : 3 Hours
Maximum marks : 30

- Comparative study: skull, limb, vertebrae and girdle bones of fowl and *Canis*.
- Study of fossil evidences from plaster cast models and pictures.
- Study of homology and analogy from specimen/ pictures.
- Construction of cladogram based on morphological characters.
- Study of teeth and skulls: horse, elephant and man showing evolutionary significance ( album preparation).
- Field visit: Indian Museum, Kolkata.
- Sessional Activities

**Reference Books (names only):**
1. Textbook of Zoology, Vol-II, Vertebrates by Parker and Haswell (edited by Marshall and Williams).
2. Vertebrate Life by Pough and McFarland.
3. Life of Vertebrates by Young.
4. Vertebrates: Comparative Anatomy, Function, Evolution by Kardong.
5. Comparative Anatomy of Vertebrates by Kent and Carr.
6. The Vertebrate Body by Romer and Parsons.
7. Analysis of Vertebrate Structure by Hildebrand.
8. Evolution by Futuyama.
9. Evolution by Dobzhansky.
10. Taxonomy by Mayr and Ashlock.
11. Taxonomy by Quicky.
12. Organic Evolution by Lull.
13. Evolution by Moody.

## CC 7.1 : PARTIAL DIFFERENTIAL EQUATIONS & SYSTEMS OF ORDINARY DIFFERENTIAL EQUATIONS

Contact Hours per Week : 4
Credit : 4
Examination Duration : 3 Hours
Maximum Marks : 70 (Terminal-50, Sessional-20)

**Unit1 :**

Systems of Linear Differential Equations: Basic theory of linear systems, Trial solution method for linear system with constant coefficients, Simultaneous linear first order equations in three variables, methods of solution, Pfaffian differential equations, methods of solutions of Pfaffian differential equations in three variables.

**Unit2 :**

Formation of first order partial differential equations, Linear partial differential equations of first order, non linear partial differential equation of first order by Charpit method, special types of first order nonlinear PDE's , Solutions of partial differential equations of first order satisfying given conditions.

**Unit3 :**

Linear partial differential equations with constant coefficients, Equations reducible to linear partial differential equations with constant coefficients, Non linear second order PDE of the the form $R_r + S_s + T_t = V$ by Mongesmethod.

**Unit4 :**

One dimensional wave equation, Solution of the wave equation (method of separation of variables), Diffusion equation, Solution of one-dimensional diffusion equation, Laplace equation, Solution of Laplace equation by separation of variables

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## CC 7.2 : PRACTICAL

Contact Hours Per Week : 2

Examination Duration : 3 Hours

Maximum Marks : 30 ( Expt-20, Viva-5, Record-5)

1. To find the general solution of the non-homogeneous system of the form:

    $\frac{dx}{dt}$ = $a_1x+b_1y+f_1(t)$, $\frac{dy}{dt}$ = $a_2x+b_2y+f_2(t)$ with given condition.

2. Plotting the integral surfaces of a given first order PDE with initial data.

3. Solution of wave equation

    $$\frac{\partial^2 u}{\partial t^2} - c^2 \frac{\partial^2 u}{\partial x^2} = 0$$

   for the following associated conditions:

   $u(x,0) = \varphi(x), u_t(x,0) = \Psi(x), x \in R, t > 0.$

   $u(x,0) = \varphi(x), u_t(x,0) = \Psi(x), u_x(0,t) = 0, x \in (0,\infty), t > 0.$

   $u(x,0) = \varphi(x), u_t(x,0) = \Psi(x), u(0,t) = 0, x \in (0,\infty), t > 0.$

   $u(x,0) = \varphi(x), u_t(x,0) = \Psi(x), u(0,t) = 0, u(1,t) = 0, 0 < x < 1, t > 0.$

4. Solution of diffusion equation $\frac{\partial u}{\partial t} - k^2 \frac{\partial^2 u}{\partial x^2} = 0$ for the following associated conditions:

   (a) $u(x, 0) = \phi(x), u(0, t) = a, u(l, t) = b, 0 < x < l, t > 0.$

   (b) $u(x, 0) = \phi(x), x \in R, 0 < t < T.$

   (c) $u(x, 0) = \phi(x), u(0, t) = a, x \in (0, \infty), t \geq 0.$

## Reference books:

1. J.Sinha Roy and S. Padhy, A Course on Ordinary and Partial Differential Equations, Kalyani Publishers, New Delhi, Ludhiana,

2. TynMyint-U and Lokenath Debnath, Linear Partial Differential Equations for Scientists and Engineers, 4th edition, Springer, Indian reprint, 2006.

3. S.L. Ross, Differential equations, 3rd Ed., John Wiley and Sons, India, 2004.

4. B.V.Ramana, Higher Engineering Mathematics, TMH publication Co.

5. P.P.Gupta and G.S.Malik, Partial Differential Equation.

6. Sankara Rao, Introduction to Differential Equation.

7. T. Amarnath, An Elementary Course on Partial Differential Equation.

## CC 8.1: Quantum Mechanics and Application

Contact Hours per Week : 4
Credit : 4
Examination Duration : 3 Hours
Maximum Marks : 70 (Terminal-50, Sessional-20)

### Unit 1 : Introduction to Quantum Mechanics:

Inadequacy of classical physics: Brief Review of Black body Radiation, Photoelectric effect, Compton effect, dual nature of radiation, wave nature of particles. de Broglie hypothesis, Experimental confirmation of matter wave, Davisson Germer Experiment, velocity of de Broglie wave, wave particle duality, phase velocity and group velocity, wave packets ,Uncertainty Principle, Illustration of the Principle through thought Experiments of electron diffraction through a slit. Time dependent Schrodinger equation and dynamical evolution of a quantum state; Properties of Wave Function.Interpretation of Wave Function Probability and probability current densities in three dimensions; Conditions for Physical Acceptability of Wave Functions.Normalization.Linearity and Superposition Principles.

### Unit 2 : Operator Formalism:

Observables and Operator, Hermitian operator, Eigen values and Eigen functions.Position, momentum and Energy operators; commutator of position and momentum operators; Expectation values of position and momentum. Hamiltonian, stationary states and energy eigen values; expansion of an arbitrary wave function as a linear combination of energy eigen functions; General solution of the time dependent Schrodinger equation in terms of linear combinations of stationary states; Application to spread of Gaussian wave-packet for a free particle in one dimension; wave packets, Fourier transforms and momentum space wave function; Position-momentum uncertainty principle.

### Unit 3 : Schrödinger's Equation in 1D:

General discussion of bound states in an arbitrary potential, continuity of wave function, boundary condition and emergence of discrete energy levels; application to one-dimensional problem-square well potential; Quantum mechanics of simple harmonic oscillator-energy levels and energy Eigen functions ground state, zero point energy & uncertainty principle. One dimensional infinitely rigid box- energy Eigen values and Eigen functions, normalization; Quantum dot as example; Quantum mechanical scattering and tunnelling in one dimension-across a step potential & rectangular potential barrier.

### Unit 4 : Atoms in Electric & Magnetic Fields:

Electron angular momentum.Space quantization.Electron Spin and Spin Angular Momentum.Larmor's Theorem. Spin Magnetic Moment. Stern-Gerlach Experiment. Zeeman Effect: Electron Magnetic Moment and Magnetic Energy, Gyromagnetic Ratio and Bohr Magneton.

**Suggested Books:**

1. A Text book of Quantum Mechanics, P. M. Mathews and K. Venkatesan, 2nd Ed., 2010, McGraw Hill
2. Quantum Mechanics, Robert Eisberg and Robert Resnick, 2nd Edn., 2002, Wiley.
3. Quantum Physics-S. Gasiorowicz (Wiley India) 2013
4. Quantum Mechanics -J.L. Powell and B. Craseman (Narosa) 1988
5. Introduction to Quantum Mechanics- M. Das, P.K. Jena, (SriKrishnaPrakashan)
6. Basic Quantum Mechanics –A.Ghatak (Mc Millan India) 2012
7. Introduction to Quantum Mechanics, D.J. Griffith, 2nd Ed. 2005, Pearson Education

**CC 8.2: Practical**

| | | |
|---|---|---|
| Contact Hours Per Week | : | 2 |
| Examination Duration | : | 3 Hours |
| Maximum Marks | : | 30( Expt-20, Viva-5, Record-5) |

**Use FORTRAN/C/C++/Scilab/Python for solving the following problems based on Quantum Mechanics:**

1. Solve the s-wave Schrodinger equation for the ground state and the first excited state of the hydrogen atom:

    Here, m is the reduced mass of the electron. Obtain the energy eigenvalues and plot the corresponding wave functions. Remember that the ground state energy of the hydrogen atom is $\approx$ -13.6 eV. Take e = 3.795 $(eV\AA)^{1/2}$, hc = 1973 (eV$\AA$) and m = 0.511x10$^6$ eV/c$^2$.

2. Solve the s-wave radial Schrodinger equation for an atom: where m is the reduced mass of the system (which can be chosen to be the mass of an electron), for the screened coulomb potential Find the energy (in eV) of the ground state of the atom to an accuracy of three significant digits. Also, plot the corresponding wave function. Take e = 3.795 $(eV\AA)^{1/2}$, m = 0.511x10$^6$ eV/c$^2$, and a = 3 $\AA$, 5 $\AA$, 7 $\AA$. In these units hc = 1973 (eV$\AA$). The ground state energy is expected to be above -12 eV in all three cases.

3. Solve the s-wave radial Schrodinger equation for a particle of mass m: For the anharmonic oscillator potentialfor the ground state energy (in MeV) of particle to an accuracy of three significant digits. Also, plot the corresponding wave function. Choose m = 940 MeV/c$^2$, k = 100 MeV fm$^{-2}$, b = 0, 10, 30 MeV fm-3In these units, ch = 197.3 MeV fm. The ground state energy I expected to lie between 90 and 110 MeV for all three cases.

4. Solve the s-wave radial Schrodinger equation for the vibrations of hydrogen molecule: Where $\mu$ is the reduced mass of the two-atom system for the Morse potential Find the lowest vibrational energy (in MeV) of the molecule to an accuracy of three significant digits. Also plot the corresponding wave function.

    Take: m = 940 MeV/C$^2$, D = 0.755501 eV, $\alpha$ = 1.44, r$_o$ = 0.131349 $\AA$

**Laboratory based experiments:**

5. Study of Electron spin resonance- determine magnetic field as a function of the resonance frequency

6. Study of Zeeman effect: with external magnetic field; Hyperfine splitting

7. To show the tunneling effect in tunnel diode using I-V characteristics.

8. Quantum efficiency of CCDs.

**Suggested Books:**

1. Schaum's outline of Programming with C++. J. Hubbard, 2000,McGraw-Hill Publication

2. Numerical Recipes in C: The Art of Scientific Computing, W.H. Pressetal., 3rd Edn., 2007, Cambridge University Press.

3. An introduction to computational Physics, T. Pang, 2nd Edn.,2006, Cambridge Univ. Press

4. Simulation of ODE/PDE Models with MATLAB®, OCTAVE and SCILAB: Scientific & Engineering Applications: A. VandeWouwer, P. Saucez, C.V. Fernández.2014 Springer.

5. Scilab(A Free Software to Matlab): H. Ramchandran, A.S. Nair. 2011, S. Chand & Co.

6. Scilab Image Processing: L.M.Surhone.2010 Betascript Publishing ISBN:978-6133459274

7. A Complete Course in Degree Practical Physics, B. B. Swain & P.K. Jena, Kalyani Publishers (2017).

## CC 8.1: Inorganic and Organic Chemistry

Contact Hours per Week : 4
Credit : 4
Examination Duration : 3 Hours
Maximum Marks : 70 (Terminal-50, Sessional-20)

### Unit 1 :

#### Nuclear Chemistry

Application of radioisotopes. Nuclear process, Nuclear binding energy, stability of nucleus, energies changes in nuclear reactions, concept of nuclear cross section and its importance, Bethe notations, nuclear fission and fusion, Uses of nuclear radiations, radiation, sterilization, radiation energy for chemical synthesis. Application of radio isotopes, Isotopes, their separation and applications.

### Unit 2 :

#### Heterocyclic compounds

Classification and nomenclature, Structure, aromaticity in 5-membered and 6-membered rings containing one heteroatom; Synthesis, reactions and mechanism of substitution reactions of: Furan, Pyrrole, thiophene (Paal-Knorr synthesis, Knorr pyrrole synthesis), Pyridine (Hantzsch synthesis), Pyrimidine, Structure elucidation of indole, Fischer's indole synthesis and Madelung synthesis), Structure elucidation of quinoline and isoquinoline.

Derivatives of furan: Furfural and furoic acid.

### Unit 3 :

#### Polynuclear aromatic hydrocarbons

Reactions of naphthalene, phenanthrene and anthracene, elucidation of their structure, preparation of $\alpha$ and $\beta$-naphthols, structural elucidation of anthraquinone and alizarins.

### Unit 4 :

#### Catalysis

Types of catalyst, specificity and selectivity, mechanisms of catalyzed reactions at solid surfaces; effect of particle size and efficiency of nanoparticles as catalysts.Enzyme catalysis, Michaelis-Menten mechanism, acid-base catalysis.(15 Lectures)

**CC 8.2: Practical**

Conctact Hours Per Week  : 2
Examination Duration    : 3 Hours
Maximum Marks           : 25 (Expt-15, Viva-6, Record-4)

I)   **Thermochemistry**

   a)   Determination of heat capacity of a calorimeter for different volumes using change of enthalpy data of a known system (method of back calculation of heat capacity of calorimeter from known enthalpy of solution or enthalpy of neutralization).

   b)   Determination of heat capacity of the calorimeter and enthalpy of neutralization of hydrochloric acid with sodium hydroxide.

   c)   Calculation of the enthalpy of ionization of ethanoic acid.

   d)   Determination of heat capacity of the calorimeter and integral enthalpy (endothermic and exothermic) solution of salts.

   e)   Determination of basicity/proticity of a polyprotic acid by the thermochemical method in terms of the changes of temperatures observed in the graph of temperature versus time for different additions of a base. Also calculate the enthalpy of neutralization of the first step.

   f)   Determination of enthalpy of hydration of copper sulphate.

   g)   Study of the solubility of benzoic acid in water and determination of $\Delta H$.

II)  Estimation of $Al^{3+}/Ca^{2+}/Mg^{2+}$ using EDTA (Erio T or other suitable indictor)

## CC 8.1: PLANT TISSUE ORGANIZATION AND EMBRYOLOGY

Contact Hour Per Week : 4
Credits : 4
Examination duration : 3 Hours
Maximum marks: 70 (Terminal- 50, Sessional- 20)

**Unit 1:**

**Anther:** Anther wall: Structure and functions, microsporogenesis, callose deposition and its significance.Pollen viability, storage and germination; Abnormal features.**Ovule:** Structure; Types; Special structures—endothelium, obturator, aril, caruncle and hypostase; Female gametophyte— megasporogenesis (monosporic, bisporic and tetrasporic) and megagametogenesis (details of *Polygonum* type);

**Pollination and fertilization:** Pollination types and significance;adaptations; structure of stigma and style; path of pollen tube in pistil;double fertilization.**Seed:** Structure, importance and dispersal mechanisms.**Polyembryony and apomixes:** Introduction; Classification; Causes andapplications.

**Unit 2:**

**Tissues:** Classification of tissues; Simple and complex tissues (no phylogeny); **Vascular Cambium and wood:** Structure, function and seasonal activity of cambium; Secondary growth in root and stem (Normal and anamalous), Sapwood and heartwood; Early and late wood, Dendrochronology.

**Unit 3:**

**Secretory System:** Hydathodes, cavities, lithocysts and laticifers.

**Unit 4: Embryo:** General pattern of development of dicoct and monocot embryo.Types of Embryo sac

## CC 8.2: Practical

Contact Hour Per Week: 2
Examination duration: 3 Hours
Maximum marks:30 (Exp. 20, Viva-5, Record-5)

1. Study of vascular tissue of angiospermic plants by tissue macerations technique .Study of anatomical details through permanent slides/temporary stain mounts/ museum specimens with the help of suitable examples.Study of permanent slide of Apical meristem of root, shoot and vascular cambium.Distribution and types of parenchyma, collenchyma and sclerenchyma.

2. Root: secondary growth.
3. Stem: monocot- secondary growth; periderm; lenticels.
4. Anomalous secondary growth in Bignonia, Boerrhavia, Amaranthus, Bouganivillea and Drac
5. Demonstration of double staining technique. (3 h)

**Reference Books :**
1. Bhojwani, S.S. and Bhatnagar, S.P. 2011. Embryology of Angiosperms.Vikas Publication House Pvt.Ltd. New Delhi. 5th edition.
2. Bhojwani, S. S. and Bhatnagar, S. P. 2000. The Embryology of Angiosperms (4th Ed.), VikasPublishing House, Delhi.

**Reference Books :**
1. Bhojwani, S.S. and Bhatnagar, S.P. 2011. Embryology of Angiosperms.Vikas Publication House Pvt.Ltd. New Delhi. 5th edition.
2. Bhojwani, S. S. and Bhatnagar, S. P. 2000. The Embryology of Angiosperms (4th Ed.), VikasPublishing House, Delhi.
3. Esau, K. 1971. Anatomy of Seed Plants. John Wiley and Son, USA.
4. Maheswari, P. 1971. An Introduction to Embryology of Angiosperms. McGraw Hill Book Co., London.

**CC 8.1: Biochemistry**

| | | |
|---|---|---|
| Contact Hour per Week | : | 4 |
| Credits | : | 4 |
| Examination duration | : | 3 Hours |
| Maximum marks | : | 70 (Terminal- 50, Sessional- 20) |

## Unit 1:
### Structural Biochemistry
Structure and properties:

- Carbohydrates ( mono-,di-, and polysaccharides).
- Amino acid and proteins (primary, secondary, tertiary and quaternary structures, motifs and protein folding).
- Lipids (steroids, fatty acids and triglycerides), storage and conjugated lipids, steroids, prostaglandins and terpenoids.

## Unit 2:
### Metabolism-1

- Carbohydrates: glycolysis, TCA cycle, glycogenolysis, glycogenesis and gluconeogenesis.
- Proteins: protein degradation, amino acid catabolism (transamination, oxidative and non-oxidative deamination, transdeamination); urea cycle.

## Unit 3:
### Metabolism-2

- Lipids: $\beta$- oxidation of fatty acids; ketogenesis.
- Biological oxidation: electron transport chain, oxidative phosphorylation and ATP synthesis.

## Unit 4:
### Enzymology

- Nomenclature and classification of enzymes, activation energy, factors affecting enzyme catalyzed reactions.
- Enzyme kinetics: Michaelis and Menten equation.
- Models and mechanism of enzyme action.
- Enzyme inhibition: competitive and non-competitive, allosteric and feedback.

**CC 8.2: Practical**

Contact Hour per Week  :  2
Examination duration  :  3 Hours
Maximum marks  :  30

- Detection of carbohydrates ( monosaccharides, disaccharides, polysaccharides).
- Detection of proteins ( albumin, gelatin and casein)
- Detection of lipids (saturated and unsaturated fats).
- Detection of urea, uric acid , ammonia and creatinine in the test sample provided.
- Sessional activities.

**Reference Books :**

1. Berg, J. M., Tymoczko, J. L. and Stryer, L. (2006). Biochemistry, 6th edition. W. H. Freeman and Co.
2. Nelson, D. L., Cox, M. M. and Lehninger, A. L. (2009). Principles of Biochemistry. 4th edition. W. H. Freeman and Co.
3. Murray, R. K., Granner, D. K., Mayes, P. A. and Rodwell, V. W. (2009). Harper's Illustrated Biochemistry. 28th edition. Lange Medical Books/McGraw-Hill.
4. Hames, B. D. and Harper, N. M. (2009). Instant Notes in Biochemistry, 2nd edition, BIOS Scientific Publishers Ltd, UK
5. Devsena, T. (2014). Enzymology, 2nd edition, Oxford University Press, UK.
6. Voet, D. and Voet, J. G. (2010). Biochemistry, 4th edition. J. Wiley and Sons.
7. Das, D. (2005). Biochemistry, 13th edition. Academic Publishers, Kolkata.

**CC 8.1: Object Oriented Programme C++ and Mechanics - II**

| | |
|---|---|
| Contact Hours per Week | : 4 |
| Credit | :4 |
| Examination Duration | :3 Hours |
| Maximum Marks | :70 (Terminal-50, Sessional-20) |

### Unit 1:

**Basic Concepts of OOP** :Data Abstraction, Encapsulation, Modularity, Inheritance, Polymorphism;Advantages and Disadvantages of OOP.

**C++ Basics:** Flow chart and Algorithm, C++ Character Set, Tokens; **Data Handling:** C++ Data Types, Variables, Formatting Output; **Operators and Expressions:** I/O Operators, Arithmetic Operators, Increment/Decrement Operators, Relational Operators, Logical Operators, Conditional Operator, Some Other Operators; **Flow of Control:** Statements, Selection Statements, Iteration Statements, Jump Statements.

### Unit 2:

**Arrays:** Single dimensional Arrays , Two- Dimensional Arrays; **Functions :** Function Definition, Default Arguments, Constant Arguments, Call By Value , Call By Reference, Calling Function With Arrays, Recursion, Returning From a Function, Scope Rules.

### Mechanics

### Unit 3:

- **Coplanar forces in general** :Resultant force and resultant couple, Special cases, Varignon's theorem,Necessary and sufficient conditions of equilibrium. Equilibrium equations of the first, second and third kind.

- **An arbitrary force system in space** :Moment of a force about an axis, Varignon's theorem. Resultantforce and resultant couple, necessary and sufficient conditions of equilibrium. Equilibrium equations, Reduction to a wrench, Poinsot's central axis, intensity and pitch of a wrench, Invariants of a system of forces. Statically determinate and indeterminate problems.

### Unit-4

- **Virtual work :**Workless constraints - examples, virtual displacements and virtual work. The principleof virtual work, Deductions of the necessary and sufficient conditions of equilibrium of an arbitrary force system in plane and space, acting on a rigid body.

- **Stability of equilibrium :**Conservative force field, energy test of stability, condition of stability of aperfectly rough heavy body lying on a fixed body.

## CC 8.2: Practical to be performed in Lab

Contact Hours Per Week    :    2
Examination Duration      :    3 Hours
Maximum Marks             :    30 ( Expt-20, Viva-5, Record-5)

**Reference books:**

1.    A.R. Venugopal, Rajkumar, and T. Ravishanker, *Mastering C++*, TMH, 1997.
2.    S.B. Lippman and J. Lajoie, *C++ Primer,* 3rd Ed., Addison Wesley, 2000.
3.    Bruce Eckel, *Thinking in C++*, 2nd Ed., President, Mindview Inc., Prentice Hall.
4.    D. Parasons, *Object Oriented Programming with C++*, BPB Publication.
5.    Bjarne Stroustrup ,*The C++ Programming Language*, 3rd Ed., Addison Welsley.
6.    E. Balagurusamy, Object Oriented Programming in C++, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2008.
7.    Gregory R D :  Classical Mechanics
8.    Synge J L & Griffith B A : Principle of Mechanics ( McGraw Hill )
9.    S L Loney : An elementary treatise on Statics

## CPS 2: PEDAGOGY OF MATHEMATICS (Part-I)

| Semester-V | Credit-4 |
|---|---|
| Marks 100 | Contact Hours- 4hrs. |
| (Internal 30 + External 70) | per week |

### Introduction

Mathematics is considered as a basic subject at the school stage enabling the students to acquire basic human values along with developing fundamental mathematical abilities like computation and logical thinking. It has its utilitarian value, practical value and disciplinary value. It contributes a lot to development of human civilization. This course is intended to develop methods and skills of teaching Mathematics and students will understand its importance along with contribution to the field of knowledge.

### Objectives

The course will enable the student teachers to:

- Understand the nature, scope, and values of Mathematics and its place in the school curriculum.

- Specify comprehensively the objectives of teaching and learning Mathematics at the secondary and higher secondary levels of school education.

- Develop long term and short term plans along with daily lesson plans for teaching and learning mathematics at the school stage.

- Know the methods of teaching – learning of mathematics and their implications in teaching the different branches of the subject.

- Select appropriate tools and procedures for conducting continuous and comprehensive evaluation and achievement.

- Develop the power of reasoning, concentration and scientific attitude.

### Unit I: Concept and Importance of Mathematics Education

- Nature and Scope of Mathematics

    - Definition of mathematics given by different eminent educationists,

    - Nature of mathematics

    - Mathematical system: undefined terms, defined terms, postulates, axioms, proofs in teaching theorems, symbolism.

    - Meaning and uses of mathematical languages, tools including implication of truth-table.

    - Field of study and practices embedded in

- Values of Mathematics : Utilitarian values, Disciplinary value, Cultural value and Vocational value

- Place of Mathematics in School Curriculum,

- Correlation of Mathematics with life activities, with other subjects and with different branches of mathematics..

- Contribution of the Indian Mathematicians in developing the subject.

- Teaching-learning of Mathematics from the view point of Piaget, Skinner, Bruner, Vygotsky and Dienes.

## Unit II: Aims and Objectives of Teaching and Learning Mathematics

- Aims and Objectives of teaching Mathematics at upper primary stage, Secondary stage and Higher Secondary stage [As recommended in various reports].

- General Objectives of teaching-learning Mathematics w.r.t. the taxonomy of educational objectives (Revised Bloolm's Taxonomy).

- Specific Objectives of teaching and learning School Mathematics like Arithmetic, Algebra, Geometry, Mensuration, Trigonometry etc.

## Unit III: Planning Teaching-Learning of Mathematics

- Content categories in Mathematics: nature of branches which included in school mathematics- importance and uses in connection with : Facts, Concepts, Illustrations, and Applications

- Content Analysis in Mathematics: Concepts and methods of Pedagogical Analysis ;

  - Division of unit in subunits with no. Of periods;
  - Previous knowledge
  - Instructional objectives in behavioural terms;
  - Sub-unit wise concepts
  - Teaching-learning strategies
  - Use of teaching aids
  - Blueprint for criterion reference test items
  - evaluation

- Designing of learning experiences in Mathematics: Preparation of Learning Design

- Yearly plan, Unit plan, Lesson plan; Elaborating specific steps of each type of plan suitable in classroom environment

## Unit IV: Methods and Approaches for Teaching and Learning Mathematics

- *Heuristic/ Discovery method:*

  -Nature and purpose of learning by heuristic/discovery method,
  - procedure, role of teacher
  - merits and limitations
  - Laboratory Methods.

- *Teaching for Understanding Proof:*
    - Inductive method
    - Examples for using Inductive method
  - Merits-demerits of the method
  - Deductive method,
  - Examples for using Deductive method,
  - Merits- demerits for the method,
  - Proof by method of Induction and Deduction.
  - Analytic Method
  - Examples to use Analytic Method
  - Merits and demerits of the method
  - Synthetic Method
  - Examples to use Synthetic Method
  - Merits and demerits of the method
  - proof by analysis and synthesis.
  -

- *Problem Solving in Mathematics*:
    - Importance of problem solving in Mathematics,
    - Characteristics of Good Problem,
    - Steps of problem solving in Mathematics,
    - Teacher's role in problem solving method
    - Types of mathematical problem,
    - Generating and solving real life problems using Mathematical principles,
    - Situation model for solving word problems,
    - Merits and Limitations of Problem-Solving Method.
- *Constructivist approaches:*

- Self-learning and peer learning strategies

- Projects and Collaborative Strategies- Principles-Types–Steps-Examples for Secondary School Students-Advantages and Limitations- Role of Teachers

- 5E Learning Cycle Model- meaning- explanation-example.

- ICON Model- Importance – preparation – use in classroom environment.

## Unit V: Assessing Learning in Mathematics
- Assessment *of* Mathematics learning: Unit test – Designing blue print, item construction, marking schemes, analysis, comment.

- Assessment *for* Mathematics Learning: Assignments, Portfolios in Mathematics, group and collaborative work setting and assessment in Mathematics.

- Non-testing methods of assessment *of/for* mathematics Learning: Observation of learners in action, rating of participation in various Mathematical tasks and activities.

- Diagnositic,and,Prognostic-Tests—definitions-importance—preparation-application-Remedial measures in learning Mathematical concepts, Preparation of Enrichment programmes and application in Mathematics learning, facilities for genius learners to get scope to National Mathematics Talent Search, Mathematics Olympiad.

- Planning for continuous assessment of classroom learning in Mathematics-formative evaluation during class teaching- preparation of relevant questions; use of summative evaluation after completion of a unit per week ; plan for mathematical quiz and puzzle once in a month.

**Suggested Activities:**
- Collection of the names of Mathematicians and preparation of a report about their contribution to Mathematics.
- Group activity for preparation of concept maps on any topic of school mathematics.
- Preparation of Simulated teaching practical five (5) lessons using five skills in each case.
- Development and use of Mathematics Laboratory.
- Prepare Mathematical Activities in the context of Socio-Cultural aspects.
- Construction of various types of test items

**Suggested Readings:**

- Beckmann C.E ,Thompson D.R and Rubenstein,R.N.(2010).*Teaching and learning high school mathematics*.New Jersey: John Wiley and Sons Inc.,

- Britton E, Huntley M.A., Jacobs G and Weinberg A.S.(1999). *Connecting mathematics and science to workplace contexts : A Guide to Curriculum materials*, Corwin Press Inc., California

- Chambers P,(2010).*Teaching Mathematics: Developing as a reflective secondary teacher*. New Delhi: SAGE.

- Cowan, Pamela (2006).*Teaching mathematics, A handbook for primary and secondary school teachers*. London: Routledge.

- Davis D.R.(1951). *The teaching of mathematics*.London: Addison Wesley Press,

- Hollands, Roy (1990).*Development of mathematical skills*, Oxford, London: Blackwell Publishers.

- James,Anice(2005). *Teaching of mathematics*.Hyderabad: Neelkamal Publications.

- Katz, V.J. (Ed.)(2007).*The Mathematics of Egypt, Mesopotamia, China, India and Islam :A Sourcebook*. Princeton, NJ: Princeton University Press.

- Kothari, R.G., and Shelat, P.H. (2011).*Mathematical weaknesses among secondary school students*. Germany: VDM Verlag Publishers.

- Kilpatrick J, Hoyles C and Skovsmose,O. (Eds.) (2005). *Meaning in mathematics education*.New York, NY: Springer.

- NCERT (2006).*Position Paper: National Focus Group On Teaching of Mathematics*. New Delhi: National Council of Educational Research and Training.

- NCERT (2012).*Pedagogy of Mathematics: Textbook for Two-Year B. Ed Course*. New Delhi: NCERT..

- Noss R.(19988). The Computer as a cultural influence in mathematical learning. In Bishop A.J. (Ed.),*Mathematics education and culture*, London : Kluwer Academic Publishers..

- Schonnel, F.J. (1965). *Diagnostic and remedial teaching in arithmetic*.London:Lever and Boyd.

- Shetty, Balkrishna(2013). *What is mathematics?* NewDelhi: National Book Trust.

- Skemp,R.R., (1971), *The Psychology of Learning mathematics*, Penguin Books

- Zubair, P.P. (2012) Teaching of Mathematics. APH PUBLISHING CORPORATION, Ansari Road, Dariya Ganj; New Delhi-110002

CPS 2: Pedagogy of Life Science (Part-I)

| Semester-V | Credit-4 |
|---|---|
| Marks 100 (Internal 30 + External 70) | Contact Hours- 4hrs. per week |

### Introduction

Being one of the disciplines of science, concerns and approaches of Life Science are almost similar to that of Science in general i.e. quest for and enhancement of scientific enquiry. Teachers of Life science also need to understand the nature of the discipline and arouse curiosity among young learners about natural surroundings vis-à-vis the entire living world. It is an established fact that concepts, theories and principles pertaining to living organisms have evolved over a period of time and are highly organized. Therefore, teaching-learning practices of biological sciences are expected to address the dynamism of evolving subject knowledge along with its organizational principles by following the strategies of scientific enquiry.

### Objectives

The course will enable the student teachers to:

- Developing insight about nature of Life sciences and facilitate inculcation of scientific attitude among learners.
- Nurture curiosity among learners about her/his natural surroundings and relationships of every day's experience with concepts of Life sciences.
- Appreciate that Life science is a dynamic and expanding body of knowledge.
- Formulate appropriate and meaningful inquiry episodes, problem-solving situations and investigatory projects, based on curriculum.
- Determining strategies of teaching-learning.

### Unit I: Foundation of Life Science Teaching

- Aims and objectives of Life Science teaching.
- Life Science curriculum, values of Life Science teaching.
- Interrelationship of various branches of Life Science.
- Scientific aptitude and attitude.
- Innovations in Life Science teaching.

### Unit II: Strategies of Life Science Teaching:

- Features, Limitations and comparison of different methods.
  (a). Lecture Method.
  (b). Demonstration Method.
  (c). Heuristic Method.
  (d). Laboratory Method.
  (e). Project Method.
  (f). CAI
  (g). Problem Solving Method.

### Unit III: Planning of Life Science Laboratory
- Importance of Life Science Laboratory.
- Organization / Planning a Life Science Laboratory.
- Equipment of Life Science Laboratory.

### Unit IV: Learning Resource in Life Science Teaching
- Meaning, Type and Importance of Learning Resources.
- Quality of Good Life Science Text Book.
- Teaching aids used in Life Science
- Improvisation of Teaching Aids.

### Unit V: The Life Science Teacher
- Qualifications and Qualities of Life Science Teachers.
- Professional Growth of Life Science Teacher.

### Suggested Activities:
- Development of learning resources for teaching Life Science including –
  - Preparation of TLM
  - Activity / Demonstration of Worksheet
  - Use of innovative approaches i.e. simulation or playway method
  - Application of ICT

- Survey of Life Science Laboratory
- Script writing for radio/television/video on science topics.
- Demonstration of Science Experiments.
- Preparation of materials and programmes to inculcate scientific attitude.

### Suggested Readings:
- Fraser, B. J. and Tobin, K. G. (Eds.). *International handbook of science teaching (Part 1)*. Dodrecht, The Netherlands: Kluwer Academic.
- Mintzes J., Wandersee, J. and Novak, J. (Eds.) (2000). *Assessing science understanding: A human constructivist view*. San Diego, CA.: Academic Press.
- Nag, S. (2015). Teaching of Life Science . Kolkata: Rita Publications.
- Nagchowdhury, D.P., Pal, S., Ganguly, A., Howladar, M. (2014). Jiban Biggyan Shikshaner Tattwa o Prayog, Aaheli Publishers, Kolkata.
- NCERT (2000). *Position paper of national focus group (NFG) on aims of education*. National Council of Educational Research and Training (NCERT), New Delhi.
- NCERT (2000). *Position paper of national focus group (NFG) on education for peace*. National Council of Educational Research and Training (NCERT), New Delhi.
- NCERT (2000). *Position paper of national focus group (NFG) on examination reforms*. National Council of Educational Research and Training (NCERT), New Delhi.

- NCERT (2000). *Position paper of national focus group (NFG) on gender issues in education*. National Council of Educational Research and Training (NCERT), New Delhi.
- NCERT (2000). *Position paper of national focus group (NFG) on habitat and learning*. National Council of Educational Research and Training (NCERT), New Delhi.
- NCERT (2000). *Position paper of national focus group (NFG) on teaching of science*. National Council of Educational Research and Training (NCERT), New Delhi.
- NCERT (2005). *National curriculum framework for school education*. National Council of Educational Research and Training (NCERT), New Delhi.
- Sutton, C.R. & Hayson, J.H. (1974). *Theart of the science teacher*, McGraw Hill Book Company Ltd.
- Vaidya, N. (1999). *Science teaching for $21^{st}$ Century*. Deep & Deep Publication.
- Journal of Research in Science Teaching (Wiley-Blackwell)

- *Science & Children*. A peer reviewed journal published by National Science Teachers Association (NSTA).
- *The Science Teacher*. A peer reviewed journal published by National Science Teachers Association (NSTA).

CPS 3: Pedagogy of Physical Science (Part-I)

| Semester-V | Credit-4 |
|---|---|
| Marks 100 | Contact Hours- 5 hrs. |
| (Internal 30  External 70) | per week |

## Introduction

Science is an organized system of knowledge based on inquiry born out from natural curiosity, logical reasoning and experimentation. Therefore, student-teachers are expected to appreciate that every child is unique and possesses natural curiosity. The course focuses to develop the proficiency in the student-teachers to design teaching-learning situations keeping in view the nature of science, learning needs, context of all children through a variety of approaches. The course is intended to enable students-teachers to design and organize learner-centered, activity based, participatory learning experiences through observation, inquiry, dialogue, discussion, experiments, projects and field work. It is suggested that student-teachers perform various activities interacting with their classmate, textbooks of Upper Primary, Secondary and Higher Secondary stages and other relevant resources available.

## Objectives

The course will enable the student teachers to:

- Gain insight on the meaning and nature of physical science.
- Understand various aims and objectives of learning physical science.
- Familiarize with different types of curricular projects in physical science, their purpose and themes.
- Understand the process of science and role of laboratory in teaching- learning situation.
- Appreciate and use various approaches of teaching-learning of physical science.
- Explore and develop different learning resources and materials in learning different units in Physical Science.

### Unit I: Nature and Scope of Physical Science

- Physical Science as a domain of inquiry, as a dynamic and expanding body of knowledge.
- Historical Perspectives in Physical Science.
- Scope of Physical Science.
- Interdisciplinary linkages and social concerns in physical science.
- Scientific methods in Physical Science: a critical view.

### Unit II: Aims and Objectives of Learning Physical Science

- Knowledge and understanding through science, Nurturing process skills of science, developing scientific attitude and scientific temper.
- Nurturing curiosity, creativity and aesthetic sense in Physical science.
- Imbibing various values related to Science.
- Developing problem solving skills in Physical Science.

### Unit III: Physical Science Curriculum

- Place of Physical Science in School Curriculum.
- Selection and Organization of Content in Physical Science.
- National Curriculum Frameworks of NCERT with specific reference to Physical Science Education.

- Analysis of school syllabus, textbooks and other printed materials in Physical Science (NCERT, State).
- Analysis of Physical Science curriculum at International Level: PSSC curriculum projects, Nuffield Physics, Nuffield Chemistry; Harvard Physics Project, Chem. Study.

## Unit IV: Approaches and Strategies in Learning Physical Science

- Selecting appropriate approach and strategy in learning Physical Science based on content, learner, context.
- Role of Observation and Experimentation in learning Physical Science.
- Approaches and Strategies of learning Physical Science: Learning by Lecture cum demonstration, Collaborative learning, Problem solving, Concept mapping, Conceptual Change Model, Experiential learning, Inquiry approach, Project Method, Analogy strategy.
- ICT integrated Physical Science Learning.

## Unit V: Preparation and Use of Learning Resources in Physical Science

- Preparation, collection, procurement and use of learning resources in Physical Science such as Charts, Graphs, Bulletin Boards, Models, ICT resources, Low or No cost teaching Learning materials etc.
- Laboratory as a learning resource to facilitate induction, deduction, process Skills acquisition, nurturing creativity, Experiences in organizing physical science laboratory.
- Role of Science museum, Science exhibitions and Science clubs in facilitating learning Physical Science.
- Innovative materials and processes, Community resources in learning Physical Science.

## Suggested Activities:

- Interviewing a few Secondary school Science teachers, University Professors on nature and practice of Science.
- Assignment on Contribution of eminent scientists- Isaac Newton, John Dalton, J.C. Bose, Albert Einstein, Niels Bohr, C.V. Raman, Marie Curie, De Broglie, V. Ramakrishnan, etc.
- Comparing the Science text books at Secondary stage on the basis of different validities of Science curriculum stipulated in NCF 2005.
- Design a learning situation in Physical Science by selecting an appropriate strategy.
- Design and develop at least two learning resources for physical science(one out of them has to be an ICT based learning resource).

## Suggested Readings:

1. Fraser, B. J. and Tobin, K. G. (Eds.). *International handbook of science teaching (Part 1)*. Dodrecht, The Netherlands: Kluwer Academic.
2. Mintzes J., Wandersee, J. and Novak, J. (Eds.) (2000). *Assessing science understanding: A human constructivist view*. San Diego, CA.: Academic Press.

3. NCERT (2000). *Position paper of national focus group (NFG) on aims of education.* National Council of Educational Research and Training (NCERT), New Delhi.

4. NCERT (2000). *Position paper of national focus group (NFG) on education for peace.* National Council of Educational Research and Training (NCERT), New Delhi.

5. NCERT (2000). *Position paper of national focus group (NFG) on examination reforms.* National Council of Educational Research and Training (NCERT), New Delhi.

6. NCERT (2000). *Position paper of national focus group (NFG) on gender issues in education.* National Council of Educational Research and Training (NCERT), New Delhi.

7. NCERT (2000). *Position paper of national focus group (NFG) on habitat and learning.* National Council of Educational Research and Training (NCERT), New Delhi.

8. NCERT (2000). *Position paper of national focus group (NFG) on teaching of science.* National Council of Educational Research and Training (NCERT), New Delhi.

9. NCERT (2005). *National curriculum framework for school education.* National Council of Educational Research and Training (NCERT), New Delhi.

10. Mohan, R. (2002) , Innovative Science Teaching for Physical Science Teachers, Prentice Hall of India Pvt. Ltd., New Delhi

11. Steve Alsop, Keith Hicks (2007). Teaching Science : A Handbook for Primary and Secondary School Teachers, Kogan Page, New Delhi.

12. Sutton, C.R. &Hayson, J.H. (1974). *Theart of the science teacher*, McGraw Hill Book Company Ltd.

13. Vaidya, N. (1999). *Science teaching for 21ˢᵗ Century.* Deep & Deep Publication.

14. Journal of Research in Science Teaching (Wiley-Blackwell)

15. *Science & Children.* A peer reviewed journal published by National Science Teachers Association (NSTA).

16. *The Science Teacher.* A peer reviewed journal published by National Science Teachers Association (NSTA).

## EPC 2: Learning to Function as a Teacher

| Semester-V | Credits-2 |
|---|---|
| Total Marks: 50 (Internal: 15, External: 35) | Contact Hours: 2 hours per week |

### Introduction

Teaching is a purposeful process of facilitating learning which involves the students/ learners in an interaction to enhance their potentialities to become self-learners. The secondary school is a crucial stage in the educational hierarchy as it prepares the learners for higher education & also for the world of work. Teacher in the present day has to be conversant with managing diversity and contexuality in the classroom. Hence student teachers need orientation and reflection on different activities and strategies to be employed during engagement with the field particularly for preparing them for the internship. Student teachers need to be oriented on processes like critical thinking, observation, communication and use of resources for effective functioning.

### Objectives

The course will enable the student teachers to:

- Develop an ability to engage students in various activities as per the emerging demands in the classroom.
- Develop self-confidence and skill to engage learners and meet their diverse needs.

### The following process based skills essential for secondary schools to be taken up:

- Content analysis.
- Content organization through concept mapping.
- Core teaching process: Introducing the lesson, Questioning, Explaining, illustrating with examples,Reinforcement (Verbal and non-verbal), Stimulus Variation, Using blackboard/white board/ smart board and using learning resources.
- Use of ICT.
- Critical thinking and reflection.
- Managing diversity.
- Contextualization.
- Organization of group activity/project..

### Guidelines for Assessment:

The above stated process-based skills will be practiced by the student-teachers which will be observed and evaluated during the simulated classroom transaction.The evaluation will be continuous and internally assessed and the reports to be submitted to the external for viva and external evaluation.

# Semester-VI

(B.Sc. B.Ed.)
Semester Structure & Title of Papers

| Sl. No. | Course Paper | Subject | Paper Name | Marks | Page No. |
|---|---|---|---|---|---|
| 1 | **CC-9**<br><br>(Course / Paper from same subject selected as CC subject in Sem.-1) | Physics | Mathematical Physica-III | 100 | 203 |
| | | Chemistry | Inorganic Chemistry | | 205 |
| | | Botany | Plant Genetics | | 207 |
| | | Zoology | Molecular Biology and Instrumentation | | 209 |
| | | Mathematics | Real Analysis-III: Riemann Integration & Series of Function | | 211 |
| 2 | **CC-10**<br><br>(Course / Paper from same subject selected as CC subject in Sem.-1) | Physics | Electromagnetic Waves | 100 | 213 |
| | | Chemistry | Organic Chemistry | | 215 |
| | | Botany | Plant Physiology and Biochemistry | | 217 |
| | | Zoology | Animal Physiology | | 219 |
| | | Mathematics | Linear Programming | | 221 |
| 3 | **CC-11**<br><br>(Course / Paper from same subject selected as CC subject in Sem.-1) | Physics | Statistical Mechanics | 100 | 223 |
| | | Chemistry | Physical Chemistry | | 225 |
| | | Botany | Plant Breeding and Biostatistics | | 228 |
| | | Zoology | Endocrinology and Immunology | | 230 |
| | | Mathematics | Numerical Analysis | | 232 |
| 4 | **CC-12**<br><br>(Course / Paper from same subject selected as CC subject in Sem.-1) | Physics | Digital and Analog Circuits and Instrumentation | 100 | 234 |
| | | Chemistry | Physical Chemistry | | 236 |
| | | Botany | Biodiversity, Plant Ecology and Phytogeography | | 238 |
| | | Zoology | Development Biology and Reproductive Biology | | 240 |
| | | Mathematics | Probability & Statistics | | 242 |
| 5 | **CBC-1***<br><br>(To be considered as an add-on course) | Need to select any one out of 11 papers | 1. Herbal Plants for Home Gardening | 100 | 245 |
| | | | 2. Chemistry and Our Life | | 246 |
| | | | 3. Renewable Energy and Energy Harvesting | | 247 |
| | | | 4. General Mathematics | | 248 |
| | | | 5. Food, Nutrition and Public Health | | 249 |
| | | | 6. Basic of Social Science | | 250 |
| | | | 7. Creativity in Translation | | 252 |
| | | | 8. Communicative Language-English | | 253 |
| | | | 9. Hindi Bhasha aur Sahitya ka Samanya | | 255 |
| | | | 10. Bangla Sahitya O Byakaran Gyan | | 256 |
| | | | 11. Education Planning, Management and Leadership | | 257 |
| 5 | **CPS-2.2** | Education | Pedagogy of School Subject-1; Part-2; Mathematics / Life Science (Same Subject as in Sem. V) | 100 | 261 |
| | **CPS-3.2** | | Pedagogy of School Subject-2; Part-2; Physical Science | 100 | 269 |
| | **FE-1** | | Multicultural Placement (2 Weeks) | 50 | 272 |
| **Total** | | | | **650+100*** | |

## CC 9.1: Mathematical Physics-III

Contact Hours per Week : 4
Credit : 4
Examination Duration : 3 Hours
Maximum Marks : 70 (Terminal-50, Sessional-20)

### Unit 1: Complex Analysis:

Complex Numbers. Functions of Complex Variables. Analyticity and Cauchy-Riemann Conditions. Examples of analytic functions. Singular functions: poles and branch points, order of singularity, branch cuts. Integration of a function of a complex variable. Cauchy's Inequality. Cauchy's Integral formula. Simply and multiply connected region. Laurent and Taylor's expansion. Residues and Residue Theorem. Application in solving Definite Integrals.

### Unit 2: Integral Transform:

Fourier Integral theorem. Fourier Transform. Examples. Fourier transform of trigonometric, Gaussian, finite wave train & other functions. Representation of Dirac delta function as a Fourier Integral. Fourier transform of derivatives, Inverse Fourier transform, Parseval's theorem. Convolution theorem. Application of Fourier Transforms to differential equations: One dimensional Wave and Diffusion Equations.

Laplace Transform (LT) of Elementary functions. Properties of LTs: LTs of Derivatives and Integrals, Derivatives and Integrals of LTs. LT of Unit Step function, Dirac Delta function, Periodic Functions. Convolution Theorem. Inverse LT. Application of Laplace Transforms to 2nd order Differential Equations: Damped Harmonic Oscillator, Simple Electrical Circuits.

### Unit 3: Tensor Analysis:

Cartesian tensors: first and zero order Cartesian tensors, second and higher order Cartesian tensors. Algebra of tensors: summation, multiplication, contraction, inner product, the quotient law. Isotropic tensors, improper rotation and pseudo-tensors, dual tensors. Non-Cartesian tensors, the metric tensors. General coordinate transformation and tensors.

### Unit 4: Applications of Vectors and Tensors to Elasticity and Fluid Dynamics:

**Elasticity:**

Strain tensor. Stress tensors. Relationship between the starian and stress tensors.

**Fluid Mechanics:**

The equation of continuity, Euler's equation for ideal fluids, Hydrostatics, Bernoulli's theorem, Potential flow, Incompressible fluids, Newtonian fluids, Navier-Stokes equation and its applications.Poiseuille's formula, Couette flow, Turbulent flow and Reynold's number.

### Suggested Books:

1. Mathematical Methods for Physicists, G.B. Arfken, H.J. Weber, F.E. Harris, 2013, 7th Edn., Elsevier.
2. Differential Equations, George F. Simmons, 2007, McGraw Hill.
3. Mathematical methods for Scientists and Engineers, D.A. Mc Quarrie, 2003, Viva Book
4. Advanced Engineering Mathematics, Erwin Kreyszig, 2008, Wiley India.
5. Essential Mathematical Methods, K.F.Riley & M.P.Hobson, 2011, Cambridge Univ. Press.

## CC 9.2: Practical

| | | |
|---|---|---|
| Contact Hours Per Week | : | 2 |
| Examination Duration | : | 3 Hours |
| Maximum Marks | : | 30 ( Expt-20, Viva-5, Record-5) |

**Scilab/Python based simulations experiments based on Mathematical Physics problems like**

1. Dirac Delta Function:

   Evaluate $\frac{1}{\sqrt{2\pi\sigma^2}} \int e^{\frac{-(x-2)^2}{2\sigma^2}} (x+3)dx$ *for* $\sigma=1, 0.1, 0.01$ and show it tends to 5

2. Fourier Series:

   Program to sum $\sum_{n=1}^{\infty} (0.2)^n$

   Evaluate the Fourier coefficients of a given periodic function (square wave)

3. Frobenius method and Special functions:

$$\int_{-1}^{1} P_n(\mu) P_m(\mu)d\mu = \delta n, m$$

   Plot $P_n(x)$, $J_\nu(x)$

   Show recursion relation

4. Calculation of least square fitting manually without giving weightage to error. Confirmation of least square fitting of data through computer program.

5. Evaluation of trigonometric functions e.g. *sin θ*, Given Bessel's function at Npoints find its value at an intermediate point. Complex analysis: Integrate $1/(x^2+2)$ numerically and check with computer integration.

6. Integral transform: FFT of $e^{-x^2}$.

7. Solution of Navier- Stokes equation around a sphere.

**Suggested Books:**

1. Mathematical Methods for Physics and Engineers, K.F Riley, M.P. Hobson and S. J.Bence, 3rd ed., 2006, Cambridge University Press
2. Mathematics for Physicists, P. Dennery and A. Krzywicki, 1967, Dover Publications
3. Simulation of ODE/PDE Models with MATLAB®, OCTAVE and SCILAB: Scientific and Engineering Applications: A. VandeWouwer, P. Saucez, C.V.Fernández. 2014 Springer ISBN: 978-3319067896
4. Scilab by Example: M. Affouf, 2012. ISBN: 978-1479203444
5. Scilab(A free software to Matlab): H. Ramchandran, A.S.Nair. 2011 S. Chand & Company
6. Scilab Image Processing: Lambert M. Surhone. 2010 Betascript Publishing
7. A Complete Course in Degree Practical Physics, B.B. Swain & P.K. Jena, Kalyani Publishers (2017).

## CC 9.1: Inorganic Chemistry

Contact Hours per Week : 4
Credit : 4
Examination Duration : 3 Hours
Maximum Marks : 70 (Terminal-50, Sessional-20)

### Unit 1 :

**Magnetic poperties and electronic spectra of transition metal complexes**

**Magnetic properties:** Types of magnetic behavior, Curie law, methods of determining magnetic susceptibility, spin only formula L-S coupling, correlation of $\mu s$ and $\mu l$ values. Orbital contribution to magnetic moments, application of magnetic moment data for 3d metal complexes.

**Electronic spectra:** Types of electronic transition, selection rules for d-d transitions, spectroscopic ground states, spectrochemical series, Orgel-energy level diagram for $d^1$ and $d^9$ states, discussion of the electronic spectrum of hexaaqua titanium (III) complex $[Ti(H_2O)_6]^{+3}$.

### Unit-2:

**Bio-inorganic Chemistry**

A brief introduction to bio-inorganic chemistry. Essential and trace elements in biological processes. Metalloporphyrins with special reference to haemoglobin and myoglobin. Role of metal ions present in biological systems with special reference to $Na^+$, $K^+$ and $Mg^{2+}$ ions: Na/K pump; Role of $Mg^{2+}$ ions in energy production and chlorophyll. Role of $Ca^{2+}$ in blood clotting, stabilization of protein structures and structural role (bones).

### Unit 3:

**Organometallic compounds-I**

Definition and classification of organometallic compounds on the basis of bond type. Concept of hapticity of organic ligands.

Metal carbonyls: 18 electron rule, electron count of mononuclear, polynuclear and substituted metal carbonyls of 3d series. General methods of preparation (direct combination, reductive carbonylation, thermal and photochemical decomposition) of mono and binuclear carbonyls of 3d series. Structures of mononuclear and binuclear carbonyls of Cr, Mn, Fe, Co and Ni using VBT. $\pi$-acceptor behaviour of CO (MO diagram of CO to be discussed), synergic effect and use of IR data to explain extent of back bonding.

Zeise's salt: Preparation and structure, evidences of synergic effect and comparison of synergic effect with that in carbonyls.

Ferrocene: Preparation and reactions (acetylation, alkylation, metallation, Mannich Condensation). Structure and aromaticity. Comparison of aromaticity and reactivity with that of benzene.

### Unit 4: Thermodynamics and Kinetic aspects of metal complexes

A brief outline of thermodynamic stability of metal complexes and the factors affecting the stability. Thermodynamic and Kinetic stability. Introduction to inorganic reaction mechanisms. Substitution reactions in square planar complexes, Trans- effect, theories of trans effect, Mechanism of nucleophilic substitution in square planar complexes, Kinetics of octahedral substitution, Crystal field effects and reaction rates, Mechanism of substitution in octahedral complexes.

**CC 9.2: Practical**

| | | |
|---|---|---|
| Conctact Hours Per Week | : | 2 |
| Examination Duration | : | 3 Hours |
| Maximum Marks | : | 30 ( Expt-20, Viva-5, Record-5) |

## Organic preparations

i.  Acetylation of aniline, β –naphthol and resorcinol by any one method:
   a. Using conventional method.
   b. Using green approach

ii.  Benzolyation of anilineandβ-naphthol/resorcinol/p-cresol) by Schotten-Baumann reaction.

iii.  Bromination of Acetanilide by

   a. Conventional methods
   b. using green approach (Bromate-bromide method)

iv.  Nitration of Salicylic acid by green approach (using ceric ammonium nitrate)

The above derivatives should be prepared using 0.5-1g of the organic compound. The solid samples must be collected and may be used for recrystallization, melting point and TLC.

## CC9.1: PLANT GENETICS

Contact Hour Per Week : 4
Credits : 4
Examination duration : 3 Hours
Maximum marks: 70 (Terminal- 50, Sessional- 20)

### Unit-1

**Mendelian genetics and its extension** Mendelism: History; Principles of inheritance; Chromosome theory of inheritance; Autosomes and sex chromosomes; Probability and pedigree analysis; Incomplete dominance and codominance; Multiple alleles, Lethal alleles.

### Unit-2

**Extrachromosomal Inheritance:** Chloroplast mutation: Variegation in Four o'clock plant; Mitochondrial mutations in yeast;Maternal effects-shell coiling in snail; Infective heredity- Kappa particles in *Paramecium*.

### Unit-3

**Linkage, crossing over and chromosome mapping:** Linkage and crossing over-Cytological basis of crossing over; Recombination frequency, two factor and three factor crosses; Interference and coincidence; Numericals based on gene mapping; Sex Linkage.

### Unit-4

**Variation in chromosome number and structure:** Deletion, Duplication, Inversion, Translocation, Position effect, Euploidy and Aneuploidy

## CC 9.2: Practical

Contact Hour Per Week: 2
Examination duration: 3 Hours
Maximum marks: 30 (Exp. 20, Viva-5, Record-5)

i. Mitosis and Meiosis through temporary squash preparation (Onion, Maize, Rheo, Vicia, Cicer, Trigonella).
ii. Mendel's laws through seed ratios. Laboratory exercises in probability and chi-square analysis.
iii. Chromosome mapping using test cross data.
iv. Incomplete dominance and gene interaction through seed ratios (9:7, 9:6:1, 13:3, 15:1, 12:3:1, 9:3:4).
v. Photographs/Permanent Slides showing Translocation Ring, Laggards and InversionBridge.

**Reference Books :**

1. Gardner, E.J., Simmons, M.J. and Snustad, D.P. 1991. Principles of Genetics, John Wiley & sons, India. 8th edition.

2.Griffiths, A.J.F., Wessler, S.R., Carroll, S.B. and Doebley, J. 2010. Introduction to Genetic Analysis. W. H. Freeman and Co., U.S.A. 10th edition.

## CC 9.1: Molecular Biology and Instrumentation

Contact Hour per Week : 4

Credits : 4

Examination duration : 3 Hours

Maximum marks : 70 (Terminal- 50, Sessional- 20)

### Unit 1:

**Nucleic cids**

- DNA: forms and organization in eukaryotes, denaturation and renaturation, hyperchromic shift.
- RNA: structure, types and different roles.
- Replication in prokaryotes and eukaryotes.

### Unit 2:

**Gene Expression-1**

- Gene Expression: transcription in prokaryotes and eukaryotes.
- Regulation of gene expression in prokaryotes (lactose operon and tryptophan operon).
- Post-transcriptional modification and processing of eukaryotic RNA.

### Unit 3:

**Gene Expression-2**

- Genetic code: properties; Wobble hypothesis.
- Translation in prokaryotes and eukaryotes.
- Gene regulation: epigenetic mechanisms, gene silencing, miRNA, siRNA.
- DNA damage and its repair: types and mechanisms.

### Unit 4:

**Instrumentation and molecular techniques**

- Instrumentation: principles and uses of analytical instruments: microscopes (light microscopy, electron microscopy), pH meter, spectrophotometer, ultracentrifuge, colorimeter, paper chromatography.
- Principles and uses of molecular techniques: PCR, electrophoresis, RAPD, RFLP, Southern blotting, Genomic and cDNA libraries, Northern blotting, DNA microarray, Western blotting.

**CC 9.2: Practical**

Contact Hour per Week : 2
Examination duration : 3 Hours
Maximum marks : 30

- Estimation of carbohydrates (Benedict's Quantitative method).
- Estimation of protein using spectrophotometer/colorimeter.
- Identification of DNA by Feulgen reaction and RNA by PMG reaction.
- Separations of amino acids by paper chromatography.
- Measurement of pH of biological samples.
- Sessional activities.

**Reference Books (names only):**

1. Molecular Biotechnology by Glick and Pasternak, 4th edition.
2. Molecular Cell Biology by Lodish et al., 8th edition.
3. Molecular Biology of the Cell by Alberts et al., 5th edition.
4. An Introduction to Genetic Analysis by Griffith et al., 11th edition.
5. Principles and Techniques of Practical Biochemistry by Wilson and Walker (eds.), 5th edition.
6. Biochemistry by Voet and Voet, 4th edition.
7. Principles of Biochemistry by Nelson and Cox, 6th edition.
8. Molecular Biology by Clark, 2nd edition.
9. Molecular Biology of the Gene by Watson et al., 7th edition.
10. Biotechnology by Clark and Pazdernik, 2nd edition.

## CC 9.1: RIEMANN INTEGRATION & SERIES OF FUNCTIONS (ANALYSIS-III)

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| | |
|---|---|
| Contact Hours per Week | : 4 |
| Credit | :4 |
| Examination Duration | :3 Hours |
| Maximum Marks | :70 (Terminal-50, Sessional-20) |

**Unit1 :**

**Riemann integration**: Partition of a closed and bounded interval, Upper and lower Darboux sum of a bounded function with respect to a partition of an interval, Definition of Riemann integrability of a bounded function,

Characterization of Reimann integrability, Continuity and Integrability, Properties of the Riemann integral, Fundamental Theorem of Calculus.

**Unit2 :**

**Improper integral**: Definition and examples, Different Kind of improper integral and their convergence, Absolute convergent integral.

**Unit3 :**

**Sequence and series of functions**: Point-wise and Uniform convergence of sequence of functions, Cauchy's criterion for uniform convergence of sequence of functions, Weierstrass M-test for absolute and uniform convergence of series of functions, Dedekind test for uniform convergence of series of functions, Uniform convergence and Continuity, Term-by- term integration of series,Term-by-term differentiation of series.

**Unit4 :**

Power series (Cauchy Hadamard Theorem), Radius of convergence, Differentiation and integration of power series, Abel's Limit Theorem, Stirling's formula, More about Taylor's series, Weierstrass Approximation Theorem( without proof).

## CC 9.2 : PRACTICAL

Contact Hours Per Week   :   2
Examination Duration   :   3 Hours
Maximum Marks   :   30 ( Expt-20, Viva-5, Record-5)

1.   Computations of Beta and Gamma functions.
2.   Convergence of improper integrals for different functions.
3.   Testing of uniform convergence of sequence and series of functions/ Power series.

**Reference books:**

1. S.C. Mallik and S. Arora-Mathematical Analysis, New Age International Ltd., New Delhi [Chapters: 9(1to9), 11 (1 to 4), 12 (1 to 5), 13 (1 to 4)].
2. K.A. Ross, Elementary Analysis, The Theory of Calculus, Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2004.
3. W. Rudin, Principles of Mathematical Analysis.
4. R.G. Bartle D.R. Sherbert, Introduction to Real Analysis, 3rd Ed., John Wiley and Sons (Asia) Pvt. Ltd., Singapore, 2002.
5. Richard R Goldberg, Methods of Real Analysis.
6. Dipak Chatterjee, Real Analysis.
7. A. N. Kolmogorov and S. V. Fomin, Introduction to Real Analysis.
8. G. Das and S. Pattanayak-Fundamentals of Mathematics Analysis, TMH Publishing Co.

## CC 10.1: Electromagnetic Waves

Contact Hours per Week : 4
Credit : 4
Examination Duration : 3 Hours
Maximum Marks : 70 (Terminal-50, Sessional-20)

### Unit 1: Maxwell's Equations:

Generalization of Ampere's law, Displacement current, Maxwell's equations and their empirical basis, Electromagnetic energy.The wave equations, Boundary conditions.The wave equations with sources.

### Unit 2: Electromagnetic Wave Propagation:

Plane monochromatic waves in nonconducting media, Polarization, Energy density and flux, Plane monochromatic waves in conducting media.Spherical waves.

### Unit 3: Electromagnetic Wave in Bounded Media:

Reflection and refraction at the boundary of two nonconducting media, Normal incidence, oblique incidence.Brewster's angle.Critical angle.Complex Fresnel coefficients.Reflection from a conducting plane.Reflection and transmission by a thin layer.Interference.Propagation between parallel conducting plates, waveguides, cavity resonators.

### Unit 4: Optical Fibres:

Numerical Aperture. Step and Graded Indices (Definitions only). Single and Multiple Mode Fibres (Concept and Definition only).Application of optical fibers in communication system.

### Suggested Books:

1. Introduction to Electrodynamics, D.J. Griffiths, 3rd Ed., 1998, Benjamin Cummings.

2. Elements of Electromagnetics, M.N.O. Sadiku, 2001, Oxford University Press.
3. Introduction to Electromagnetic Theory, T.L. Chow, 2006, Jones & Bartlett Learning
4. Fundamentals of Electromagnetics, M.A.W. Miah, 1982, Tata McGraw Hill
5. Electromagnetic field Theory, R.S. Kshetrimayun, 2012, Cengage Learning
6. Electromagnetic Field Theory for Engineers & Physicists, G. Lehner, 2010, Springer
7. Electricity and Magnetism – D.C. Tayal (Himalaya Publication) 2014
8. Introduction to Electrodynamics-A.Z.Capri&P.V.Panat (Alpha Science) 2002
9. Optics E. Hecht, (Pearson India)
10. Electromagnetic Fields & Waves, P. Lorrain & D. Corson, 1970, W.H. Freeman & Co.
11. Electromagnetics, J.A. Edminster, Schaum Series, 2006, Tata McGraw Hill.
12. Electromagnetic field theory fundamentals, B. Guru and H. Hiziroglu, 2004, Cambridge University Press
13. Electromagnetic Theory-A. Murthy (S. Chand Publication) 2014
14. Classical Electrodynamics, J.D. Jackson (Wiley India)
15. Lectures on Engineering Physics, L. Moharana, P.K. Panda, S.K. Dash and B. Ojha, Pearson Publishers (2017)

## CC 10.2: Practicals

Contact Hours Per Week : 2
Examination Duration : 3 Hours
Maximum Marks : 30 ( Expt-20, Viva-5, Record-5)

1. To verify the law of Malus for plane polarized light.
2. To determine the specific rotation of sugar solution using Polarimeter.
3. To study dependence of radiation on angle for a simple Dipole antenna.
4. To study Polarization and double slit interference in microwaves.
5. To analyze elliptically polarized Light by using a Babinet's compensator.
6. To determine the refractive index of liquid by total internal reflection using Wollaston's air-film.
7. To study the polarization of light by reflection and determine the polarizing angle for air-glass interface.
8. Optical communication with LED, photodiode and optical fibers.

## Suggested Books:

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
3. A Text Book of Practical Physics, I.Prakash& Ramakrishna, 11th Ed., 2011, Kitab Mahal
4. Electromagnetic Field Theory for Engineers & Physicists, G. Lehner, 2010, Springer.

## CC 10.1: Oorganic Chemistry

Contact Hours per Week : 4
Credit : 4
Examination Duration : 3 Hours
Maximum Marks : 70 (Terminal-50, Sessional-20)

### Unit1:

#### Amino Acids, Peptides and Proteins

Amino acids and their classification.α-Amino Acids – General methods of Synthesis, ionic properties and reactions. Zwitterions, p$Ka$ values, isoelectric point and electrophoresis.

Study of peptides: classification, determination of their primary structures-end group analysis, methods of peptide synthesis. Synthesis of peptides using N-protecting, C-protecting and C-activating groups -Solid-phase synthesis

Structure of peptides and proteins, labels of proteins structure, protein denaturation.

### Unit2:

#### Synthetic Dyes

Classification, Colour and constitution; Mordant and Vat Dyes; Chemistry of dyeing.

Synthesis and applications of: Azo dyes – Methyl Orange and Congo Red (mechanism of Diazo Coupling); Triphenyl Methane Dyes -Malachite Green, Rosaniline and Crystal Violet; Phthalein Dyes – Phenolphthalein and Fluorescein; Natural dyes –structure elucidation and synthesis of Alizarin and Indigo; Edible Dyes with examples.

### Unit 3:

#### Pharmaceutical compounds

Classification, structure and therapeutic uses of antipyretics: Paracetamol (with synthesis), Analgesics: Ibuprofen (with synthesis), Antimalarials: Chloroquine (with synthesis). An elementary treatment of Antibiotics and detailed study of chloramphenicol, Medicinal values of curcumin (haldi), azadirachtin (neem), vitamin C and antacid (ranitidine).

### Unit 4:

#### Alkaloids and Terpenes

Alkaloids:Natural occurrence, Isolation, Classification,General properties and their physiological action. General structure determination.Hoffmann's exhaustive methylation, Emde's modification, Structure elucidation and synthesis of quinine and Nicotine.Medicinal importance of Nicotine, Hygrine, Quinine, Morphine, Cocaine, and Reserpine.

Terpenes: Occurrence, isolation, properties (physical and chemical) classification, isoprene rule; Elucidation of stucture and synthesis of Citral.
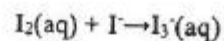
## CC 10.2: Practical

Conctact Hours Per Week : 2

Examination Duration : 3 Hours

Maximum Marks : 30 ( Expt-20, Viva-5, Record-5)

I. Distribution of acetic/ benzoic acid between water and cyclohexane.

II. Study the equilibrium of at least one of the following reactions by the distribution method:

$I_2(aq) + I^- \rightarrow I_3^-(aq)$

$Cu^{2+}(aq) + nNH_3 \rightarrow Cu(NH_3)n$
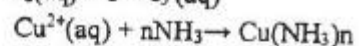
III. Study the kinetics of the following reactions.

1) Integrated rate method:

a. Acid hydrolysis of methyl acetate with hydrochloric acid.

b. Saponification of ethyl acetate.

2) Compare the strengths of HCl and $H_2SO_4$ by studying kinetics of hydrolysis of methyl acetate.

## Adsorption

I. Verify the Freundlich and Langmuir isotherms for adsorption of acetic acid on activated charcoal.

## CC10.1: Plant Physiology and Biochemistry

Contact Hour Per Week: 4
Credits: 4
Examination duration: 3 Hours
Maximum marks: 70 (Terminal- 50, Sessional- 20)

### Unit 1 :

**Nutrient Uptake:** Soil as a nutrient reservoir, transport of ions across cell membrane, passive absorption, electrochemical gradient, facilitated diffusion, active absorption, role of ATP, carrier systems, proton ATPase pump and ion flux, uniport, co-transport, symport, antiport.

**Plant growth regulators:** Discovery, chemical nature (basic structure), bioassay and physiological roles of Auxin, Gibberellins, Cytokinin, Abscisic acid, Ethylene. Brassinosteroids and Jasmonic acid.

### Unit 2 :

**Physiology of flowering:** Photoperiodism, flowering stimulus, florigen concept, vernalization, seed dormancy.
**Phytochrome:** Discovery, chemical nature, role of phytochrome in photomorphogenesis, low energy responses (LER) and high irradiance responses (HIR), mode of action.

### Unit 3 :

**Concept of metabolism:** Introduction, anabolic and catabolic pathways, regulation of metabolism, role of regulatory enzymes (allosteric, covalent modulation and Isozymes). **Carbohydrate metabolism:** Synthesis and catabolism of sucrose and starch. **Lipid metabolism:** Synthesis and breakdown of triglycerides, β-oxidation, glyoxylate cycle, gluconeogenesis and its role in mobilisation of lipids during seed germination, α oxidation. **Nitrogen metabolism:** Nitrate assimilation, biological nitrogen fixation (examples of legumes and non-legumes); Physiology and biochemistry of nitrogen fixation; Ammonia assimilation and transamination.

### Unit 4 :

**Mechanisms of signal transduction:** Calcium, phospholipids, cGMP, NO.

## CC 10.2: Practical

Contact Hour Per Week: 2
Examination duration:     3 Hours
Maximum marks: 30 (Exp. 20, Viva-5, Record-5)

1. Assay of catalase, peroxidase, and Urease activity from plant samples
2. Detection of calcium & magnesium from ash
3. Colorimetric estimation of IAA by salkowski method.
4. Isolation of chloroplast and assay of Hill activity.
5. Determination of R.Q. of germinating seeds

### References

1. Conn, E.E., Stumpf, P.K., Bruening, G. and Doi, R.H. Outlines of Biochemistry[John Wiley & Sons]
2. Lehninger, A.L., Nelson, D.L. and Cox, M.M. Principles of Biochemistry [CBS]
3. Elliot, W.H. and Elliot, D.C. Biochemistry and Molecular Biology [Oxford University Press]
4. Goodwin, T.W. and Mercer, E.I. Introduction to Plant Biochemistry [Oxford: Pergamon]
5. Jain, V.K. Fundamentals of Plant Physiology [S. Chand & Co.]

## CC10.1: Animal Physiology

| | | |
|---|---|---|
| Contact Hour per Week | : | 4 |
| Credits | : | 4 |
| Examination duration | : | 3 Hours |
| Maximum marks | : | 70 (Terminal- 50, Sessional- 20) |

### Unit 1:
### pH, buffers and principles of homeostasis

- pH, buffers, acid-base balance for buffering action of blood.
- Vitamins and minerals, control of blood sugar level and blood calcium level.
- Osmoregulation and thermoregulation.

### Unit 2:
### Physiology of circulation and excretion

- Circulation: components of blood and lymph and their functions; hematopoiesis: basic steps and its regulation; blood groups - ABO and Rh factor.
- Excretion: nitrogenous wastes - ammonia, urea, uric acid, creatinine; physiology of urine formation; ultrafiltration, countercurrent mechanism and role of vasa recta; reabsorption; juxtaglomerular apparatus (JGA) and its role.

### Unit 3:
### Nerve and muscle physiology

- Nervous system: structure and function of neuromuscular junction; structure, types and role of synapses (chemical and electrical) in propagation of nerve impulse, EPSP and IPSP, reflex action and its types.
- Muscle physiology: molecular and chemical basis of muscle contraction, role of calcium in muscle contraction, energetics of muscle contraction, rigor mortis, muscle twitch and fatigue.

### Unit 4:
### Physiology of respiration and sense organ

- Respiration: mechanism of breathing; transport of $O_2$ and $CO_2$ in mammals; Bohr effect, Haldane effect and chloride shift (Hamburger effect).
- Physiology of vision: retinal components, photoreceptors, photo-pigments, visual pathway; myopia, metropia (types) and astigmatism.
- Physiology of hearing: role of internal ear (vestibule and cochlea); auditory pathway.

## CC10.2: Practical

Contact Hour Per Week : 2
Examination duration : 3 Hours
Maximum marks : 30

- Estimation of haemoglobin of human.
- Study of total count of RBC and total as well as differential count of WBC.
- Measurement of blood pressure, heartbeat and pulse rate.
- Effect of different concentrations of NaCl on RBC.
- Determination of bleeding time and clotting time.
- Estimation of erythrocyte sedimentation rate in human.
- Sessional activities

**Reference Books:**

1. Hoar, W. S. (1983). General and Comparative Physiology, Prentice Hall of India, New Delhi.
2. Prosser, C. L and Brown, F. A. (1965). Comparative Animal Physiology, Prentice Hall of India, New Delhi.
3. Chatterjee, C. C. (1986). Human Physiology, Vols. I and II, Medical Allied Agency, Kolkata.
4. Guyton, A. C. (2006). Tex book of Medical Physiology, W. B. Saunders Co.
5. Prosser, C. L. (1991). Comparative Animal Physiology, Wiley-Liss.
6. Schmidt-Nielson, K. (1997). Animal Physiology, Cambridge University Press.
7. Smyth and Nelson: Adapative Physiology
8. Barne, R. M., Levy, M. N., Koeppen, B. M. and Stanton, B. N. (2011). Physiology, Elsevier.
9. Barrett, K. E., Barman, S. M. and Boitano, S. (2015). Ganong's Review of Medical Physiology, McGraw Hill Professional.

## CC 10.1: LINEAR PROGRAMMING

Contact Hours per Week    : 4

Credit    : 4

Examination Duration    : 3 Hours

Maximum Marks    : 70 (Terminal-50, Sessional-20)

**Unit1 :**

Introduction to linear programming problems(LPP), Mathematical formulation of the LPP with illustrations, Graphical method, General Linear programming problems, Canonical & standard form of LPP. Theory of Simplex method,

Optimality and unboundedness, the Simplex algorithm, Simplex method in tableau format, Introduction to artificial variables, Two-phase method, Big-M method and their comparisons.

**Unit2 :**

**Duality in LPP:** Introduction, General Primal-Dual pair, Formulation of the Dual problem, Primal-Dual relationships, Duality theorems, Complementary slackness theorem, Duality & Simplex method, Economic interpretation of the Duality.

**Unit3 :**

**Transportation Problem(TP):** LP formulation of TP, Existence of solution and Duality in TP, Solution of Transportation problems, North-West corner method, Least-Cost method and Vogel approximation method for determination of starting basic solution, Algorithm for solving transportation problem, Assignment problem and its mathematical formulation, Solution methods of Assignment problem, Special cases in Assignment problems.

**Unit4 :**

**Games and Strategies:** Introduction, Formulation of two person zero sum games, solving two person zero sum games, Maximin-Minimax principle, Games without saddle points, Games with mixed strategies, Graphical solution procedure to $(2 \times n)$ and $(m \times 2)$ games.

## CC 10.2 : PRACTICAL

Contact Hours Per Week : 2
Examination Duration : 3 Hours
Maximum Marks : 30 ( Expt-20, Viva-5, Record-5)

Activity oriented problem solving/ experiments based on the content studied in theory.

**Reference books:**

1. Kanti Swarup, P.K. Gupta and Man Mohan: Operations Research, S. Chand and Co. Pvt. Ltd.

2. P.K. Gupta and D.S. Hira-Operations Research, S. Chand and Company Pvt. Ltd., New Delhi. [Chapters : 2, 3, 4]

3. G. Hadley, Linear Programming, Narosa Publishing House, New Delhi, 2002.

4. N.V.R. Naidu, G. Rajendra and T. Krishna Rao-Operations Research, I.K. International Publishing House Pvt. Ltd., New Delhi, Bangalore.

5. R. Veerachamy and V. Ravi Kumar-Operations Research- I.K. International Publishing House Pvt. Ltd., New Delhi, Bangalore.

6. Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali, Linear Programming and Network Flows, 2nd Ed., John Wiley and Sons, India, 2004.

7. F.S. Hillier and G.J. Lieberman, Introduction to Operations Research, 9th Ed., Tata McGraw Hill, Singapore, 2009

## CC 11.1: Statistical Mechanics

Contact Hours per Week : 4
Credit : 4
Examination Duration : 3 Hours
Maximum Marks : 70 (Terminal-50, Sessional-20)

### Unit 1 : Classical Statistics-I:

Macrostate& Microstate, Elementary Concept of Ensemble, Microcanonical, Canonical and grand canonical ensemble. Phase Space, Entropy and Thermodynamic Probability, Maxwell-Boltzmann Distribution Law, Partition Function, Thermodynamic Functions of an Ideal Gas, Classical Entropy Expression.

### Unit 2 :Classical Statistics-II:

Gibbs Paradox, Sackur Tetrode equation, Law of Equipartition of Energy (with proof) – Applications to Specific Heat and its Limitations, Thermodynamic Functions of a Two-Energy Levels System, Negative Temperature.

### Unit 3 : Radiation:

Properties of Thermal Radiation.Blackbody Radiation.Pure temperature dependence.Kirchhoff's law. Stefan-Boltzmann law: Thermodynamic proof. Radiation Pressure.Wien's Displacement law. Wien's Distribution Law. Saha's Ionization Formula. Rayleigh-Jean's Law.Ultraviolet Catastrophe. Planck's Law of Blackbody Radiation: Experimental Verification.

### Unit 4 : Quantum Statistics:

Identical particles, macrostates and micro states. Fermions and Bosons, Bose Einstein distribution function and Fermi-Dirac Distribution function. Bose-Einstein condensation, Bose deviation from Planck's law, Effect of temperature on F-D distribution function, degenerate Fermigas, Density of States, Fermi energy.

### Suggested Books:

1. Statistical Mechanics-R.K. Pathria& Paul D. Beale (Academic Press) 3rd Edition (2011)
2. Statistical Physics, Berkeley Physics Course, F. Reif, 2008, Tata McGraw-Hill
3. Statistical and Thermal Physics, S. Lokanathan and R.S. Gambhir. 1991, Prentice Hall
4. Thermodynamics, Kinetic Theory and Statistical Thermodynamics, Francis W. Sears and Gerhard L. Salinger, 1986, Narosa.
5. Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, 2009, Springer
6. An Introduction to Statistical Mechanics & Thermodynamics, R.H. Swendsen, 2012, Oxford Univ. Press.
7. Statistical Physics - F. Mandl (CBS) 2012.

## CC 11.2: Practicals

Contact Hours Per Week : 2
Examination Duration : 3 Hours
Maximum Marks : 30 ( Expt-20, Viva-5, Record-5)

**Use C/C++/Scilab/Python for solving the problems based on Statistical Mechanics like**

1. Plot Planck's law for Black Body radiation and compare it with Wein's Law and Raleigh-Jeans Law at high temperature (room temperature) and low temperature.
2. Plot Specific Heat of Solids by comparing (a) Dulong-Petit law, (b) Einstein distribution function, (c) Debye distribution function for high temperature (room temperature) and low temperature and compare them for these two cases
3. Plot Maxwell-Boltzmann distribution function versus temperature.
4. Plot Fermi-Dirac distribution function versus temperature.
5. Plot Bose-Einstein distribution function versus temperature.

**Suggested Books:**

1. Elementary Numerical Analysis, K.E. Atkinson, 3 r d Edn. 2007, Wiley India Edition
2. Statistical Mechanics, R.K. Pathria, Butterworth Heinemann: $2^{nd}$ Ed., 1996, Oxford University Press.
3. Thermodynamics, Kinetic Theory and Statistical Thermodynamics, Francis W. Sears and Gerhard L. Salinger, 1986, Narosa.
4. Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, 2009, Springer
5. Simulation of ODE/PDE Models with MATLAB®, OCTAVE and SCILAB: Scientific and Engineering Applications: A. VandeWouwer, P. Saucez, C.V. Fernández. 2014 Springer ISBN: 978-3319067896
6. Scilab by example: M. Affouf, 2012. ISBN: 978-1479203444
7. Scilab Image Processing: L.M. Surhone. 2010, Betascript Pub., ISBN: 978-6133459274
8. A Complete Course in Degree Practical Physics, B. B. Swain & P.K. Jena, Kalyani Publishers (2017).

## CC 11.1: Physical Chemistry

Contact Hours per Week : 4
Credit : 4
Examination Duration : 3 Hours
Maximum Marks : 70 (Terminal-50, Sessional-20)

### Objectives:

On completion of the course the students will be able to

- Describe the types of reversible electrodes
- Understand the electrode reactions
- Describe the electrochemical series and its significance
- Differentiathe the electrolytic and galvanic cells
- Understand calculate the EMF of cells
- Explain the process of corrosion
- Understand the application of conductivity measurements, conductometric titrations and potentiometric titration
- Understand phase equilibria and its application

### Unit 1 :

#### Conductance-II

Ionic velocities, mobilities and their determinations, transference numbers and their relation to ionic mobilities, determination of transference numbers using Hittorf and Moving Boundary methods.

### Unit 2 :

#### Electrochemistry-I

Quantitative aspects of Faraday's laws of electrolysis, rules of oxidation/reduction of ions based on half-cell potentials, applications of electrolysis in metallurgy and industry.

Chemical cells, reversible and irreversible cells with examples.Electromotive force of a cell and its measurement, Nernst equation; Standard electrode (reduction) potential and its application to different kinds of half-cells.Application of EMF measurements in determining free energy, enthalpy and entropy of a cell reaction, (ii) equilibrium constants, and (iii) pH values.

### Unit 3 :

#### Electrochemistry-II

Concentration cells with and without transference, liquid junction potential; determination of activity coefficients and transport numbers.Qualitative discussion of potentiometric titrations (acid-base, redox, precipitation).Drycell, Lead-acid storage cell, fuel cell.Corrosion.

### Unit 4 :

#### Phase Equilibrium

Concept of phases, components and degrees of freedom, derivation of Gibbs Phase Rule for nonreactive and reactive systems; Clausius-Clapeyron equation and its applications to solid-liquid, liquid-vapour and solid-vapour equilibria,

Phase diagram for one component systems (water and sulphur system), with applications.

Phase diagrams for two component systems; simple eutectic, Pb-Ag system, desilverization of lead.

*Binary solutions:* Gibbs-Duhem-Margules equation, its derivation and applications to fractional distillation of binary miscible liquids, ideal and non-ideal, azeotropes, ethanol-water systems. partial miscibility of liquids, Lower and upper consolute temperatures, effect of impurity on consulate temperatures. Phenol-water, trimethylamine-water, nicotine-water systems.

Nernst distribution law: its derivation and applications.

**CC 11.2: Practical**

Conctact Hours Per Week : 2
Examination Duration : 3 Hours
Maximum Marks : 30 ( Expt-20, Viva-5, Record-5)

## Gravimetric Analysis:

i. Estimation of nickel (II) using Dimethylglyoxime (DMG).
ii. Estimation of copper as CuSCN
iii. Estimation of iron as $Fe_2O_3$ by precipitating iron as $Fe(OH)_3$.
iv. Estimation of Al (III) by precipitating with oxine and weighing as Al(oxine)$_3$ (aluminium oxinate).
v) Estimation of Ba as $BaSO_4$
vi) Estimation of Pb as $PbSO_4$

## Chromatography of metal ions

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

i. Ni (II) and Co (II)
ii. Fe (III) and Al (III)

## CC11.1: PLANT BREEDING AND BIOSTATISTICS

Contact Hour Per Week: 4
Credits:                4
Examination duration:   3 Hours
Maximum marks: 70 (Terminal- 50, Sessional- 20)

### Unit 1 :

**Methods of crop improvement:** Introduction: Centres of origin and domestication of crop plants, plant genetic resources; Acclimatization; Selection methods: For self pollinated, cross pollinated and vegetatively propagated plants; Hybridization.

### Unit 2 :

**Quantitative inheritance and crop improvement:** Quantitativeinheritance conceptsConcept. Genetic basis of inbreeding depression and heterosis; Applications.Role of mutations; Polyploidy as methods of crop improvement.

### Unit-3

Measures of central tendency - Mean, median, mode, geometric mean - merits & demerits. Measures of dispersion - range, standard deviation, mean deviation, quartile deviation - merits and demerits; Co- efficient of variations.

### Unit-4

Statistical inference - hypothesis - simple hypothesis - student 't' test-chi square test.

## CC 11.2: Practical

Contact Hour Per Week: 2
Examination duration: 3 Hours
Maximum marks: 30 (Exp. 20, Viva-5, Record-5)

    i. Emasculation technique.
    ii. Selfing and cross hybridization process.
    iii. Pollen maturity test.
    iv. Calculation of mean, standard deviation and standard error.
    v. Calculation of correlation coefficient values and finding out the probability.
    vi. Calculation of 'F' value and finding out the probability value for the F value.
    vii. T-test and Chi square test.
    viii. Regression analysis.

### Reference Books :

1. Singh, B.D. 2005. Plant Breeding: Principles and Methods. Kalyani Publishers. 7th edition.
2. Chaudhari, H.K. 1984. Elementary Principles of Plant Breeding. Oxford – IBH. 2ndedition.
3. Acquaah, G. 2007. Principles of Plant Genetics & Breeding. Blackwell Publishing.
4. Danniel, W.W. 1987. Biostatistic, New York, John Wiley Sons.
5. An introduction to Biostatistics, 3rd edition, Sundarrao, P.S.S and Richards, J. Christian MedicalCollege, Vellore.
6. Selvin, S. 1991. Statistical Analysis of epidemiological data, New York University Press.
7. Freedman, P. The Principles of scientific research, New York, Pergamon Press.
8. Campbell, R.C., 1998. Statistics for Biologists,.Cambridge University Press.

## CC11.1: Endocrinology and Immunology

Contact Hour per Week : 4
Credits : 4
Examination duration : 3 Hours
Maximum marks : 70 (Terminal- 50, Sessional- 20)

### Unit 1:
### Endocrinology-1

- General idea of mammalian endocrine systems: major endocrine glands and locations.
- Hormones: chemical nature, classification, mechanism of action of a protein and a steroid hormone.
- Hypothalamus: hypothalamic releasing factors.
- Pituitary: histology, major hormones and their chief functions and disorders.
- Thyroid: histology, hormones, synthesis and function, disorders.

### Unit 2:
### Endocrinology-2

- Endocrine glands: histology, hormones and functions of pancreas, parathyroid, adrenal, gonads, and disorders.
- Hormonal regulation of mammalian reproduction; role of hypothalamo-hypophyseal-gonadal axis.

### Unit 3:
### Immunology - 1

- Immunity: basic concept on immunity and susceptibility, innate and adaptive immunity.
- Cells and organs of immune system.
- Antigens and immunogens, properties of immunogens, adjuvants.
- Antibody: structure, types and functions.
- Antigen processing and presentation: APCs.
- B and T-cells: structure and cooperation.
- Mechanism of immune response; ADCC.

### Unit 4:
### Immunology-2

- Antigen-antibody interactions; concept of hybridoma technology; monoclonal and polyclonal antibodies.
- Cytokines and T-cell receptors.
- Complement system: complement and complement fixation reactions in immune system.
- Hypersensitivity, immunodeficiency and autoimmune diseases.

### CC11.2: Practical

Contact Hour Per Week : 2
Examination duration : 3 Hours
Maximum marks : 30

- Tissue fixation, microtomy, block preparation, staining and mounting of endocrine tissues (pancreas, thyroid and testis).
- Dissection and display of pituitary gland of fish.
- Ouchterlony's double immunodiffusion method.
- Determination ABO blood group and RH factor.
- Study of endocrine disorders and collection of photographs/pictures.
- Sessional activities.

### Reference Books :

1. Bolandar, M. (2001). Molecular Endocrinology. Elsevier Science.
2. Greenspan, F. S. and Gardener, F. G. (2003). Basic and Clinical Endocrinology, 7th ed. McGraw Hill.
3. Hadley, M. E. (2000). Endocrinology, 5th ed. Pearson Education.
4. Negi, C. S. (2010). Introduction to Endocrinology. PHI Learning Pvt. Ltd.
5. Norris, D. O. (2006). William's Textbook of Endocrinology: Vertebrate Endocrinology, 3rd ed. Academic Press.
6. Turner, C. D. and Bagnara, J. T. (1976). General Endocrinology, 6th ed. W. B. Saunders.
7. Kindt, T. J., Goldsby, R. A., Osborne, B. A. and Kuby, J. (2006). Immunology. 6th ed. W. H. Freeman and Co.
8. Abbas, A., Lichtman, A. H. A. and Pillai, S. (2017). Basic Immunology: Functions and Disorders of the Immune System, 5th ed. Elsevier.
9. Murphy, K. and Weaver, C. (2016). Janeway's Immunobiology, 9th ed. Kindle Books.
10. Male, D., Brostoff, J., Roth, D and Roitt, I. (2012). Immunology, 8th ed. W. B. Saunders.

## CC 11.1: NUMERICAL ANALYSIS

Contact Hours per Week : 4
Credit : 4
Examination Duration : 3 Hours
Maximum Marks : 70 (Terminal-50, Sessional-20)

**Unit1 :**

Rate of convergence, Algorithms, Errors: Relative, Absolute, Round off, Truncation. Numerical solution of non-linear equations: Bisection method, Regular-Falsi method, Secant method, Newton-Raphson method, Fixed-point Iteration method, Rate of convergence of these methods.

**Unit2 :**

System of linear algebraic equations: Gaussian Elimination and Gauss Jordan methods. Gauss Jacobi method, Gauss Seidel method and their convergence analysis.

**Unit3 :**

Polynomial interpolation: Existence uniqueness of interpolating polynomials, Lagrange and Newtons divided difference interpolation, Error in interpolation, Forward and back ward difference operator Central difference & averaging operators, Gauss-forward and backward difference interpolation.

**Unit4 :**

Numerical Integration: Some simple quadrature rules, Newton-Cotes rules, Trapezoidal rule, Simpsons $\frac{1}{3}$ -rd rule, Simpsons $\frac{3}{8}$ -th rule, compound trapezoidal rule, compound Simpsons rule, Gauss-Legendre 2-point and 3-point rules. Numerical solutions of Differential Equations: Euler's Method, Modified Euler's method. Runge-Kutta Method

## CC 11.2 : PRACTICAL

Contact Hours Per Week   :   2
Examination Duration     :   3 Hours
Maximum Marks           :   30 ( Expt-20, Viva-5, Record-5)

1. Bisection Method.
2. Newton Raphson Method.
3. Secant Method.
4. Regula Falsi
5. Lagrange Interpolation
6. Newton Interpolation method.
7. Compound Trapezoidal rule
8. Compound Simpson's rules.
9. Euler's Method
10. Runge-Kutta Method

**Reference books:**

1. B.P. Acharya and R.N. Das, A Course on Numerical Analysis, Kalyani Publishers, New Delhi,Ludhiana. Chapters:1,3(3.1-3.4, 3.6-3.8), 8(8.1-8.4), 2 (2.1-2.9),6(6.1-6.5,6.10-6.12),7(7.1-7.7)
2. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, 6th Ed., New age International Publisher, India, 2007.
3. C.F. Gerald and P.O. Wheatley, Applied Numerical Analysis, Pearson Education, India, 2008.
4. Uri M. Ascher and Chen Greif, A First Course in Numerical Methods, 7th Ed., PHI Learning Private Limited, 2013.
5. J B Scarborough : Numerical Mathematical Analysis ( Oxford &IBH Publishing )
6. Brian Bradie, A Friendly Introduction to Numerical Analysis, Pearson Education, India, 2007.
7. E. KendaliAthinson, An Introduction to Numerical Analysis.
8. Prasun Kr. Nayak : Numerical Analysis ( Asian Book Pvt. Ltd. )
9. D.C. Sanyal and K. Das, Introduction to Numerical Analysis.
10. S.S Sastry, Introductory Methods of Numerical Analysis.

## CC 12.1: Digital and Analog Circuits and Instrumentation

Contact Hours per Week : 4
Credit : 4
Examination Duration : 3 Hours
Maximum Marks : 70 (Terminal-50, Sessional-20)

### Unit 1: Digital Circuits:

Difference between Analog and Digital Circuits.Binary Numbers. Decimal to Binary and Binary to Decimal Conversion, AND, OR and NOT Gates (Realization using Diodes and Transistor). NAND and NOR Gates as Universal Gates. XOR and XNOR Gates.

De Morgan's Theorems.Boolean Laws. Simplification of Logic Circuit using Boolean Algebra. Fundamental Products.Conversion of a Truth Table into an Equivalent Logic Circuit by (1) Sum of Products Method and (2) Karnaugh Map.

### Unit 2: Semiconductor Devices and Amplifiers:

Zener Diode and its characteristics, LED, Photodiode (working principle). Bipolar Junction transistors: n-p-n and p-n-p Transistors. Characteristics of CB, CE and CC Configurations.Current gains $\alpha$ and $\beta$. Relations between $\alpha$ and $\beta$. Load Line analysis of Transistors.DC Load line and Q-point.Active, Cutoff, and Saturation Regions.Voltage Divider Bias Circuit for CE Amplifier.h-parameter Equivalent Circuit. Analysis of a single-stage CE amplifier using Hybrid Model. Input and Output Impedance. Current, Voltage and Power Gains. Class A, B, C and AB Amplifiers. JFET: n-channel and p-channel.

### Unit 3: Operational Amplifiers (Black Box approach) :

Characteristics of an Ideal and Practical Op-Amp (IC 741), Differential amplifier and its gain, input/output resistance, Open-loop& Closed-loop Gain. CMRR, concept of Virtual ground. Applications of Op-Amps: (1) Inverting and Non-inverting Amplifiers, (2) Adder, (3) Subtractor, (4) Differentiator, (5) Integrator, (6) Zero Crossing Detector.

### Unit 4 : Instrumentation:

Oscillators, criteria for sustained oscillation, tank circuit, Hartley, Colpitt and Weinbridge Oscillators, Multivibrators.Power Supply: Half-wave Rectifiers. Centre-tapped and Bridge Full-wave Rectifiers Calculation of Ripple Factor and Rectification Efficiency, Basic idea about series inductor, L-section and $\Pi$-section filters, Zener Diode and Voltage Regulation , Radio Transmission, Modulation and demodulation (Amplitude and Frequency).

### Suggested Books:

1. Integrated Electronics, J. Millman and C.C. Halkias, 1991, Tata Mc-Graw Hill.
2. Electronic Circuits and Systems: Analog and Digital, Y N Bapat, 1992, Tata Mc-Graw Hill
3. Electronic devices and circuits, S. Salivahanan and N. Suresh Kumar, 2012, Tata Mc-Graw Hill.

4. Microelectronic Circuits, M.H. Rashid, 2$^{nd}$Edn., 2011, Cengage Learning.

5. Modern Electronic Instrumentation & Measurement Tech., Helfrick& Cooper, 1990, PHI Learning

6. Digital Principles & Applications, A.P. Malvino, D.P. Leach &Saha, 7th Ed.,2011, Tata McGraw Hill

7. Fundamentals of Digital Circuits, A. Anand Kumar, 2nd Edition, 2009, PHI Learning Pvt. Ltd.

8. OP-AMP and Linear Digital Circuits, R.A. Gayakwad, 2000, PHI Learning Pvt. Ltd.

9. Textbook on Electronics, B. B. Swain, Kitab Mahal, Cuttack (2015).

## CC 12.2: Practicals

Contact Hours Per Week     :     2
Examination Duration       :     3 Hours
Maximum Marks              :     30 ( Expt-20, Viva-5, Record-5)

1. To verify and design AND, OR, NOT and XOR gates using NAND gates.
2. Half adder, Full adder and 4-bit Binary Adder.
3. Adder-Subtractor using Full Adder I.C.
4. To design an astablemultivibrator of given specifications using 555 Timer.
5. To design a monostablemultivibrator of given specifications using 555 Timer.
6. To study IV characteristics of PN diode, Zener and Light emitting diode
7. To design a CE amplifier of a given gain (mid-gain) using voltage divider bias.
8. To design an inverting amplifier of given gain using Op-amp 741 and study its frequency response.
9. To design a non-inverting amplifier of given gain using Op-amp 741 and study its Frequency Response.
10. To study a precision Differential Amplifier of given I/O specification using OP amp.
11. To investigate the use of an op-amp as a Differentiator.

## Suggested Books:

1. Basic Electronics: A text lab manual, P.B. Zbar, A.P. Malvino, M.A. Miller, 1994, Mc-Graw Hill.

2. Electronics: Fundamentals and Applications, J.D. Ryder, 2004, Prentice Hall.

3. OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edition, 2000, Prentice Hall.

4. Electronic Principle, Albert Malvino, 2008, Tata Mc-Graw Hill.

5. A Complete Course in Degree Practical Physics, B. B. Swain, Kalyani Publishers (2017).

## CC 12.1: Physical Chemistry

Contact Hours per Week  :  4
Credit                          :  4
Examination Duration   :  3 Hours
Maximum Marks          :  70 (Terminal-50, Sessional-20)

### Unit 1 :

#### Principle of Molecular spectroscopy-II

Nuclear Magnetic Resonance (NMR) spectroscopy: Principles of NMR spectroscopy, Larmorprecession, chemical shift and low resolution spectra, different scales, spin-spin coupling andhigh resolution spectra, interpretation of PMR spectra of organic molecules.

Electron Spin Resonance (ESR) spectroscopy: Its principle, hyperfine structure, ESR ofsimple radicals.Mass spectroscopy.

### Unit 2 : Spectroscopy of Organic Molecules -II

*NMR Spectroscopy:* Basic principles of Proton Magnetic Resonance, chemical shift and factors influencing it; Spin – Spin coupling and coupling constant; Anisotropic effects in alkene, alkyne, aldehydes and aromatics, Interpetation of NMR spectra of simple compounds.

Mass Spectroscopy- Basic principle, Fragmentation pattern, Instrumentation, Determination of m/e ratio.Application of Mass Spectroscopy on $CH_4$, $C_2H_6$, *n*-butane and *neo*-pentane.

Applications of IR, UV and NMR for identification of simple organic molecules.

### Unit 3 :

#### a) Liquid state of matter

Qualitative treatment of the structure of the liquid state; Radial distribution function; physical properties of liquids; vapour pressure, surface tension and coefficient of viscosity, and their determination. Effect of addition of various solutes on surface tension and viscosity.Explanation of cleansing action of detergents.Temperature variation of viscosity of liquids and comparison with that of gases.Qualitative discussion of structure of water.

Liquid crystals, classification and structure of nematic and cholestric phase

#### b) Third Law of Thermodynamics: Nernst Heat theorem. Statement of third law, concept of residual entropy, calculation of absolute entropy of molecules from heat capacity data.

### Unit 4 :

#### a) Quantum chemistry

Heisenberg Uncertainty principle; wavefunctions, probability distribution functions, nodal properties.Postulates of quantum mechanics, quantum mechanical operators, Schrödinger equation and its application to free particle and "particle-in-a-box" (rigorous treatment), quantization of energy levels, zero-point energy. Qualitative treatment of simple harmonic oscillator model of vibrational motion: Setting up of Schrödinger equation and discussion of solution and wavefunctions. Extension to two and three dimensional boxes, separation of variables, degeneracy.

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Vibrational energy of diatomic molecules and zero-point energy.

Angular momentum: Commutation rules, quantization of square of total angular momentum and z-component.

Rigid rotator model of rotation of diatomic molecule.Schrödinger equation, transformation to spherical polar coordinates.Separation of variables.Spherical harmonics.Discussion of solution.

Qualitative treatment of hydrogen atom and hydrogen-like ions: setting up of Schrödinger equation in spherical polar coordinates, radial part, quantization of energy (only final energy expression). Average and most probable distances of electron from nucleus.

Setting up of Schrödinger equation for many-electron atoms (He, Li). Need for approximation methods. Statement of variation theorem and application to simple systems (particle-in-a-box, harmonic oscillator, hydrogen atom).

b) **Photo-Chemistry:** Characteristics of electromagnetic radiation, Lambert-Beer's law and its limitations, physical significance of absorption coefficients. Laws of photochemistry ( Grothus-Drapper law, Stark-Einstain law), Jablonski diagram depicting various processes occurring in the excited state, quantum yield, actinometry, examples of low and high quantum yields, photochemical equilibrium and the differential rate of photochemical reactions, photosensitised reactions, quenching. Role of photochemical reactions in biochemical processes, photostationary states, chemiluminescence. Qualitative description of fluorescence and phosphorescence, Non radiative processes (internal conversion, intersystem crossing).

## CC 12.2: Practical

Conctact Hours Per Week    2
Examination Duration    3 Hours
Maximum Marks    30 ( Expt-20, Viva-5, Record-5)

**Conductometry**

I.    Determination of cell constant
II.    Determination of equivalent conductance, degree of dissociation and dissociation constant of a weak acid.
III.    Perform the following conductometric titrations:
     i.    Strong acid vs. strong base
     ii.    Weak acid vs. strong base
     iii.    Strong acid vs. weak base

**Potentiometry**

I    Perform the following potentiometric titrations:
     i.    Strong acid vs. strong base
     ii.    Weak acid vs. strong base
     iii.    Dibasic acid vs. strong base

## CC12.1 Biodiversity , Plant ecology and Phytogeography

Contact Hour Per Week: 4
Credits: 4
Examination duration: 3 Hours
Maximum marks: 70 (Terminal- 50, Sessional- 20)

### Unit 1 :

**Concept of Biodiversity:** Loss of genetic diversity, Loss of species diversity,Loss of ecosystem diversity, Loss of agrobiodiversity, Projected scenario for biodiversity loss,Organizations associated with biodiversity management-Methodology for execution-IUCN, UNEP;UNESCO, WWF, NBPGR; Biodiversity legislation and conservations, Biodiversity information management and communication.

### Unit 2 :

**Concept of Conservation :**Conservation of genetic diversity,speciesdiversity and ecosystem diversity, *In situ* and *ex situ* conservation,Socialapproaches to conservation, Biodiversity awareness programmes,Sustainable development.

### Unit 3 :

**Ecology :**Concept of ecology, Autecology, Synecology, systemecology, Levels of organization. Inter-relationships between the living worldand the environment, the components of environmental, concept ofhydrosphere and lithosphere and dynamism, homeostasis.**Water:** Importance: States of water in the environment; Atmosphericmoisture; Precipitation types (rain, fog, snow, hail, dew); HydrologicalCycle; Water in soil; Water table.

### Unit 4 :

**Phytogeography:** Principles; Continental drift; Theory of tolerance;Endemism; Brief description of major terrestrial biomes (one each fromtropical, temperate & tundra); Phytogeographical division of India; Local Vegetation.

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## CC 12.2: Practical

Contact Hour Per Week: 2
Examination duration: 3 Hours
Maximum marks: 30 (Exp. 20, Viva-5, Record-5)

    I. Plant Biodiversity study of Particular area
    II. Estimation Soil organic matter in different soil samples by titration method
    III. pH and rapid field tests of soils for carbonates, chlorides, nitrates, sulphates, organic matter and base deficiency.
    IV. Determination of dissolved oxygen of water samples from polluted and unpolluted sources.

### Reference Books:

1. Vasudevan, N. 2006. Essentials of Environmental Science. Narosa Publishing House, New Delhi.
2. Singh, J. S., Singh, S.P. and Gupta, S. 2006. Ecology, Environment and Resource Conservation.

3. Rogers, P.P., Jalal, K.F. and Boyd, J.A. 2008. An Introduction to Sustainable Development. Prentice Hall of India Private Limited, New Delhi.
4. Vasudevan, N. 2006. Essentials of Environmental Science. Narosa Publishing House,New Delhi.
5. Singh, J. S., Singh, S.P. and Gupta, S. 2006. Ecology, Environment and Resource Conservation. Anamaya Publications, New Delhi
6. Rogers, P.P., Jalal, K.F. and Boyd, J.A. 2008. An Introduction to Sustainable Development. Prentice Hall of India Private Limited, New Delhi.

### CC12.1: Developmental Biology and Reproductive Biology

Contact Hour per Week : 4
Credits : 4
Examination duration : 3 Hours
Maximum marks : 70 (Terminal- 50, Sessional- 20)

**Unit 1:**

**Principles of development**

- Principles of development: epigenesis, preformation theory.
- Induction: concept of embryonic induction and organizer in development, Spemann and Mangold's experiment.
- Stem cell: characteristics, types, culture and application.
- Ageing and senescence.

**Unit 2: Development of frog, chick and insect**

- Neurulation, notogenesis and enterogenesis.
- Organogenesis: basic concept, development of eye and heart in chick.
- Metamorphosis: changes and hormonal regulation of metamorphosis in insects and amphibians.

**Unit 3:**

**Regeneration and parthenogenesis**

- Regeneration: basic concept, regeneration in *Hydra* and *Planaria*.
- Parthenogenesis: natural and artificial.

- In-vitro fertilization: in vitro fertilization (IVF) and embryo transfer mechanism (IVF-ET), advantages and disadvantages.

**Unit 4:**

**Reproductive Biology**

- Hormonal control of spermatogenesis and oogenesis.
- Reproductive cycles and their hormonal regulation: Oestrous cycle and menstrual cycle.
- Implantation.
- Placentation - types and physiology of placenta.
- Hormonal regulation of pregnancy, parturition and lactation.

**CC12.2:Practical**

Contact Hour per Week : 2

Examination duration : 3 Hours

Maximum marks : 30

- Study of developmental stages of chick - 24h, 48h, 72h, 96h of incubation.
- Study of various developmental stages of frog/toad (tadpole larva metamorphosis).
- Temporary slide preparation of chick embryo of different hours of incubation.
- *Drosophila* - study of developmental stages and life cycle from culture.
- Sessional activities.

**Reference Books :**

1. Gilbert, S. F. (2006). Developmental Biology, 8th ed. Sinauer Associates, Inc., USA.
2. Balinsky, B. I. (2008). An Introduction to Embryology, 5thed. International Thomson Computer Press.
3. Browder, L. W. (1984). Developmental Biology. 2nd ed. CBS College Publishing.
4. Carlson, B. M. (1999). Patten's Foundations in Embryology. 6th ed. McGraw Hill.
5. Kalthoff, K., (2001). Analysis of Biological Development. 2nd ed. McGraw Hill.
6. Moody, S. A. (ed.). (2007). Principles of Developmental Genetics. Academic Press.
7. Wolpart, L. (2002 ). Principles of Development, 2nd ed. Oxford University Press.

## CC 12.1: PROBABILITY & STATISTICS

Contact Hours per Week    : 4
Credit                    : 4
Examination Duration      : 3 Hours
Maximum Marks             : 70 (Terminal-50, Sessional-20)

**Unit1 :**

Events and Sample space, Probability axioms, additive theorem of probability, Independent events, Conditional probability, Multiplication theorem of probability,Bayes' theorem and its application.

**Unit2 :**

Random variables, probability mass function, probability density function, distribution function(discrete and continuous) Joint probability distribution function, Marginal & conditional distributions, definition and examples of mathematical expectation, variance and covariance.

**Unit3 :**

Generating function and law of large number, Some probability distributions (Discrete and Continuous case), Binomial, Poission, Uniform, Gamma, Exponential, Beta distributions, Normal distributions, Normal approximation to the Binomial distribution, Bivariate normal distribution.

**Unit 4:**

Random sampling, Estimation of Parameters, Confidence Intervals, Significance Level,Testing of hypothesis, Acceptance sampling, Regression Analysis, Fitting Straight Lines, Correlation analysis.

## CC 12.2 : PRACTICAL

| | | |
|---|---|---|
| Contact Hours Per Week | : | 2 |
| Examination Duration | : | 3 Hours |
| Maximum Marks | : | 30 ( Expt-20, Viva-5, Record-5) |

Activity oriented problem solving/ experiments based on the content studied in theory.

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**Reference Books:**

1. S. Ross-A First Course in Probability, Pearson Education.Chapters:2,3,4,5 ,6(6.1 to 6.5,6.7), 7 (7.1-7.4,7.6)
2. P.C.Biswal , Probability and Statistics,PHI publication
3. Irwin Miller and Marylees Miller, John E. Freund, Mathematical Statistics with Applications, 7<sup>th</sup> Ed., Pearson Education, Asia, 2006.
4. Sheldon Ross, Introduction to Probability Models, 11th Ed., Academic Press, Indian Reprint, 2007.
5. Alexander M. Mood, Franklin A. Graybill and Duane C. Boes, Introduction to the Theory of Statistics, 3rd Ed., Tata McGraw- Hill, Reprint 2007.
6. S.C. Gupta and V.K. Kapoor-Fundamentals of Mathematical Statistics, S. Chand and Company Pvt. Ltd., New Delhi. [ Chapters : 3 (3.1 to 3.15), 4 (4.1 to 4.2)]

7. N G Das :Statistical Methods ( Vol. I & II )
8. Robert V. Hogg, Joseph W. McKean and Allen T. Craig: Introduction to Mathematical Statistics, Pearson Education, Asia, 2102.
9. J. N. Kapur and H.C. Saxena, Mathematical Statistics.
10. Goon, Gupta and Dasgupta : Fundamentals of Statistics ( Vol. I & II )
11. D. W. Elhance, Fundamentals of Statistics.
12. Murray R Spigel, Probability and Statistics.

# SEMESTER-VI
## CBCS

The aim of these courses is not just to impart theoretical knowledge to the students but to provide them with exposure and hands-on learning wherever possible.

# HERBAL PLANTS FOR HOME GARDENING

Contact Hours per Week: 4
Credit: 4
Examination Duration: 3 Hours
Maximum Marks: 100
(Terminal-80, Sessional-20)

**Unit 1:** Gardening: definition, objectives and scope - Garden tools and implements different types of gardening -computer applications in landscaping - Gardening operations: soil laying, manuring, watering, management of pests and diseases and harvesting.

**Unit 2:** Introduction to Herbs: .Herbal Gardening; Planting, propagation, soils, plant nutrition, and container growing. Plant identification, plant names, general characteristics of herbs, the history of herbs, and herb resources (nurseries, seeds, clubs, etc) Growing Herbs to Harvest. Herb products, setting up a herb farm, making compost.

**Unit 3:** (a) Indoor gardening – Selection of indoor plants, care and maintenance of indoor plants, Bonsai – Principle, Creating the bonsai.(b) Outdoor gardening.(1) Floriculture: Factors affecting flower production; Production andpackaging of cut flowers; Flower arrangements; Methods to prolong vase life; Cultivation of Important cut flowers Aster, Dahlia, Gerbera, Gladiolous, Marigold,Rose, Lilium, Orchid, Cultivation of Rose, *Jasminum, Chrysanthemum,* Orchids, *Anthurium.*

**Unit 4 :** Scope and importance of traditional medicine Plants in primary health care: study of selected Common medicinal plants – Tinospora cordifolia, Oscimum sanctum, Piper longum, Terminalia chebula , Aloe vera , Curcuma longa.Brahmi Phyllanthus emblica, Coleus, Catheranthus, Adathoda, Rauwolfia, Mentha,. Withania somnifera, Phyllanthus amarus and Phyllanthus emblica.

## Reference Books:

1. Nishi Sinha: Gardening in India, Abhinav Publications, New Delhi.
2. Andiance and Brison. 1971. Propagation Horticultural Plants.Rekha Sarin. The Art of Flower Arrangement, UBS Publishers,New Delhi.
3. Katyal, S.C., Vegetable growing in India, Oxford, New York.
4. Chanda, K.L. and Choudhury, B. Ornamental Horticulture in India.Premchand, Agriculture and Forest Pest and their Management, Oxford Publication.
5. Prasad, S., and U. Kumar. Green house Management for Horticultural Crops, Agrobios, Jodhpur.
6. Kolay, A.K. Basic Concepts of Soil Science. New Age International Publishers, Delhi.
7.Hudson, T. Hartmann, Dale K. Kester, Fred T. Davies, Robert L. Geneve, Plant Propagation,Principles and Practices.

# CHEMISTRY AND OUR LIFE

Contact Hours per Week: 4

Credit: 4

Examination Duration: 3 Hours

Maximum Marks: 100 (Terminal-80, Sessional-20)

Unit 1:

**Food Chemistry (Water, Beverage, Kitchen, Fire chemistry):**
Water, a universal solvent, hard and soft water, demineralized water, water in our body, common beverages: tea, coffee, milk, soft drinks, alcoholic beverages, process in cooking, food ingredients.

Unit 2:

**Chemistry in day-to-day life (Tooth paste, soap, cosmetics):** toothpaste, soaps, detergents, fairness creams, anti-aging cream, sunscreen creams, shampoos, hair dyes, perfumes and deodorants.

Unit 3:

**Chemistry in Health and Disease:** Drugs and pharmaceuticals, antiseptics and disinfectants, mosquito repellants, chemical fertilizers, chemical pesticides.

Unit 4:

**a) Plastics and polymers:** somecommon plastics: polystyrene, polycarbonate, PET, PVC, Polyurethane, Polymethyl methacrylate, polypropylene, tricot, ABS plastic, nylon, Bakelite, melamine, PTFE.

**b) Fuel Chemistry (Battery and Petrochemicals):** Types of fuels, match box, rocket propellants, solid propellants, liquid propellants, hybrid propellants, fireworks.

Primary cell, secondary cell, rechargeable batteries, fuel cells (zero emission vehicles).

Petroleum and natural gas, their composition, petroleum mining, petroleum refining, octane number and cetane number.

Clean alternative fuels: Compressed Natural Gas (CNG), LNG, LPG, bio diesel.

**Reference Books :**
1. Chemistry in Our Life- Biman Basu

# Renewable Energy and Energy Harvesting

Contact Hours per Week: 4
Credit: 4
Examination Duration: 3 Hours
Maximum Marks: 100 (External-80, Sessional-20)

**Unit 1: Fossil fuels and Alternate Sources of energy:** Fossil fuels and nuclear energy, their limitation, need of renewable energy, non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, solar energy, biomass, biochemical conversion, biogas generation, geothermal energy tidal energy, Hydroelectricity.

**Unit 2: Solar energy:** Solar energy, its importance, storage of solar energy, solar pond, non plate collector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning. Need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits, and sun tracking systems.

**Unit 3: Wind Energy harvesting:** Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces, and grid interconnection topologies.
**Ocean Energy:** Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices.
Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy, Osmotic Power, Ocean Bio-mass.

**Unit 4: Geothermal Energy:** Geothermal Resources, Geothermal Technologies.

**Hydro Energy:** Hydropower resources, hydropower technologies, environmental impact of hydro power sources.

## Reference Books:

1. Non-conventional energy sources - G.D Rai - Khanna Publishers, New Delhi

2. Solar energy - M P Agarwal - S Chand and Co. Ltd.

3. Solar energy - Suhas P. Sukhative Tata McGraw - Hill Publishing Company Ltd.

4. Godfrey Boyle, "Renewable Energy, Power for a sustainable future", 2004, Oxford University Press, in association with The Open University.

5. Dr. P. Jayakumar, Solar Energy: Resource Assessment Handbook, 2009

6. J. Balfour, M. Shaw and S. Jarosek, Photovoltaics, Lawrence J. Goodrich (USA).

# GENERAL MATHEMATICS

Contact Hours per Week: 4
Credit: 4*
Examination Duration: 3 Hours
Maximum Marks: 100 (Terminal-80, Sessional-20)

## Unit 1:

What isMathematics, Role and real life application of Mathematics, History of Mathematics,Introduction to number systems: Natural numbers, Integers, rational numbers, real numbers, complex numbers. Elements of set theory: Set, Types of set with examples. Representation of sets. Basic operations on sets ( union, intersection, complementation). Venn diagram. Verbal reasoning: Logical Venn Diagrams; Mathematical Operations-Problem solving by substitution, Interchange of signs and numbers, Logical sequences of words.

## Unit 2:

Number series, letter series, coding-decoding, analogy test, Relationship problems, Calendar problems. Arithmetical reasoning: number series completion, calculation based problems, data based problems, problem on ages, work and time problems, percentage problems.

## Unit 3:

Logical deductions: logical reasoning, logical deductions, two-premise and three-premise arguments; Statement-Arguments; Statement-Assumptions; Statement-Courses of Action; Statement-Conclusions.

## Unit 4:

Organisation of data: Frequency table, Grouping. Pictorially displaying data: dot plots, bar graphs, line graphs, pie charts. Data interpretation: Numerical based on analysis of data presented in tabular, bar chart, pie-chart or line graph.

## Reference Books :

1. R.S. Aggarwal A modern approach to Verbal and non-verbal reasoning. S. Chand and Co.

# FOOD, NUTRITION AND PUBLIC HEALTH

Contact Hours per Week: 4
Credit: 4*
Examination Duration: 3 Hours
Maximum Marks: 100 (Terminal-80, Sessional-20)

### Unit1:

**Food and Nutrients**

Food, Nutrients (Macro and Micro) Synthetic foods, Diet and dietary guidelines, Junk foods, Function of food, Food adulteration, Food poisoning, Balanced diet, Nutrient need and dietary pattern for various age groups, Food hygiene, potable water source and methods of purification.

### Unit 2:

**Nutritional Disorders**

Nurition – related disorders: Under nutrition and over nutrition, obesity, Nutritional deficiencies: Vitamins deficiencies, Protein- energy malnutrition ( marasmus and kwashiorkor; iodine deficiency disorder; Anaemia.)

### Unit 3: Health and Communicable Diseases

Concept of Health; Communicable and non-communicable diseases. Control, prevention and Management of some vector- borne diseases ( Malaria, filaria, chikungunya) and other communicable diseases ( Rabies, leprosy, thyphoid and AIDS)

### Unit 4: Non-communicable Diseases

Non communicable diseases and their preventive measures, Cardiovascular diseases, Diabetes, Cancer, Alzheimers & parkinsons Diseases, Osteoporosis.

### Reference Books :

1. Arora, D.R and Arora, B. (2001) Medical Parasitology. II Edition. CBS Publications and Distributers.
2. K. W. Appeal et al (2012), Zoonoses: Infectious diseases Transmissible from animal to human.
3. MJ. Gibney, Barrie M. Margetts, JM. Kearney and L. Arab.(2004), Public Health Nutrition, Blackwell Publishing company U.K.
4. P Agarwal (2014), Human Nutrition : Meal Planning Health Care & Common Diseases. Premier publishing house Calcutta.
5. Park, K. (2007) Preventive and social medicine. XVI Edition. B.B Publisher.

## BASICS OF SOCIAL SCIENCES

Contact Hours per Week: 4
Credit: 4*
Examination Duration: 3 Hours
Maximum Marks:100 (Terminal-80, Sessional-20)

### Unit –I Histoty

- The French revolution, Socialism in Europe and Russian revolution
- Causes of first world war,Causes of Second world war,Cold war and its impact

### Unit-II Geogrphy

- India-Major physiographic units,the monsoons its characteristics,rain fall and temperature distribution
- Natural distribution,land degradation in India and Conservation measures

### Unit-III Political Science

- Democracy, Indian constitution and its main features;
- Fundamental rights and duties,rights,Rights of the child

### Unit-IV Economics

- Poverty as a challang,food security in India,consumer awareness
- Role of government in ensuring food security.

### References

History
1. William Doyle, The Oxford History of the French Revolution, Oxford University press, London, 2003.
2. James Joll, Europe since 1870 : An International History, Pelican series.
3. Arjun Dev, History of contemporary world, Orient Black Swan, New Delhi, 2007
4. Cambridge Modern History of Europe, Cambridge University series, London 1962
5. John Lewis Gaddis, The Cold War : A new History, Penguin, London, 2007.
6. Peter McPhee, The French Revolution. 1789-1799, Oxford University Press, 2003
7. Sean McMeekin, The Russian Revolution; A new History 1st Ed., Basic Books, 2017.
8. Rex A. Wade, The Russian Revolution, 1917 (Vol. 53 of New Approaches to European History), Cambridge University Press, 2017.
9. Eric Dorn Brose, A History of the Great War : World War first and the International crisis of the Early Twentieth Century, Oxford University Press, 2009
10. Martin Gilbert, The Second World War ; A complete History, Holt Paperbacks, 2004.
11. Norman Lowe, Mastering Modern World History, Palgrave Macmillan, 2013

### Geography

1. Majid Husain, Geography of India, Mac Grow Hill Publication
2. Khular, India a comprehensive Geography, Kalyani Publishers.
3. V. S. Katiyar, The Indian Mansoon and it Frontiers, Inter India Publisher
4. R. L. Singh, India a regional Geography
5. Mukaram Bhagat, Land degradation: India's silent crises, Centre for Information technology and Education
6. V.C. Jha, Land degradation and desertification, Rawat Publication.
7. P. K. Das, The Monsoon
8. P. A Menon, Ways of weather, National book trust
9. R. C. Tiwari, Geography of India, Pravalika Publication.

### Political Science

1. Basu,D.D(2002).Introduction to Constitution of India,Lexis nexis.Delhi

### Economics

1. Rudder Dutt and Mahajan, Indian Economy, S. Chand and Company, New Delhi
2. I.C. Dhingra, Indian Economy, Environment and Policy, S. Chand and Company ltd, New Delhi.
3. S. K. MIshra and V. K. PUri, Indian Economy, its development experience Himalaya Publishing House, Mumbai, 2001.
4. Food security of India – An overview Suresh C. Modgal, NBT, India.

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# CREATIVITY IN TRANSLATION

Contact Hours per Week: 4

Credit: 4*

Examination Duration: 3 Hours

Maximum Marks: 100 (Terminal-80, Sessional-20)

### Unit I:

Literature, fiction and translation.

Indian fiction in English translation: problems and perspectives.

### Unit II:

Rabindranath Tagore: Selections from Galpa guchcha 1; Kabuliwala and other stories, by R.N.Tagore, trans. Ratan K. Chattopadhyay. The stories are: The Postmaster, Return of the Little Master, Holiday, The Visitor, The Exercise Book, The Pedlar from Kabul

### Unit III:

The Boatmanboy and Forty Poems by Sachi Routray, Trans. Harindranath Chattopadhyay and B.Sinha. The poems are: Red Flower, To the Poet, To the Mother, To the Wayfarer, Return.

### Unit IV:

Karukku by F.Bama, trans. Laxmi Holmstrom

### Refrences

- Rabindranath Tagore: Selections from Galpaguchcha 1; Kabuliwala and other stories, by R.N.Tagore, trans. Ratan K. Chattopadhyay, Orient Blackswan. 2013
- The Boatmanboy and Forty Poems by Sachi Routray, Trans. Harindranath Chattopadhyay and B.Sinha. Prabasi Press, Calcutta.
- Karukku by F.Bama, trans. Laxmi Holmstrom. OUP
- The Twice Born Fiction by Meenakshi Mukherjee
- Theories of Translation by J.Williams, Palgrave Macmillan, 2013
- Introducing Translation Studies by J.Munday, Routledge, 2016.

# COMMUNICATIVE LANGUAGE: ENGLISH – II

Contact Hours per week: 4
Credit: 4
Exam Duration: 3 Hours
Maximum Marks: 100
(Term End Exam: 80 Marks
Sessional: 20 Marks)

**Objectives: At the end of the course students are expected to be able to use English effectively in their communication.**

## Unit-I : Reading Comprehension

- Locate and remember the most important points in the reading
- Interpret and evaluate events, ideas, and information
- Read "between the lines" to understand underlying meanings
- Connect information to what they already know

## Unit-II: Writing Part I

- Expanding an Idea
- Note Making
- Information Transfer
- Writing a Memo
- Writing Formal Email
- Writing a Business Letter
- Letters to the Editor

## Unit-III: Writing Part II

- CV & Resume Writing
- Covering Letter
- Report Writing
- News Story
- Interviewing for news papers

(The above-mentioned writing activities are covered in the prescribed textbook *Vistas and Visions*)

**Unit-IV: Language functions in listening and conversation; grammar in context**

**Section- A**

1. Discussion on a given topic in pairs
2. Speaking on a given topic individually
3. Group Discussion
4. Interview
5. Using functions in conversation contexts

**Section B**

**Grammar and Usage**

1. Phrasal Verbs
2. Collocation
3. Using Modals
4. Subject-Verb agreement
5. Use of Preposition
6. Common Errors in English Usage.

**Transactional Strategies:**

- Lecture, group interaction, material review and presentation, etc.

**Book Prescribed:**

Vistas and Visions: An Anthology of Prose and Poetry. (Ed.) Kalyani Samantray, Himansu S. Mohapatra, Jatindra K. Nayak, Gopa Ranjan Mishra, Arun Kumar Mohanty. Orient Blackswan

**Recommended Reading:**

1. Fluency in English – Part II, OUP, 2006
2. Business English, Pearson, 2008
3. Communicative English. E. Suresh Kumar and P. Sreehari. Orient Blackswan. 2007
4. Break Free: Unlock the Powerful Communicator in You. Rajesh, V. Rupa, 2015
5. Soft Skills Shalini Verma, 2009.
6. Business Communication, Orient BlackSwan. 2012
7. Language through Literature. ed. Gauri Mishra, Dr. Ranajan Kaul, Dr. Brati Biswas, Primus Books (2016)
8. Advanced Grammar in Use – Martin Hewings CUP, 2013
9. Basic communication skills- Dutt and Rajeevan CUP/Foundation books, 2006
10. Enjoying every day English – A.R.Rao, Sangam Books (2009)
11. Fundamentals of technical communications – Raman and Sharma OUP, 2014
12. Enriching oral and written communication in English – Thorat and Lokandwala, Orient BlackSwan; First edition (2009)
13. Communication skills – Kumar and Lata OUP, 2011

# हिन्दी भाषा और साहित्य

उद्देश्य-

* पाठयक्रम के अंत में विद्यार्थी हिन्दी भाषा की गद्य, पद्य और भाषा प्रयोग को आलोचनात्मक ढंग से समझ सकेंगे

### इकाई1: हिन्दी निबंध

क.रवीन्द्रनाथ टैगोर------शिक्षा का विकिरण
ख.प्रेमचंद-------महाजनी सभ्यता
ग.हरिशंकर परसाई----मैं नरक से बोल रहा हूँ

### इकाई2: हिन्दी काव्य

क.कबीरदास— साखी (11-25)
ख.सूरदास ---बाललीला (3,7,8,) , भ्रमरगीत (1-5)
ग.नागार्जुन—अकाल और उसके बाद, मंत्र
घ.माखनलालचतुर्वेदी–सिपाही, पुष्प कीअभिलाषा

### इकाई3: हिन्दी कहानियाँ

क.भीष्म साहनी— चीफ की दावत
ख.मोहन राकेश--- मलवे का मालिक
ग.मन्नू भण्डारी---- दो कलाकार

### इकाई 4: व्याकरण और रचना

क.प्रत्यय और उपसर्ग
ख.शब्द शुद्धि व वाक्य शुद्धि
ग.पर्यायवाची और विलोमशब्द
घ.अनेक शब्दों के लिए एक शब्द

सन्दर्भ

1. कबीर – हजारी प्रसाद द्विवेदी
2. भ्रमर गीत सार- रामचंद्र शुक्ल
3. प्रमुख हिन्दी कहानियाँ–डॉ. रामलाल यादव
4. टैगोर के निबंध- बाबू शेषनाथ

व्याक्रण एवं रचना- विजय हेला

# Bangla Sahitya O Bhakaran Gyan

Contact Hours per Week: 4
Credit: 4*
Examination Duration: 3 Hours
Maximum Marks: 100 (Terminal-80, Sessional-20)

Unit-I:

i. Pracheen Yug.

ii. Adhunik Yug.

Unit-II:

i. Bhab – Samprasarn (Pradatya Kobita ba Gadyer angsha)

ii. Patra Likhan Byektigata Patra, Samajik Patra O Sarkari Patra.

Unit- III:

i. Bangla Shabda Bhandar.

ii. Bangla Banan.

Unit- IV: Engrajee theke Bangla Anubad.

### Reference Books :

i.  Bangla Sahitya Sampurna Itibritta.
    By Dr. Ashit Kumar bandopadhyae.
ii.  Bhashar Itibritta.
    By sukumar Sen.
iii. Bhasha Tatwa
    By Ateendra Majumdar.
iv. bangabhasa O Sahitya
    By Deenesh Chandra Sen.

## Educational Planning, Management and Leadership

| Semester-VI | Credits-4 |
|---|---|
| Total Marks:100 (Internal:20 External: 80) | Contact Hours: 4 hours per week |

### Introduction:

The course intends to introduce the basic concepts, types, conditions, approaches and techniques of educational planning, management and leadership styles. It makes an attempt to introduce the concept of decentralized planning and planning practices currently being adopted in various education sub-sectors in India, including the secondary education sub-sector. It also attempts to discuss the concept and application of strategic planning techniques in education and the way these techniques have been contextualized and built into district planning models in India. As such, the course would provide an overview of the changing landscape of educational planning in India, including the latest planning approaches and frameworks. A discussion of the theoretical approaches to educational planning would help enable student teachers to contextualise and analyse educational planning models and practices in India. It would help them to participate in the current debate on 'whether educational planning and management in India is rhetoric or a reality?' The course also intends to provide the student teachers exposure to the concept, theory and various dimensions of educational school management and leadership styles. The student teacher should be aware about how the job of the teacher has changed immensely in last decade. The teacher as the head of the school or class teacher has to perform many managerial functions in relation to the management of human and material resources. A professionally trained teacher is expected to have know-how of managing instructional and other school activities. The core paper "Educational Planning, Management and Leadership" is intended to enable the development of skill how to plan and manage for effective schooling of the children at the secondary level. The paper will be taught through deliberations, discussion, reflection, school visit, library reading and presentations.

### Objectives

The course will enable the student teachers to;

- Understand Concepts, types and approaches of educational planning
- Develop institutional plan and school development plan
- Understand recommendations of different five year plans relating to school education

- Develop understanding about educational decentralization in India and district planning practices
- Understand concept, nature and approaches of educational management
- Develop understanding and skills in managing material and human resources of school
- Understanding the skills of using different managerial and leadership styles for effective management of a school.

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### Unit-I: Understanding Educational Planning
- Educational planning: Meaning, Nature, purpose
- Traditional educational planning and strategic educational planning-steps and benefits
- Approaches to educational planning: Social demand, manpower requirement and cost benefits
- Planning for human resource development in school: Manpower forecasting and Manpower planning
- Institutional Planning: School development plan as per the RTE Act 2009

### Unit-II: Educational Planning in India
- Beginning of five year Plans: its historical background; Main features of five year plans with special reference to education, Impact of five year plans on education.
- 12th Five year plan: Major recommendations relating to school education(elementary and secondary education)
- Educational decentralization in India: legal provisions and institutional framework and planning machinery
- District planning under the on-going country-wide education development programmes like the SSA and the RMSA
- Financing school education in India, fund flow and related issues

### Unit-III: Educational Management: Concept, Processes
- Educational management: Concept and Process( Planning, organization, control ,decision making and evaluation) and approaches to management: Classical, Human relation and system
- Structure of education management in India and in states
- Management of resources:Material resource,general class room equipments; school building, library, laboratory ,assembly hall play ground and surroundings of school ;Human resource -organizational climate in school, Professional development of teachers-Self learning, reflective practices, orientation, seminars and colloquium
- Managenment of teaching learning context:C;assroom,Time, curricular and other curricular activities.
- Total quality management

### Unit-IV: Leadership: Concepts, Traits and Styles
- Leadership: Concept, types-administrative and instructional
- Leadership traits: responsible, self disciplined, innovative, imaginative, good at organization, correct in judgment, visionary etc.
- Educational administration leadership skills: Decision making, Planning and Co-Ordinating, Communicating, Evaluating and Feedback
- Styles of educational leadership: autocratic, Laissez-faire and democratic

#### Suggested Activities
- Read school development plan of elementary schools and prepare reflective notes on it.
- Prepare report after collecting views of SMC members about their contribution to school improvement.
- Critically analyze district educational planning of your district.
- Interact with five HMs/Principals of nearby schools and prepare a report management of material and human resources.
- Make a case study on a successful HM/principal of a school; Leadership quality and styles

**Suggested Readings:**

- Ayyar, R.V. Vaidyanatha (1993). Educational Planning and Administration in India: Retrospect and Prospect. *Journal of Educational Planning and Administration*, VII (2): 197-214.
- Blaug, Mark (1972). An *Introduction to Economics of Education*. The Penguin: London.
- Bray, Mark and N.V. Varghese (ed.) (2010): *Directions in Educational Planning: Report on an IIEP Symposium*. IIEP: Paris.
- Brown, D. (1990): *Decentralisation and School-based Management*. Falmer Press: London.
- Bullock, A. and H. Thomas (1997). *Schools at the Centre? A Study of Decentralisation*. Routledge: London.
- Bush, T., L. Bell, R. Bolam, R. Glatter and P. Ribbins (eds.) (1999). *Educational Management: Redefining Theory, Policy and Practice*. Paul Chapman: London.
- Carron, Gabriel (2010). *Strategic Planning: Concept and Rationale*. IIEP Working Paper 1. IIEP: Paris.
- Carron, Gabriel (2010). *Strategic Planning: Techniques and Methods*. IIEP Working Paper 3, IIEP: Paris.
- Chau, Ta-Ngoc (2003). *Demographic Aspects of Educational Planning*. IIEP: Paris.
- Coombs, P.H. (1969). *What is Educational Planning?* Paris: International Institute of Educational Planning (IIEP).
- Government of India (2011). *SarvaShikshaAbhiyan: Framework for Implementation*, Department of School Education and Literacy, Ministry of Human Resource Development: New Delhi.
- Govinda, R. and M. Bandyopadhyay (2010). *Changing Framework of Local Governance and Community Participation in Elementary Education in India*, CREATE PATHWAYS TO ACCESS, Research Monograph No. 35, available at http://www.create-rpc.org/ pdf_documents/PTA35.pdf.
- Hallack, Jack (1977). *Planning the Location of Schools: An Instrument of Educational Policy*, IIEP: Paris.
- Jha, Jyotsna, K.B.C. Saxena and C.V. Baxi (2001): *Management Processes in Elementary Education: A Study of Existing Practices in Selected States in India*. The European Commission: New Delhi.
- Kaufman, Herman, Watters (eds.) (1996). *Educational Planning: Strategic Tactical Operational*. Pa. Technomic: Lancaster.
- Kochhar, S. K. (1994). Secondary School Administration, Sterling Publisher New Delhi
- Litvack, Jennie, Junaid Ahmed and Richard Bird (1998). *Rethinking Decentralization in Developing Countries*. World Bank: Washington D.C.
- Mathur, S.S. (1990). *Educational Administration and Management*. The Indian Publications: India.
- MHRD. (2009). *RashtriyaMadhyamikShikshaAbhiyan: A Framework for Implementation*. Department of School Education and Literacy, GOI: New Delhi.
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- Varghese, N. V. (1996): "Decentralization of Educational Planning in India: The Case of District Primary Education Programme." *International Journal of Educational Development,* Vol. 16 (4): 355-365.
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- Varghese, N.V. (ed.) (1997): *Modules on District Planning in Education,* NIEPA: New Delhi.

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## CPS 2: Pedagogy of Mathematics (Part-II)

| Semester-VI | Credit-4 |
|---|---|
| Marks 100 | Contact Hours- 4hrs. |
| (Internal 30 + External 70) | per week |

### Introduction

As a sequel to the Part I of the Pedagogy of Mathematics, this course (Part II) is designed to broaden the scope of Mathematics learning focusing on enhancing quality of Mathematics learning and teaching strategies including the use of ICT and other resource materials. The prospective teachers in Mathematics are expected to develop abilities to create, adopt and use innovative materials and strategies to enrich Mathematics teaching and learning practices while aiming at continuing their professional development as a lifelong mission.

### Objectives

The course will enable the student teachers to:

- Understand and adopt ways in enhancing quality of Mathematics learning.

- Develop competency in the use of learner friendly information and communication technologies for widening scope and enhancing quality of Mathematics learning.

- Acquire expertise in development, adoption and use of different types of teaching learning material for effective Mathematics learning and teaching.

- Develop awareness of innovations in the teaching-learning processes of Mathematics and ways to adopt those in the classroom practices.

- Understand the various ways of continuing professional development as Mathematics.

### Unit I: Enhancing Quality of Mathematics Learning

- Exploring the learner: Identifying individual differences in learning mathematics,

  cater individual differences–ability grouping/homogeneous grouping, differentiated assignments, identification of students' strengths and weaknesses in Mathematics learning; educational arrangement for students weak as well as gifted in Mathematics.

- Activities for enhancing motivation in Mathematics learning: Participation in Mathematics competitions (like Mathematics Olympiads. National Talent Search) quizzes, debates and conduct exhibitions on mathematical themes. Collection of sketches and biography of great mathematicians.

- Encouraging Creativity in Mathematics: Developing innovative materials and games using mathematical principles, Collaborative peer activities- preparation of models to explain mathematical principles and properties, Brain storming - select appropriate concepts and techniques to apply to unfamiliar and non-routine problems, interpret their solutions in the context of a given problem, Mathematics club activities.

- **Unit II: Use of ICT in Teaching and Learning Mathematics**

  - Meaning and importance of use of ICT in the teaching –learning procedure.

  - Use of Computer –forms-advantages-limitations

  - Use of calculator-guidance-advantages-limitations

  - Using open education resources (OERs) in Mathematics- *Geogebra*, interactive "worksheets,Desmos-meaning and uses.

## Unit III: Teaching Learning Materials of Mathematics

- Mathematics Textbooks: Needs and significance, Characteristic of a good Mathematics textbook, proper use of mathematics text book.

- Evaluation of Mathematics Text books: Weight age to the topics-examples-exercise including enrichment problems, diagrams, anecdotes, activities in each chapter, clarity and precision, page layout.

- Use of various Teaching-Learning Material(teaching aids) in Mathematics - Charts, models, flash cards, posters, overhead projector with their specific use and limitations.

- Use of Innovative Resources in Co-Related Mathematics learning: Using community resources in teaching-learning mathematics- visit to important places-observe memorable days in school- developing subject library- running small co operative- mentioning use of mathematics concepts

## Unit IV: Innovations in teaching of Mathematics

- Teaching of Mathematics in the socio-cultural context: action research-planning –executing – comments on a problem related in learning mathematics.

- Recreation in Mathematics: Mathematics Club –to organize Debate-Exhibition-Inter school quizzes, Preparation of Models; events andt games related to the concepts of Vedic Mathematics

- Mathematics Laboratory: Need and Importance, Physical Infrastructure, Materials, Planning and Organization. Functions of the Math Laboratory.

- Developing methodology for teaching children with dyscalculia: Identify symptoms,-its nature- set arrangement for learning mathematics infavour of disletic child, possible treatment

### Unit V: Professional Development of Mathematics Teachers

- Professional development of Mathematics teachers: Arrangement to Deliver 40 learning design in mathematics between Class VI - X in selected schools organized for 8-weeks

- Courses and in-service programmes for mathematics teachers- during practice teaching period the student teacher will identify the meaning and need of in-service programme..

- Role of mathematics teachers association- keep communication with associated teachers and authorities, organize —seminar-conference-summer school, orientation programme

- Journals and other resource materials in mathematics education; Using ICT and internet for professional development, e-book review, publish departmental magazine, wall magazine

- Professional growth—participation in Conferences/seminars/workshops.

### Suggested Activities:

- Preparation of a report of observation of children doing everyday Maths, playing folk games;or community numeracy practices..
- Action Research on selected classroom problems in teaching and learning Mathematics.
- Development and trying out of innovative teaching-learning strategy for teaching of specific Mathematical concepts.
- Analysis of Mathematics text book.
- Use of Computer in Teaching of Mathematical concepts. (PowerPoint presentation)
- Use of Mathematics activities for recreation.
- Plan for development and use of Mathematics laboratory..
- Development of innovative teaching-learning materials and activities in Mathematics

### Suggested Readings:

- Anice, J. (2008). *Methods of Teaching Mathematics*. New Delhi: Neelkamal Publications.
- Butler, C.H., Wren, F.L. and Banks, J.H. (1971).*The teaching of Secondary Mathematics*. New York: McGraw Hill.
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- Kidd, P.K., Myers, S.S., Cilley David, M. (1970).*The Laboratory Approach to Mathematics*. Chicago: Science Research Associates Inc.
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- Kothari, R.G., and Shelat, P.H. (2011).*Mathematical weaknesses among secondary school students*. Germany: VDM Verlag Publishers.
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- : Anmol Pub. Pvt.
- Mottershead, L. (1978). *Sources of mathematical discovery*.Oxford: Basil black Wall.
- Nickson, M. (2006).*Teaching and learning mathematics: A guide to recent research and its application*. London: Continuum.
- Pandya, B. (2007). *Teaching of mathematics*. Agra: Radha Prakashan Mandir.
- Paul Chambers (2008). *Teaching mathematics: developing as a reflective secondary teacher*. New Delhi: Sage Publication.
- Rao, N.M. (2007). *A manual of mathematics laboratory*. New Delhi: Neelkamal Publications.
- Reeve, W.D. (1954).*Mathematics for the secondary school*. New York: Holt, Rinehart and Winston, Inc.
- Servais, W., and Varga, T. (ed.) (1971). *Teaching school mathematics. A UNESCO Source Book*.UNESCO, Penguin books.

**Web Resources**
- https://www.youtube.com/watch?v=hbDkSaSnbVM (Unit I)
- https://www.youtube.com/watch?v=IQ19-MTwThI (Unit I)
- https://www.youtube.com/watch?v=MrIdc-Hs-is (Unit I)
- https://www.youtube.com/watch?v=IhwAMhZQ6kU (Unit I)
- http://mathigon.org/resources/value-of-mathematics.pdf (Unit I)
- http://mathedu.hbcse.tifr.res.in (Unit 3)
  http://www.ncert.nic.in/departments/nie/niew/school_kits/kit_manuals.html
- http://nrich.maths.org
- http://www.slideshare.net/MiraculeDanielGavor/ict-tools-in-mathematics-instruction
- http://karnatakaeducation.org.in/KOER/en/index.php/Portal:Mathematics
- http://www.mathcelebration.com/index.html
- http://map.mathshell.org
- http://www.cimt.plymouth.ac.uk/projects/mep/default.htm
- http://nrich.maths.org/students
- http://mathbits.com
- http://www.math-play.com
- http://www.geogebra.org
- http://classroom-aid.com/educational-resources/mathematics
- http://etc.usf.edu/math
- https://www.merlot.org/merlot/materials.htm?category=2513
- http://www.ck12.org
- https://www.khanacademy.org
- http://www.learner.org/resources/browse.html?d=5
- https://blossoms.mit.edu/resources/math_resources

- Matthew J. Koehler, Punya Mishra , Mete Akcaoglu & Joshua M. Rosenberg (2013), The Technological Pedagogical Content Knowledge Framework for Teachers and Teacher Educators,

http://cemca.org.in/ckfinder/userfiles/files/ICT%20Integrated%20Teacher%20Education%20(Chapter%201).pdf

- Integrating Open Educational Resources Lesson Plan Integration Model Designed for Pre-Service Elementary Educators Course: Mathematics Methods,
- https://currikicdn.s3-us-west 2.amazonaws.com/resource files/54d2dd15bb67b.pdf
- Teaching of Mathematics, NCERT http://www.ncert.nic.in/departments/nie/dse/activities/advisory_board/PDF/teaching_maths.pdf
- Googleweblight.com--APass Education.

CPS 2: Pedagogy of Life Science (Part-II)

| Semester-VI | Credit-4 |
|---|---|
| Marks 100 (Internal 30 + External 70) | Contact Hours- 4hrs. per week |

### Introduction

The discourse of teaching-learning process may include situations leading to understanding of Biological facts and phenomena in conceptually organized manner revolving around the fundamental themes. For this, proper planning of teaching-learning process, allocation/development of appropriate learning resource along with continuous and comprehensive evaluative criteria and strategies are required to be addressed. Further, learners are required to engage in critical enquiry regarding the process of knowledge development Life science as well as its pedagogy. Future teachers should also be encouraged toward their continuing professional development on the basis of life-long learning principles.

### Objectives

The student teachers will be able to :

- Be aware of teaching & learning of the subject concern.
- Examine critically the major concept, ideas, principles & values relating the subject concern.
- Engage the students into the methods of Teaching & learning the subject.
- Provide the students authentic historical knowledge with the proposed content & make them to be component to do pedagogical analysis of the subject.

### Unit I:

- Concepts and Methods of Pedagogical Analysis;
- The Pedagogical knowledge of the content from various classes (Class -VI to VIII, IX-X,XI- XII) on the following items :

  ➢ Breaking of Unit into Sub-unit with no. of Periods;
  ➢ Previous knowledge;
  ➢ Instructional Objectives in behavioural terms;
  ➢ Sub-unit wise concepts
  ➢ Teaching- Learning Strategies
  ➢ Use of teaching aids
  ➢ Blueprint for criterion reference test Items.

### Unit II: Learning Designing:

- Concept and importance.
- Qualities of good lesson plan.
- Steps of lesson planning.

## Unit III: Teaching skills:

- Micro-teaching
- Simulated Teaching.
- Teaching in class room situation
- Laboratory practical based demonstration skill.

## Unit IV: Assessment of Science Learning:
- Concept of assessment and evaluation;
- Concepts of Achievement Test and Identification of Test Items under various criterion like knowledge, understanding and application and skill.
- Construction of achievement tests and their administration.
- Preparation of a continuous and comprehensive evaluation plan for a particular class (VI to XII).

## Unit V: Development of Scientific Attitude:
- Academic Science and Popular Science.
- Importance, Planning & Organization of various science activities like field trip, project work, science quiz, excursion, science exhibition, science fair, science Exhibition, aquarium, bird watching etc.
- Formation and activities of Science club in school.

## Suggested Activities:
Any one of the following :-
- Analysis of Science Textbook.
- Pedagogical analysis of a suitable topic of Life Science (Class VII –XII)
- Construct an Achievement Test on a suitable topic of Life Science (Class VII – XII)
- Prepare a learning design on a topic of Life Science (Class VII –XII)
- Present a write up based on simulated teaching on a suitable topic of Life Science (Class VII –XII)
- Evolving suitable technique(s) to evaluate laboratory work.
- Visit to Community Science Centre, Nature Park and Science City

## Suggested Reading:

- Fraser, B. J. and Tobin, K. G. (Eds.).*International handbook of science teaching (Part 1)*. Dodrecht, The Netherlands: Kluwer Academic.
- Mintzes J., Wandersee, J. and Novak, J. (Eds.) (2000).*Assessing science understanding: A human constructivist view*. San Diego, CA.: Academic Press.
- Nag, S.(2012) Teaching of Life Science,Rita Publication,Kolkata
- Nagchowdhury, D. P., Pal, S., Ganguly, A., Haowladar, M. (2014) Jiban Biggyan Shikhshaner tattwa O Proyog, Aaheli Publishers, Kolkata.
- Joyce, B. and Weil, M. (2009). Models of teaching. USA: Pearson higher education.

- NCERT (2000).*Position paper of national focus group (NFG) on aims of education*.National Council of Educational Research and Training (NCERT), New Delhi.
- NCERT (2000).*Position paper of national focus group (NFG) on education for peace*. National Council of Educational Research and Training (NCERT), New Delhi.
- NCERT (2000).*Position paper of national focus group (NFG) on examination reforms*. National Council of Educational Research and Training (NCERT), New Delhi.
- NCERT (2000).*Position paper of national focus group (NFG) on gender issues in education*. National Council of Educational Research and Training (NCERT), New Delhi.
- NCERT (2000).*Position paper of national focus group (NFG) on habitat and learning*. National Council of Educational Research and Training (NCERT), New Delhi.
- NCERT (2000).*Position paper of national focus group (NFG) on teaching of science*. National Council of Educational Research and Training (NCERT), New Delhi.
- NCERT (2005).*National curriculum framework for school education*. National Council of Educational Research and Training (NCERT), New Delhi.
- Sutton, C.R. & Hayson, J.H. (1974).*Theart of the science teacher*, McGraw Hill Book Company Ltd.
- Vaidya, N. (1999). *Science teaching for 21$^{st}$ Century*.Deep & Deep Publication.
- Journal of Research in Science Teaching (Wiley-Blackwell)
- *Science & Children*. A peer reviewed journal published by National Science Teachers Association (NSTA).
- *The Science Teacher*. A peer reviewed journal published by National Science Teachers Association (NSTA).

## CSP 3: Pedagogy of Physical Science (Part-II)

| Semester-VI | Credit-4 |
|---|---|
| Marks 100 (Internal30, External 70) | Contact Hours- 4 hrs. per week |

**Introduction:**

The course is intended to enable students-teachers to design and organize learner-centered, activity based, participatory learning experiences through observation, inquiry, dialogue, discussion, experiments, projects and field work. This goal will be realized only if teacher-educators actively involve student-teachers in the construction of their knowledge by providing such opportunities to student-teachers and encourage to think critically on the relevant issues.

**Objective:**

The course will enable the student teachers to;

- Plan learning designs based on problem situations, inquiry and projects to facilitate learning of Physical Sciences.
- Realise his/her role as a facilitator in enhancing Physical Science learning in the real classroom situation.
- Explore different ways of creating learning situations considering learning needs and context of the learner.
- Familiarize with various tools and techniques of assessing physical science learning.

- Critically analyse various issues in Physical Science.
- Become aware of various professional development programs in Physical Science.

**Unit I: Planning of Facilitating Learning in Physical Science**

- Need for planning teaching-learning experiencesin Physical Science.
- Identification of Concepts and unifying themes related to Physical Science, inter-relation among various concepts in Physical Science.
- Designing of Year plan and Unit Plan in Physical Science and its significance in understanding comprehensive nature of knowledge.
- Writing learning objectives for different content areas in Physical Science.
- Planning lessons based on behaviourist and constructivist approaches-5E model, ICON model considering learners with different pace, learning styles and learning needs.
- Planning laboratory work and ICT application in learning Physical Science.

### Unit II: Learning Assessment in Physical Science

- Planning assessment framework in Physical Science.
- Learning Indicators in Physical Science.
- Tools and techniques of assessment in Physical Science—assessment of written and oral work, project work, laboratory work, field trips, journal writing, concept map and V mapping.
- Assessment of learners with special needs.
- Recording and reporting of learning evidences – Measurement of students' achievement in Physical Science – marks and grading, Measurement of science process skills and aptitude of learners, Portfolio – its role in evaluating students' performance.

### Unit III: Pedagogical Processes in Physical Science

- Using different pedagogical approaches (Behaviourist and Constructivist) and strategies (Problem Solving, experimenting, project based, cognitive conflict) along with identification of major concepts, themes and criteria for assessment to treat major concepts in school Physical Science content -Motion, Force, Heat, Electricity, Magnetism, Acids and Bases, Physical and chemical changes, Matter.

### Unit IV: Issues and Concerns in Physical Science

- Social and ethical issues related to Physical Science.
- Role of Language in Physical Science.
- Gender and Physical Science.
- Inclusiveness in Physical Science learning.
- Physical Science and Sustainable development.

### Unit V: Professional Development of Physical Science Teachers

- Need for professional development of Physical Science Teachers.

- Various opportunities for in-service professional development—interaction with peer teachers, membership of professional organization such as National Physics Teacher Association, sharing through conferences, seminars and Journals.
- Collaboration with Research Institutes such as IISc, IPA, HBCSE, Regional Science Centre.
- Participation in Professional Learning Community and in Online forum for Science Teachers.
- Role of reflective practices in professional development.
- Criterion of a good Physical Science Teacher

**Suggested Activities:**

1. Preparation of year plan and unit plan in Physical Science.
2. Preparation of 2 lesson plans in Physical Science- one based on behaviourist and another on constructivist approach.
3. Preparation of an assessment framework in any one unit in Physical Science.
4. Debate (choose any one topic from unit 4).
5. Visit to any of the professional organization and prepare a report on the in-service professional development programmes that they undertake for Science teachers.

**Suggested Readings**

1. NCERT (2000). *Position paper of national focus group (NFG) on teaching of science*. National Council of Educational Research and Training (NCERT), New Delhi.
2. Steve Alsop, Keith Hicks. (2007). Teaching Science: A Handbook for Primary and Secondary School Teachers, Kogan Page, New Delhi.
3. Judith Bennett (2003) Teaching and Learning Science : A guide to recent research and its applications, Continuum, London.
4. Robin Millar (1984) Doing Science : Images of Science in Science Education, The Falmer Press, London.
5. NCERT Textbook in Physics for IX and X Students.
6. State Textbook in Physics for IX and X students. 7. Nathan S Washton (1967). Teaching Science Creatively, Saunders Company, London.
7. Novak D J and D Bob Gowin (1984) Learning how to learn, Press Syndicate of the University of Cambridge, Ohio.
8. Carin A and B R Sund (1964), Teaching Science through Discovery, Charles E. Merrill Books Inc., Columbus Ohio.
9. Ralph Martin, Colleen Sexton, Kay Wagner, Jack Gerlovich (2000) Science for All Children : Methods for Constructing Understanding, Allyn and Bacon, London.
10. School Science Review, The Association for School Education, College Lane, Hatfield, Hertfordshire, AL 109 AA, UK.
11. Physics Education, Institute of Physics Publishing, Dirac House, Temple Block, Bristol BS1 6BE, UK.
12. Physics Teacher, American Association of Physics Teachers, Department of Physics and Astronomy, University of Maryland, College Park, MO 20742.

## FE-1: MULTICULTURAL PLACEMENT

| Semester-VI | Credits-2 |
|---|---|
| Total Marks: 50 | Contact Hours: |
| (Internal: 15, External: 35) | 2 hours per week |

### Introduction

Multi-cultural education and teaching for diversity are the needs of contemporary times. India is a culturally plural country and prospective secondary school teacher preparation programme needs to focus on addressing diversity in classroom and managing schools from different cultural set up. Multicultural placement of student teachers aims at exposing them to different type of schools such as urban, schools for differently abled children with a view to develop critical reflection about activities of schools with different cultures and teaching learning process adopted in different types of school .

### Objectives

The course will enable the student teachers to:

- Experience different type of schools such as urban, rural, tribal, schools for challenged learners.
- Develop understanding about the school activities with different cultures/set up.
- Develop the process of engaging students in classrooms through observing the practice adopted by regular teachers.
- Develop understanding to manage a substitute(arrangement class).
- Experience of conducting classroom activities.
- Conduct case studies.

The institute will identify suitable number of cooperating urban schools, rural schools, and tribal schools, and students will be placed by rotation in all the three types of schools. All activities listed below are to be completed within two weeks during the placement of student teachers in three types of schools in rotation. Each pupil teacher performs the following activities under the guidance of supervisor/mentor and prepares reports on all the activities. The report will be assessed as the guideline given below.

### Guidelines for Assessment

| Sl.No. | Activities | Marks |
|---|---|---|
| 1 | Observing 6 lessons 3 in each method delivered by regular teachers with the help of observation schedule | 10 |
| 2 | Observation of day-to-day school activities and preparation of comprehensive report highlighting working of the library, co-scholastic activities, games and sports, functioning of laboratory, school morning assembly and preparation of reflective report | 10 |
| 3 | Availing at least 6 substitute teaching opportunities in actual school situation | 10 |
| 4 | Teaching 4 lessons (two lessons in each method subject) by using learning resources and ICT. | 10 |
| 5 | Undertaking a case study on students/institution | 10 |
| Total | | 50 |

# Semester-VII

(B.Sc. B.Ed.)
Semester Structure & Title of Papers

| Sl. No. | Course Paper | Subject | Paper Name | Marks | Page No. |
|---------|--------------|---------|------------|-------|----------|
| 1 | **PE-7** | Education | Knowledge and Curriculum | 100 | 274 |
| | **EPC-3** | | Arts in Education (2 Weeks) | 50 | 278 |
| | **EPC-4** | | ICT Practicum (2 Weeks) | 50 | 280 |
| | **FE-2** | | Internship: Teaching (14 Weeks) | 350 | 281 |
| **Total** | | | | **550** | |

PE 7: Knowledge and Curriculum

| Semester-VII | Credits-4 |
|---|---|
| Total Marks:100 (Internal: 30, External: 70) | Contact Hours: 4 hours per week |

### Introduction:

The purpose of school education is to make students understand structure of knowledge, ways of knowing and process of its construction. The role teacher is to facilitate learners in creating and transferring knowledge from school to outside. In this context, the teachers are required to be competent about the epistemological thinking of knowledge and also in dealing with the social environment involving transaction of knowledge. This paper imparts necessary preparation to student teachers in dealing with various dimensions of knowledge and its transaction in school set up.

**Objectives**

The course will enable the student teachers to:

- Understand concept of knowledge, process and sources of knowing.
- Develop understanding on teacher centric and learner centric knowledge transmission.
- Understand concept, types of curriculum and differentiate between curriculum framework, curriculum and syllabus.
- Apply recommendations of the NCF 2005 in school.
- Understand process and principles of curriculum development.
- Develop understanding in the process of curriculum transaction, evaluation and renewal.

## Unit I: Understanding the Nature of Knowledge

- Knowledge: Concept, Nature, Types, Theories of knowledge.
- Constituents of knowledge: Facts, Principles, Laws, Concepts and Theories.
- Knowing process: Sensation, perception, reason and conception.
- Methods of acquiring knowledge: Tradition, experience, authority, reasoning (deductive and inductive) and scientific inquiry.

## Unit II:Construction of Knowledge

- Knowledge transmission (teacher-centric) vs. Knowledge construction (learner-centric).
- Experience: Meaning, nature and role of experience in knowledge construction.
- Reason: Meaning, nature and role of reasoning in knowledge construction.
- Validation of knowledge: approaches and theories-correspondence, coherence, dialects and pragmatics theory.
- Relationship between powers, structures of Society and knowledge.
- Distinction and relationship between:
  - ➤ Knowledge and skill.
  - ➤ Teaching and training.
  - ➤ Knowledge and information.
  - ➤ Reason and belief

### Unit III: Understanding Curriculum

- Concept of curriculum (difference between curriculum framework, curriculum, syllabus and textbook); need of a good curriculum.
- Types of curriculum: subject-centered, learner-centered, learning-centred, experience-centered, activity-centered, core curriculum.
- Core Curriculum, Null Curriculum, Hidden Curriculum & Latent Curriculum
- Curriculum framework–principles and coverage; NCF 2005 and NCFTE 2009–significant recommendations.
- Interface between the teacher education curriculum and school curriculum.

### Unit IV: Curriculum planning and development

- Determinants of curriculum: Philosophical, Sociological, Psychological and Technological.
- Framing of Curriculum objectives: Cognitive, Affective and Psychomotor domains.
- Principles of selecting curriculum content.
- Principles of curriculum development.
- General Principles and Factors of Curriculum Construction.


- Bases of Curriculum: Philosophical, Psychological, Sociological & Technological.
- Models of curriculum planning: Top down (Tyler) and Bottom up (Taba) model.
- Processes/stages of curriculum development (preparation, tryout and finalization).

### Unit V: Curriculum Transaction, Evaluation and Renewal

- Transaction: Planning (time, space, manpower, material and scheme of lessons); Preparation of curricular materials and activities (text and support materials, learning activities); conducting classroom transaction (preparation of lesson plans/notes, mode of transaction, learners' involvement, use of TLMs, use of assessment mechanism for learning
- Evaluation: Objectives of curriculum evaluation; Mode (internal and external), periodicity (continuous, periodic), Mechanism (research studies, on-site observation, Focus Group Discussion FGD, on-line feedback); Model-CIPP (Stufflebeam).
- Renewal: Use of evaluation feedback/inputs for Immediate/long-term revision, Specific/comprehensive improvement.
- Methodology of curriculum transaction.
- Curriculum evaluation (formative, summative, Micro and Macro)

### Suggested Activities:

- Identify concepts, facts, principles, laws and theories in any secondary class school textbook and report.
- Examine your own process of knowing and prepare a report on how you are using knowing process in gaining knowledge.
- Preparation of an appraisal report on any one aspect of the Systemic Reform envisaged in the NCF 2005 and its reflection in current practices.

- Identification of learning resources and designing of beyond classroomactivities for transacting a lesson.
- Preparation of a transactional blueprint of any content unit in any school subject at the secondary level.
- Preparation of an appraisal report on the curriculum renewal process during post NPE(1986) period.

## Suggested Readings:

- Arora, G.L.(1984).Reflections on curriculum.NewDelhi: NCERT.
- Dewey,John(1956).*Thechildandthecurriculum*.Chicago,Illinois:UniversityofChicago Press.
- Dewey,John(1997).*Experience andEducation*.NewYork: Touchstone.
- Dewey,John(1997).Mypedagogiccreed.InD.J.FlindersandS.J.Thorton(eds.),*The*
- *Curriculum studies reader*.NewYork: Routledge,Kegan&Paul.
- Egan,K.(2005). *Animaginativeapproachtoteaching*.SanFrancisco: Jossey-Bass. Erickson,H.L.(2002).Concept-basedcurriculumandinstruction.California:Corwin Press.
- Jangira,N.K.&Singh,A.(1982).*Coreteachingskills:Themicroteachingapproach*. NewDelhi:NCERT,
- Mohapatra,J.K.,Mahapatra,M.andParida,B.K.(2015).*Constructivism:The newparadigm: From theorytopractice*.NewDelhi: AtlanticPublishers.
- NCERT(2005).Nationalcurriculumframework 2005.NewDelhi: NCERT.NCTE(1990).*Policyperspectiveinteachereducation*.NewDelhi: NCTE
- Olivia, PeterF.(1988).Developingthecurriculum.London: ScottandForesman.
- Sharma,S.(2006).*Constructivistapproachestoteachingandlearning*.NewDelhi: NCERT.
- Taba, Hilda(1962). *Curriculum development: Theory and practice*. New York: Harcourt,BraceandWald.
- VonGlasersfeld, F.(1995).*Radicalconstructivism: A wayofknowingandlearning*.WashingtonD.C.:Falmer Press.
- Vygotsky,Levy(1986).*Mindinsociety*.Cambridge,MA: Harvard University Press.
- Taba, H (1962). Curriculum Development: Theory and Practice. N Y Harcout, Brace and World.
- Tylor, Ralpha W (2013). Basic Principles of Curriculum and Instruction. Amazon Kindle.

### EPC 3: Art in Education

| Semester-VII | Credits-2 |
|---|---|
| Total Marks: 50 | Contact Hours: |
| (Internal: 15, External: 35) | 2 hours per week |

### Introduction

The need to integrate art education in the formal schooling is to retain our unique cultural identity in all its diversity and richness. Art education encourages young students and develops a creative mind to them. The innate potentiality of learners will be given an opportunity to be explored and manifested through the medium of art. An understanding of the arts will give the ability to appreciate the richness and variety of artistic traditions as well as make them liberal, creative thinkers and good citizens of the nation. National Curriculum Framework-2005 introduced art education as a mainstream curricular area, which must be taught in every school as a compulsory subject.It is important that art education is integrated in the school curriculum to provide an aesthetically viable atmosphere in schools encouraging creativity. For this, not only the art teachers but every teacher should be sensitive to appreciate different form of art.

### Objectives:

The student teachers will be able to:

- Understand the use of 'Drama' as Pedagogy.
- Use 'Role play' technique in the teaching learning process.
- Understand the importance of dramatic way of presentation.
- Integrate singing method in teaching learning process.
- Understand various 'Dance forms' and their integration in educational practices.
- Use art of drawing and painting in teaching learning process.
- Develop creativity through different creative art forms.
- Understand the efficacy of different art forms in education.

### Unit I: Drama, Dance and Music

- Drama as a tool of learning, Different Forms of Drama.
- Role play and Simulation.
- Use of Drama for Educational and social change (Street play, Dramatization of a lesson).
- Use of Drama Techniques in the Classroom: voice and speech, mime and movements, improvisation, skills of observation, imitation and presentation.
- Different Forms of Dance:Bharat Natyam, Kathakali, Garba, Bhavai, Bhangra, Bihu and various other dances.

- Integration of Dance in educational practices.
- Concept of Music, Musical Instruments and Songs.
- Integration of Music and Songs in educational practices.

### Unit II: Drawing and Painting

- Colours, Strokes and Sketching: understanding of various means and perspectives.
- Different forms of painting:Worli art, Madhubani art, Glass painting, Fabric painting and various otherforms of painting.
- Use of Drawing and Painting in Education: Chart making, Poster making, Match-stick drawing and other forms.

## Unit III: Creative and DecorativeArt

- Creative writing: Story writing, Poetry writing.
- Model making: Clay modeling, Origami, Puppet making.
- Decorative Art:Spray painting,Rangoli, Ikebana, Wall painting (Mural).
- Designing: Computer graphics, CD Cover, Book cover, Collage work.
- The use of different art forms in Education.

### Activities:

- Develop a script of any lesson in any subject of your choice to perform a Play / Drama.
- Develop a script for the street play focusing on "Girl's education and Women empowerment".
- Prepare a pictorial monograph on "Various Dance forms in India".
- Prepare a calendar chart on "Various Musical Instruments in India".
- Develop an Audio CD based on newly composed Poems of Gujarati / Hindi language.
- Prepare some useful, productive and decorative models out of the west materials.
- Visit the Faculty of Performing Arts in your city and prepare a detailed report on its multifarious functioning.

### Mode of Transaction:

Lecture, Lecture cum discussion, Workshop schedule, Slide/Film show, Project work, Demonstration, Visit, Group work and its Presentation

### Suggested Readings:

- Theory of Drama by A.Nicoll
- Natya Kala by DhirubhaiThakar
- Natyalekhan by DhananjayThakar
- Natakdeshvidesman by HasmukhBaradi
- Gujarati theatre no Itihas by BaradiHasmukh
- Acting is Believing by CharlsMc.Gaw
- Art of Speech by Kethlin Rich
- NatyaSahitynaswaroopo by Nanda kumarpathak
- Bhavai by Sudahaben Desai
- Bhavai by KrishnakantKadkiya
- NatyaManjarisaurabh by G.K.Bhatt
- KramikPustak Malika by Pt. Bhatkhande
- AbhinavGeetManjari by Ratanjankar

- NCERT, (2006). Position Paper by National Focus Group on Arts, Music, Dance and Theatre

### EPC 4: ICT Practicum

| Semester-VII | Credits-2 |
|---|---|
| Total Marks: 50 (Internal: 15, External: 35) | Contact Hours: 2 hours per week |

### Introduction

The main purpose of this practicum is to provide hands on experience to student teachers in creating and using ICT related teaching learning materials. For realizing this, the following activities will be organized in the workshop.

### Practicum:

- Installation of Operating systems, Windows, installation of essential Software and Utilities.
- Projects that may involve the hardware like LCD Projector, digital camera, camcorder, scanner, Printer, interactive white board and software like word processors (MS Word/Libre Office), spread sheet and Slide Presentation (PPT/impress); and/or Creating and using Blogs,and Google Groups andGoogle Docs.
- Develop a report on preparing a lesson plan on any topic from your methods while using internet resources. They report should mention the details of navigating, searching, selecting, saving and evaluating the authenticity of the material and also mention how it adds or justify the facts, figures(data), graphics, explanation and logic of the topic.
- Teaching with a multimedia e-content developed by the student.

### Mode of Transaction:

LCD Projection, Demonstration, Lecture,Web Surfing, Designing WBI.

**FE-2: School Internship**

| Semester-VII | Credits-14 |
|---|---|
| Total Marks: 350 | Contact Hours: |
| Internal: 350 (300 + 50*) | 14 week |

*Marks will be given by the cooperative/mentor teachers/HM/Principal of mentoring schools*

### Introduction:

In any professional pre-service course, the theory learnt by the student has to be tried out in a real situation. Internship provides this opportunity and thereby complements the course. In teacher development programmes, internship provides the opportunity where the student-teachers can find for themselves the extent to which the methods and techniques of teaching they have learnt during the course, are useful in classroom situation. Internship is the period during which the student teacher stays in the school for a certain extended period, mingles with the school community, gets the first-hand knowledge of the school situation and the associated problems, participate in the programmes of the school, organizes new and productive programmes for the benefit of the school. These helps in developing the right skills, attitudes, interests and appreciation and make the best use of the expertise and resources in the school to blossom into good teachers who could be an asset to any school.

An intern is like an apprentice working under the guidance of highly motivated and experienced teachers of the school. For the first time he faces a cross section of the students which is a mixture of different ability groups often having varied social backgrounds, in a real classroom. While he will have learnt techniques of teaching for different uniform ability groups, he will be called upon to tailor new techniques and methods to suit mixed ability groups and this real challenge gets the best in the internee.

### Objectives

The course will enable the student teachers to:

- Develop the ability to define clearly the general and specific objectives of teaching the subject, the different units, and the individual lessons.
- Develop the ability to select units and subject matter suitable to the class, and resource material and aids - readymade, improvised - suitable to the units.
- Develop the ability to plan the lesson effectively with an understanding of the principles of learning and organize the subject matter suitably indicating the appropriate techniques and aids to be used at each stage and for each purpose.
- Develop the ability to prepare the pupils adequately for each lesson and develop it in ways most suitable to the occasion and most appropriate for realizing the objectives set forth.
- Develop the ability to motivate the pupils sufficiently and sustain their interest as well as maintain discipline in the class.
- Develop the ability to adjust the programme to the varying needs interests and abilities of the pupils, while making for maximum group progress.
- Develop the ability, to use different methods and techniques of teaching and use them effectively in appropriate situations.

- Develop the ability to plan the details of the curriculum with the pupils (teacher pupil planning) and work out resource units, spelling out the experiences, activities, aids, techniques, etc.
- Develop the ability to develop and apply different techniques and tools for the continuous evaluation of the achievement and progress of the pupils, taken as individuals and as a group, especially the ability to construct and use oral, written and performance tests.
- Develop the ability to judge the effectiveness of teaching and the success of each programme in relation to the goals, from the participation and performances of the pupils.
- Develop the ability to diagnose the strengths and weaknesses and the achievements and failures of the individual pupils, in relation to the objectives and decide, plan and organize the reinforcement of remedial assistance needed by each.
- Develop the ability to correlate his subject and its teaching with other subjects taught in the class, with other activities in the school with life, so that, the education of the child becomes an integrated programme.
- Develop the ability to plan, organize and guide enrichment activities and field programmes related to the subjects taught.
- Develop the ability to plan, organize and guide various co-curricular activities, which are considered as important constituents of a rich education for the citizens of tomorrow.
- Develop the ability to see the school as organized center of the community and relate the provisions and practices in the school to the needs and conditions of the pupils and of the community.

### Duration: 14 Weeks

14 weeks internship shall be carried out during the third semester. The student teachers are required to be placed in the schools selected by the Institute. The number of student teachers to be allotted to a particular school shall be 10-12 or as decided by the institute. The institute may appoint a senior faculty as coordinator of the entire programme, who, *inter alia*, would identify and allot schools to student teachers, and maintain liaison with the schools. In addition, a separate coordinator may be appointed for each state knowing the regional language of the respective state.

### Nomination of Mentor Teachers

The internship coordinator/s while visiting the schools for identification purposes, would seek information about different teachers of the schools, who may be nominated as mentor teachers. The role of the mentor teacher would be to share his/her professional experiences, present model lessons, assess student teachers' performance, and provide on-site guidance and support during internship.

### Identification of Supervisors

The faculty members of the institute would be allotted to different schools as supervisors during the internship period. Along with the names of the faculty members, the subject/subjects to be observed and the schools for observation may be written. A chart depicting the names of the internship schools, names of student teachers, name(s) of faculty members (supervisors), and the dates of visit shall be prepared and notified by the coordinator every week. The supervisor shall coordinate the activities of the mentor teacher of the school; and assess student teachers' performance, and provide on-site guidance and support during internship.

*The institute will:*

1. Provide Internship handbook to the internship schools.
2. Organize orientation cum-consultation meetings with the school principals and mentors teachers.
3. Develop supplementary material for additional activities in collaboration with mentor teachers.
4. Hold fortnightly review meetings with mentor teachers.
5. Hold follow -up meetings with student -teachers at regular intervals in the TEI.
6. Monitor implementation of internship including observation of practice teaching.
7. Assess, in collaboration with school mentor -teachers, the internship performance of student -teachers.

**Student teachers shall undertake the following activities during the internship period:**

### I. Planning and Facilitating Teaching Learning

- Unit/ Lesson planning.
- Classroom teaching in two school subjects.
- Lesson observation of mentor teacher and peers.
- Developing and Using Teaching Learning Resources.
- Integrating ICT in regular teaching.

### II. Assessment, Remediation and Action Research

- Preparation of CCE activities including unit tests.
- Preparation of diagnostic tests and identifying learning difficulties.
- Planning and executing remediation.
- Conducting action research.

### III. Understanding School Context

- Prepare Profile of the school (Type of School/infrastructure, facilities teachers, students and community information).
- Analyze Learner Performance(One class).

### IV. Participation in School Activities

- Organize all types of curricular activities, e.g. sports and games, debate, song, art, music, painting.

### V. Community and school Activities

- Survey of households in local community.
- Interaction with SDMC/SMC/PTA/MTA members.
- Interacting with parents.
- The 14 week school internship will be organized in three phases: (i) pre internship; (ii) internship (iii) and post internship.

### Phase-1: Pre internship

The pre internship will be of one week duration during which necessary orientation programmes for Mentor Teachers and Heads of the selected schools will be organized in the institute. The following activities shall be organized during pre-internship phase:

- Orientation of the mentor teachers and Heads of the schools regarding the objectives and different aspects of internship in teaching.
- Orientation about the roles and responsibilities of different personal involved in internship in teaching specially roles of mentor teachers/HM/Principal.
- Discussion on process involved in unit planning/ lesson planning.
- Discussion on process of developing achievement test and its administration and uses.

- Discussion on records to be maintained by student teachers during internship.
- Orientation about process of giving constructive feedback to student teachers.
- Demonstration of model lessons by the experts/supervising teacher followed by discussion, preferably in DMS.
- Demonstration and criticism lessons of at least 2 lessons, by the student teachers, of their peers in each subject followed by discussion.

### Phase-2: Internship

Every student teacher shall undergo an internship of 14 weeks in an identified school. During this period the student teacher shall be attached to a school and he/she shall undertake such duties as are assigned to him / her by the Head Master/Principal of the school in all school related activities. During this period, he/she shall teach at least 120 lessons in the school, taking equal number of lessons from each of his/her pedagogy subjects, under the supervision of the mentor teacher and respective teacher educator (s) from RIE. The first week will be utilized for developing rapport with school (Students, teachers, Principal/Head Master/other staffs, etc.) and familiarity with school system.

### Practicum during Internship

Student teachers shall perform the following during internship:
- Prepare 120 lesson plans in two school subjects and deliver at least 60 lessons in each subject.
- Integrate student assessment activities with teaching learning process.
- Development and use learning resources related to pedagogy courses.
- Observation of peer teaching: 10 in each school subject.
- Observation of teachers' lessons: 5 in each school subject.
- Develop, administer, score and analyze at least 2 unit tests: one in each school subject.

- Conducting action research based on real classroom problems.
- Prepare and maintain student portfolios.
- Preparation of the school time table.
- Organize and participate in: morning assembly, literary and cultural activities, Club activities, Exhibitions, Excursions and field trip, Mock parliament, Quiz, Games and sports and PTA/SMC meetings.
- Maintenance of school library and laboratory.
- Maintaining a reflective diary of his/her school experience.

### Records to be submitted:
- Lesson plans/Unit plans.
- School profile: infrastructure; Social Science Laboratory- physical facilities, Equipments; School Library- facilities.
- Record of Participation/organization of school activities.
- Record of observation of peer teaching.
- Report of action research.
- Assessment record.
- Reflective Journal.

**Phase-3: Post Internship**

The post internship is required to be organized in the Institute for one week just after completion of internship in teaching programme. The following activities shall be organized in the Post Internship phase:

- Preparation of brief report by each student teacher on his/her internship experiences.
- Presentation of the reflections of internship by student teachers, which will be conducted in smaller group/subject wise and assessed by the supervisors.
- Some of the video clippings of lesson delivering developed earlier during internship will be shown for critical reflection
- Inviting feedback from cooperating schools/mentor teachers/HM/Principal/institute faculty.

**Internal Assessment**

The assessment of the performance of student teachers shall be based on the feedback received from all associated with the programme, including mentor teachers/HM/Principal, peers, supervisors of the institute; and various records submitted by the student teachers.

# Semester-VIII

(B.Sc. B.Ed.)
Semester Structure & Title of Papers

| Sl. No. | Course Paper | Subject | Paper Name | Marks | Page No. |
|---|---|---|---|---|---|
| 1 | **CC-13** (Course / Paper from same subject selected as CC subject in Sem.-1) | Physics | Solid State Physics | 100 | 287 |
| | | Chemistry | Analytical, Inorganic and Organic Chemistry | | 290 |
| | | Botany | Ethnobotany, ITK, IPR and Pharmacognocy | | 292 |
| | | Zoology | Biotechnology and Microbiology | | 294 |
| | | Mathematics | Metric Space & Complex Analysis | | 296 |
| 2 | **CC-14** (Course / Paper from same subject selected as CC subject in Sem.-1) | Physics | Nuclear and particles Physics | 100 | 298 |
| | | Chemistry | Organic and Physical Chemistry | | 300 |
| | | Botany | Plant Biotechnology | | 304 |
| | | Zoology | Ecology and Biostatistics | | 306 |
| | | Mathematics | Liner Algebra | | 308 |
| 3 | **DSE-2** (From same subject selected as CC subject in Sem.-1) | Physics | Seminar or Project | 100 | 310 |
| | | Chemistry | Seminar or Project | | 310 |
| | | Botany | Seminar or Project | | 310 |
| | | Zoology | Seminar or Project | | 311 |
| | | Mathematics | Seminar or Project | | 311 |
| 5 | **PE-8** | Education | Vision of Indian Education | 100 | 312 |
| | **EPC-5** | | Guidance and Counselling ( 2 Weeks) | 50 | 316 |
| | **EPC-6** | | Health, Yoga & Physical Education | 50 | 318 |
| | **EPC-7** | | Reading and Reflecting on Texts | 50 | 322 |
| | **FE-3** | | Community Work (2 Weeks) | 50 | 324 |
| **Total** | | | | **600** | |

## CC 13.1: Solid State Physics

Contact Hours per Week : 4

Credit : 4

Examination Duration : 3 Hours

Maximum Marks : 70 (Terminal-50, Sessional-20)

### Unit 1: Crystal Structure and Bonding in Solids:

Crystalline periodicity, crystal symmetry, Bravais lattices, position, directions and planes in crystals. Simple lattice, Close-packed structures & Reciprocal lattice. The Bragg diffraction law, Laue condition of X-ray diffraction, determination of crystal structure with X-rays.

Different types of bonding – ionic, covalent, metallic, van der Waals & hydrogen type.

### Unit 2: Lattice Vibration & Specific heat of solids:

One dimensional monatomic lattice, periodic boundary condition & vibrational modes of the 1-D lattice, Classical calculation of lattice specific heat. Einstein's and Debye's theories of specific heat.

### Unit 3: Energy band structure and Free Electron Theory of Metals :

Periodic potential in a crystalline solid, Bloch theorem, Kroning Penny model and the formation of energy allowed and forbidden energy gaps, number of electrons in a band, reciprocal effective mass tensor of electrons. Electrons and holes. Metals, insulators and semiconductors. Relaxation time, mean free path, mobility and thermal conductivity. Drude model – electrical conductivity. Wiedemann Franz Lorentz relation. Hall effect in metals.

### Unit 4: Dielectric, Magnetic and Superconducting Properties of Solids:

**Dielectric Properties:**

Static dielectric constant of solids, dipole moment and polarization, types of polarization–electronic, ionic and orientational polarizations. Internal fields of solids. Clausius-Mosotti relation.

### Magnetic Properties of Solids:

Magnetic susceptibility, Diamagnetism of core electrons. Paramagnetism. Langevin equations for dia&paramagnetism. Curie's law. Quantum theory of paramagnetism (for S=1/2 system). Spontaneous magnetization and ferromagnetic properties of solids. Temperature variation of spontaneous magnetization, Curie-Weiss law. Domain structure & hysteresis in ferromagnets.

### Superconducting Properties of Solids:

Critical Temperature. Critical magnetic field. Meissner effect. Type I and type II Superconductors, London's Equation and Penetration Depth. Isotope effect. Cooper pair and Idea of BCS theory (No derivation), Entropy, specific heat, energy gap of super conductor.

**Suggested Books:**

1. Introduction to Solid State Physics, Charles Kittel, 8th Edition, 2004, Wiley India Pvt. Ltd.
2. Elements of Solid State Physics, J.P. Srivastava, 2nd Edition, 2006, Prentice-Hall of India
3. Introduction to Solids, Leonid V. Azaroff, 2004, Tata Mc-Graw Hill
4. Solid State Physics, N.W. Ashcroft and N.D. Mermin, 1976, Cengage Learning
5. Solid-state Physics, H. Ibach and H. Luth, 2009, Springer
6. Elementary Solid State Physics, 1/e M. Ali Omar, 1999, Pearson India
7. Solid State Physics, M.A. Wahab, 2011, Narosa Publications
8. Solid State Physics – S. O. Pillai (New Age Publication).

## CC 13.2: Practicals

Contact Hours Per Week    :    2
Examination Duration      :    3 Hours
Maximum Marks             :    30 ( Expt-20, Viva-5, Record-5)

1. Measurement of susceptibility of paramagnetic solution (Quinck's Tube Method)
2. To measure the Magnetic susceptibility of Solids.
3. To determine the Coupling Coefficient of a Piezoelectric crystal.
4. To measure the Dielectric Constant of a dielectric Materials with frequency
5. To determine the complex dielectric constant and plasma frequency of metal using Surface Plasmon Resonance (SPR)
6. To study the PE Hysteresis loop of a Ferroelectric Crystal.
7. To measure the resistivity of a semiconductor (Ge) with temperature by four-probe method  (room temperature to $150^0$C) and to determine its band gap.
8. To determine the Hall coefficient of a semiconductor sample.

**Suggested Books:**
1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
3. A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11th Ed., 2011, Kitab Mahal
4. Elements of Solid State Physics, J.P. Srivastava, 2nd Ed., 2006, Prentice-Hall of India.
5. A Complete Course in Degree Practical Physics, B.B. Swain, Kalyani Publishers (2017).

## CC 13.1: Analytical, Inorganic and Organic chemsitry

Contact Hours per Week :  4

Credit :  4

Examination Duration :  3 Hours

Maximum Marks :  70 (Terminal-50, Sessional-20)

Unit 1 :

### Chromatography

Principle, steps involved in chromatography, Separation of mixtures by following chromatography techniques (column, paper and thin layer)

Paper Chromatography: Separation of mixture of

i) cations of group-I/group-II,

ii) amino acid (viz. arginine, glutamic acid, lysine, aspartic acid),

iii) D-glucose, D-xylose and lactose,

iv) alizarin red, methyl red, methyl orange.

Column Chromatography: Separation of mixture of:

i) methylene blue and malachite green,

ii) $Pb^{2+}$, $Cu^{2+}$, $Cd^{2+}$, $Bi^{3+}$ or mixture of $Ag^{2+}$, $Pb^{2+}$, $Hg^{2+}$ .

iii) chlorophylls and carotenoids from spinach.

TLC: Separation of mixture of:

i) e-ink pigments in black ink, blue ink and red ink,

ii) dyes containing malachite green, fluorescein, rhodamin B,

iii) phenolic mixtures like phloroglucinol, resorcinol, o/m-nitrophenol.

iv) amino acids in a mixture.

Unit 2:

a) **Inorganic Polymers**

Types of inorganic polymers, comparison with organic polymers, synthesis, structural aspects and applications of silicones and siloxanes. Borazines, silicates and phosphazenes, and polysulphates.

b) **Non-aqueous solvents**

Classification of solvents: liquid ammonia solvent system with reference to a) acid-base reactions, b) solvolysis, c) precipitation reactions.

Unit 3:

a) **Lipids, fats, oils and detergents**

Introduction to lipids, classification.

Oils and fats: Common fatty acids present in oils and fats, Omega fatty acids, Trans fats, Hydrogenation, Saponification value, Iodine number.

Biological importance of triglycerides, phospholipids, glycolipids, and steroids (cholesterol).

b) **Nucleic acids**

Components of nucleic acids, Nucleosides and nucleotides; Structure, synthesis and reactions of: Adenine, Guanine, Cytosine, Uracil and Thymine; Structure of polynucleotides

**Unit 4:**

**a)**    **Enzymes**

Introduction, classification and characteristics of enzymes. Salient features of active site of enzymes.

Mechanism of enzyme action (taking trypsin as example), factors affecting enzyme action, coenzymes and cofactors and their role in biological reactions, specificity of enzyme action (including stereospecificity), enzyme inhibitors and their importance, phenomenon of inhibition (competitive, uncompetitive and non-competitive inhibition including allosteric inhibition).

**b)**    **Concept of energy in Biosystems:**

Introductionto metabolism (catabolism and anabolism). Concept of hydrolyses of ATP and ADP and coupling reaction.

Overview of catabolic pathways of fat and protein.

Interrelationship in the metabolic pathways of protein, fat and carbohydrate.Caloric value of food, standard caloric content of food types.

**CC 13.2: Practical**

| | | |
|---|---|---|
| Conctact Hours Per Week | : | 2 |
| Examination Duration | : | 3 Hours |
| Maximum Marks | : | 30 ( Expt-20, Viva-5, Record-5) |

1.    Checking the calibration of the thermometer
2.    Chromatography

a.    Separation of a mixture of two amino acids by ascending and horizontal paper chromatography

b.    Separation of a mixture of two sugars by ascending paper chromatography

c.    Separation of a mixture of o-and p-nitrophenol or o-and p-aminophenol by thin layer chromatography (TLC)

## CC13.1 Ethnobotany, ITK, IPR and pharmacognocy

Contact Hour Per Week: 4
Credits: 4
Examination duration: 3 Hours
Maximum marks: 70 (Terminal- 50, Sessional- 20)

### Unit 1: Ethnobotany

Introduction to Ethnobotany, Concept, Importance of Medicinal Ethnobotany & Ethnopharmacology

### Unit 2: ITK & IPR

Introduction to ITK, Scope, Conservation of ITK; History of IPR, Nature, Overview of IPR in India, Limitations

### Unit 3: Pharmacognosy

Introduction, Importance of Pharmacognosy in medicine, Crude drugs, Organoleptic evaluation of drugs.

### Unit 4: Plant Disease Management

Quarantine; physical control, chemical control, biological control, integrated disease management. Bacteria and Fungi mediated disease and its control (Bacterial disease of rice and fungal disease of Wheat)

## CC 13.2: Practical

Contact Hour Per Week: 2
Examination duration:    3 Hours
Maximum marks: 30 (Exp. 20, Viva-5, Record-5)

- Studies on plants of ethnobotanical interest
- Plant disease study

**References**

1.Bruneton  J.1999  Pharmacognosy,Phytochemistry,Medicinal  Plants  Intercept Ltd.,Paris

2.Plant Pathology Agrios,G.N.

**CC13.1: Biotechnology and Microbiology**

Contact Hour per Week : 4

Credits : 4

Examination duration : 3 Hours

Maximum marks : 70 (Terminal- 50, Sessional- 20)

## UNIT 1:
### Genetic Engineering

- Basic concept of genetic engineering.
- Cloning Vectors: plasmids, lambda bacteriophage, cosmid, phagmid, BAC, YAC, expression vector, Ti-plasmid.

- Restriction endonuclease: source, types and uses; DNA ligase.
- Transformation techniques: calcium chloride, gene gun, electroporation, microinjection.

## UNIT 2:
### Recombinant DNA technology

- Recombinant DNA technology: cloning by using vectors (plasmid and lambda phage).
- DNA fingerprinting, DNA sequencing - Sanger method, EST, STS.
- Human genome project.

## UNIT 3:
### Animal biotechnology

- Animal cell culture, expressing cloned genes in mammalian cells, molecular diagnosis of genetic disease (sickle cell anaemia, cystic fibrosis).
- Gene therapy, bio-reactors, recombinant DNA medicines - recombinant insulin and hGH.
- Production of cloned and transgenic animals (nuclear transplantation, retroviral method, DNA microinjection), knock-out animals: types, procedure of generation.

## UNIT 4:
### Microbiology

- Virus, viroid, virion, mycoplasma: structure and general characters; classification, structure and life cycle of bacteriophage
- Bacteria: structure, classification and transfer of genetic materials (transformation, transduction and conjugation).

## CC13.2: Practical

Contact Hour per Week : 2
Examination duration : 3 Hours
Maximum marks : 30

- Genomic DNA isolation.
- Study of following techniques through ICT:
    a) Southern blotting.
    b) Northern blotting.
    c) Western blotting.
    d) DNA fingerprinting.
    e) PCR.
- Report on animal cell culture/report on institute visited.
- Preparation and use of culture media for microbes and animal tissues, sterilization, inoculation and growth monitoring, use of fermenters.
- Counting of bacterial population/mammalian cells using haemocytometer.
- Sessional activities.

## Reference Books (names only):

1. Molecular Biotechnology by Glick and Pasternak, 4th edition.
2. Gene Cloning and DNA Analysis: An Introduction by Brown, 6th edition.
3. Principles of Gene Manipulation and Genomics by Primrose and Twyman, 7th edition.
4. Principles and Techniques of Practical Biochemistry by Wilson & Walker (eds.), 5th edition.
5. Biochemistry by Voet and Voet, 4th edition.
6. Principles of Biochemistry by Nelson and Cox, 6th edition.
7. Molecular Biology by Clark, 2nd edition.
8. Molecular Biology of the Gene by Watson et al., 7th edition.
9. iGenetics by Russell, 3rd edition.
10. Microbiology: An Introduction by Tortora, 12th edition.
11. Microbiology: Principles and Explorations by Black, 9th edition.
12. Biotechnology by Clark and Pazdernik, 2nd edition.

## CC 13.1: METRIC SPACES & COMPLEX ANALYSIS (ANALYSIS-IV)

Contact Hours per Week   : 4
Credit   : 4
Examination Duration   : 3 Hours
Maximum Marks   : 70 (Terminal-50, Sessional-20)

**Unit1 :**

**Metric spaces:** Definition and examples, Open & Closed spheres, Neighborhoods, Interior points, Open set, Closed set, Boundary points, Limit points & isolated points, Closure of a set, Sequences in metric spaces, Convergent sequences, Cauchy sequences, Complete metric spaces, Continuity & Uniform continuity in metric space.

**Unit2 :**

Limits & Continuity of complex functions, Derivatives, Differentiation formulas, Cauchy-Riemann equations, Sufficient conditions for differentiability, Analytic functions, Examples of analytic functions Caucy Riemann equation.

**Unit3 :**

**Complex integration:** Complex line integral, Cauchy- theorem, Cauchy-Goursat theorem (statement only), Definite integrals of functions, Cauchy integral formula, Cauchy integral formula for higher order derivative (without prof). Extension of Caucy's integral formula to multiply connected region (statement only) to solve integral problems.

**Unit4 :**

Taylor series (with Proof), Laurent series (without proof) with examples, Singularities, Different types of singularity, Zerosof complex functions., Residue and its application for solving $\int_0^{2\square} \square(\sin\square, \cos\square)\,\square\square$.

## CC 13.2 :PRACTICAL

Contact Hours Per Week   :  2
Examination Duration   :  3 Hours
Maximum Marks   :  30 ( Expt-20, Viva-5, Record-5)

Activity oriented problem solving/ experiments based on the content studied in theory.

**Reference Books :**

1. P.K. Jain and K. Ahmad: Metric Spaces, Narosa Publishing House, New Delhi.
2. James Ward Brown and Ruel V. Churchill: Complex Variables and Applications, 8th Ed., McGraw Hill International Edition, 2009.
3. John H. Mathews & Russel W. Howell, Complex Analysis for Mathematics and Engineering, 5th Edition, Jones &Batlett Publications. [Chapter 2 (2.3), 3 (3.1 to 3.31), 6 (6.1 to 6.4), 7 (7.1 to 7.4), 8 (8.1 to 8.2)].
4. G. F. Simmons, Introduction to topology and modern analysis, Robert E. Krieger Publishing Company, Malabar, Florida. [Chapter 2 (9 to 14)]
5. S.Arumugam, A.T.Isaac, A.Somasundaram-Complex Analysis, Scitech Pub.(INDIA) pvt.ltd.
6. Satish Shirali and Harikishan L. Vasudeva, Metric Spaces, Springer Verlag, London, 2006.
7. S. Kumaresan, Topology of Metric Spaces, 2nd Ed., Narosa Publishing House, 2011.
8. S. Ponnusamy-Foundations of Complex Analysis, Alpha Science International Ltd.
9. J.B. Conway-Functions of one complex variable, Springer.
10. N. Das- Complex Function Theory, Allied Publishers Pvt. Ltd., Mumbai.
11. Merk, J. Ablowitz and Athanassias S. Fokas, Introduction and Applications of Complex Analysis.
12. A. R. Vasishta, Complex Analysis.

## CC 14.1: Nuclear and Particle Physics

Contact Hours per Week :  5
Credit                 :  5
Examination Duration   :  3 Hours
Maximum Marks          :  70 (Terminal-50, Sessional- 20)

### Unit 1: General Properties of Nuclei:

Constituents of nucleus and their Intrinsic properties, quantitative facts about mass, radii, charge density (matter density), binding energy, average binding energy and its variation with mass number, main features of binding energy versus mass number curve, N/A plot, angular momentum, parity, magnetic moment, electric moments, nuclear excites states.

### Nuclear Models:

Liquid drop model approach, semi empirical mass formula and significance of its various terms, condition of nuclear stability, two nucleon separation energies, evidence for nuclear shell structure, nuclear magic numbers, basic assumption of shell model.

### Unit 2: Radioactivity decay:

(a) Alpha decay: basics of α-decay processes, theory of α- emission, Gamow factor, Geiger Nuttall law. (b) β-decay: energy kinematics for β-decay, positron emission, electron capture, neutrino hypothesis. (c) Elementary idea of Gamma decay.

### Nuclear Reactions:

Types of Reactions, Conservation Laws, kinematics of reactions, Q-value.

### Unit 3 : Detector for Nuclear Radiations:

Gas detectors: estimation of electric field, mobility of particle, for ionization chamber and GM Counter. Basic principle of Scintillation Detectors and construction of photo-multiplier tube (PMT).Semiconductor Detectors (Si and Ge) for charge particle and photon detection (concept of charge carrier and mobility), neutron detector.

### Unit 4 : Particle Accelerators:

Van-de Graaff generator (Tandem accelerator), Linear accelerator, Cyclotron, Synchrotrons.

### Particle physics:

Four basic interactions in nature and their relative strengths, examples of different types of interactions.Symmetries and Conservation Laws: energy and momentum, angular momentum, parity, baryon number, Lepton number, Isospin, Strangeness and charm. Elementary ideas of quarks and gluons.

Suggested Books:

1. Introductory nuclear Physics by Kenneth S. Krane (Wiley India Pvt. Ltd., 2008).
2. Concepts of nuclear physics by Bernard L. Cohen. (Tata Mcgraw Hill, 1998).
3. Introduction to High Energy Physics, D.H. Perkins, Cambridge Univ. Press
4. Introduction to Elementary Particles, D. Griffith, John Wiley & Sons
5. Basic ideas and concepts in Nuclear Physics - An Introductory Approach by K. Heyde (IOP- Institute of Physics Publishing, 2004).
6. Theoretical Nuclear Physics, J.M. Blatt & V.F. Weisskopf (Dover Pub. Inc., 1991)
7. Atomic and Nuclear Physics -A.B. Gupta, Dipak Ghosh. (Books and Allied Publishers)
8. Physics of Atoms and Molecules – Bransden (Pearson India) 2003
9. Introduction to Nuclear and Particle Physics- A. Das and T. Ferbel (World Scientific)

### CC 14.2: Practical (Tutorial)

| | | |
|---|---|---|
| Contact Hours Per Week | : | 2 |
| Examination Duration | : | 3 hour |
| Maximum Marks | : | 30 ( Expt= 20, Viva-5, Record-5) |

## CC 14.1: Organic and Physical Chemsitry

Contact Hours per Week : 4
Credit : 4
Examination Duration : 3 Hours
Maximum Marks : 70 (Terminal-50, Sessional-20)

### Objectives:

On completion of the course the students will be able to

- Explain the microscopic properties of solids
- Understand the laws of crystallography
- Describe the chemistry of synthetic polymers
- Study about petrochemicals
- Explain the application of organometallic compounds as catalyst
- Define the colloids adsorption
- Classify the colloids and adsorption

### Unit 1:

**a) Organometallic compounds-II**

Metal Alkyls: Important structural features of methyl lithium (tetramer) and trialkyl aluminium (dimer), concept of multicentre bonding in these compounds. Role of triethylaluminium in polymerisation of ethene (Ziegler – Natta Catalyst). Species present in ether solution of Grignard reagent and their structures, Schlenk equilibrium.

**b) Catalysis by some Organometallic Compounds**

Study of the following industrial processes and their mechanism:

1. Alkene hydrogenation (Wilkinsons Catalyst)
2. Hydroformylation (Co salts)
3. Wacker Process
4. Synthetic gasoline (Fischer Tropsch reaction)
5. Synthesis gas by metal carbonyl complexes

### Unit 2:

**a) Organic polymers**

Introduction and classification including di-block, tri-block and amphiphilic polymers;

Number average molecular weight, Weight average molecular weight, Degree of polymerization, Polydispersity Index.

Polymerisation reactions -Addition and condensation -Mechanism of cationic, anionic and free radical addition polymerization; Metallocene-based Ziegler-Natta polymerisation of alkenes; Preparation and applications of plastics – thermosetting (phenol-formaldehyde, Polyurethanes) and thermosoftening (PVC, polythene);

Fabrics – natural and synthetic (acrylic, polyamido, polyester); Rubbers – natural and synthetic: Buna-S, Chloroprene and Neoprene; Vulcanization; Polymer additives; Introduction to liquid crystal polymers; Biodegradable and conducting polymers with examples.

## b) Petroleum and petrochemicals

Origin of petroleum, composition, refining, reforming, fractionation, cracking, knocking, octane number, cetane number, kerosene, naphtha, LPG, synthetic petrol, petrochemicals.

## Unit 3:

### Solid State of matter

Nature of the solid state, law of constancy of interfacial angles, law of rational indices, Miller indices, elementary ideas of symmetry, symmetry

elements and symmetry operations, qualitative idea of point and space groups, seven crystal systems and fourteen Bravais lattices; X-ray diffraction, Bragg's law, a simple account of rotating crystal method and powder pattern method. Analysis of powder diffraction patterns of NaCl, CsCl and KCl. Defects in crystals. Glasses and liquid crystals.

## Unit 4:

### Colloidal and Surface Chemistry

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, liquid in solid (gels): classification, preparation and properties, general application of colloids.
Adsorption: Types of adsorption, Freundlich, Langmuir and Gibb's adsorption isotherm.

## CC 14.2: Practical

| | | |
|---|---|---|
| Conctact Hours Per Week | : | 2 |
| Examination Duration | : | 3 Hours |
| Maximum Marks | : | 30 ( Expt-20, Viva-5, Record-5) |

### Spectrophotometry

1. To Determine of strength of $KMnO_4$ solution using spectrophotometer.
2. To determine the concentration of $Fe^{3+}$ spectrophotometrically by thiocyanate.
3. To find the strength of given ferric ammonium sulfate solution of (0.05 M) by using EDTA spectrophotometrically.
4. To find out the strength of $CuSO_4$ solution by titrating with EDTA spectrophotometrically.
5. To determine the concentration of Cu(II) and Fe(III) solution spectrophotometrically by titrating with EDTA.

### Polarimetry

To determine the specific rotation of optically active compounds.

## Reference Books

### Physical Chemistry

1. Principles for physical Chemistry- Puri, Sharma and Pathania
2. Physical chemistry – Bahl and Tuli
3. Physical chemistry-S. Glasstone
4. Physical chemistry (vol I to V) K. L. Kapoor
5. Physical chemistry-Soni, Dharmarah and Dash
6. Physical chemistry-P.C. Rakhit
7. Thermodynamics for chemists- S. Glasstone
8. Electrochemistry- S. Glasstone
9. Physical chemistry- Atkins
10. Basic physical chemistry- G. M. Barrow
11. Physical chemistry (solved Problems) Dogra and Dogra
12. Problems in Physical chemistry- Pahari and Pahari

### Inorganic Chemistry

1. Concise Inrganic chemistry- J. D. Lee
2. Advanced Inorganic chemistry- R. D. Madan
3. Inorganic chyemistry-Pur, Sharma, Kalia
4. Selected Topics in Inorganic Chemistry- Malik, Tuli and Madan
5. Inorganic Chemistry- J.E. Huheey
6. Inorganic chemistry- Meissler and Tarr
7. Nuclear chemistry-H. J. Arnikar
8. Nuclear Chemistry. U. N. Dash
9. Advancaed Inorganic Chemisgtry- F. A. Cotton and Wilkinson
10. Theoretical Inorganic Chemistry- Day and Selbin
11. Inorganiac Chemistry-R.L. Dutta
12. Magnetochemistry- R.L. Carlin

## Organic chemistry

1. Advanced Organic Chemistry-Bahl and Bahl
2. Advanced organic chemistry-Jagadamba singh and L.D. S. Yadav
3. Organic Reacation Mechanism-P.S. Kalsi
4. Organic chemistry-R. K. Bansal'
5. Organic Chemistry-Mukherjee, Singh and Kapoor
6. Organic Chemistry-I.L. Finar (Part 1 & 2)
7. Organic Chemistry-R.T. Morison and R. N. Boyd
8. Organic Chemistry-Clayden, Greeves, Warren and Wothers
9. Organic Chemistry-Solomon
10. Stereochemistry, Conformation and Mechanism-P.S. Kalsi
11. Stereochemistyr of carbon compounds-D. Nasipuri
12. Advanced organic chemistry-Reactions, mechanism and structure, Jerry March
13. Advanced Organic chemistry-F. A. Carey and R. J. Sundberg
14. Reaction Mechanism in Organic Chemisu y-S.M. Mukherjee and S. P. Sigh
15. A Guidebook of mechanism in organic chemistry-Peter Sykes
16. Organic Chemistry-P.Y. Bruice

## Spectroscopy

1. Spectroscopy-P.S. Kalsi
2. Spectroscopy, Y. R. Sharma
3. Spectroscopic Identification of Organi Compounds- Silverstein and Bassler
4. Fundamentals of Molecular Spectroscopy- C. N. Banwel

## General Chemsitry

1. University General Chemistry-C.N.R. Rao
2. Chemistry-Raymond and Chang

## Practical

1. Inorganic qualitative Analysis- A.I. Vogel
2. Inorganic Quantitative Analysis- A.I. Vogel

3. A text book of Practical Organic Chemistry-A. I. Vogel
4. Laboratory annual in Organi Chemistry- R.K. Bansal
5. Experimental Organic Chemistry (Vol.I and II)- Singh, Gupta and Bajpai.
6. Practical Organic Chemistry-I.L. Finar.
7. Handbook of Organic Analysis, Qualitative and Quantitative. M. T. Clarke.
8. Practical Chemistry- Gurdeep Raj Chatawal
9. A Complete Course in Practical Chemistry- Y. R. Sharma and R.C. Acharya.

## CC-14.1 PLANT BIOTECHNOLOGY

Contact Hour Per Week: 4
Credits: 4
Examination duration: 3 Hours
Maximum marks: 70 (Terminal- 50, Sessional- 20)

**Unit 1: Introduction of Plant Biotechnology: Concept and main branches.**

Historical perspective of Plant tissue culture and plant genetic engineering. Preliminary idea regarding Plant biotechnology based industry. Main branches of plant biotechnology.

**Unit 2: Plant Tissue Culture concept and applications.**

Primary concept of Plant tissue culture Laboratory, Composition of culture media, sterilization process.

Concept of totipotency. Callus and cell suspension culture methods and applications.

Micropropagation: fundamental concept, stages of micropropagation and applications.

Somatic embryogenesis: induction and germination, applications

Haploid culture: Anther and pollen culture, applications.

Zygotic embryo culture: Method and applications

Protoplast culture and hybridization: Method and applications

Somaclonal variation: concept and applications

**Unit 3: Fundamental concept of Molecular biology and Recombinant DNA Technology**

Nucleic acid: Structure and properties of DNA & RNA.

Central dogma. DNA replication, transcription and translation in *E.coli*.

Gene concept.

Restriction Endonucleases: history, types and applications

Ligase – properties, types and applications

Principle of Gel Electrophoresis, Principle of Submarine and vertical gel electrophoresis

PCR: Principle and applications.

Cloning Vectors: Properties, Types (pUC 18 pBR322, Ti, plasmid; Lambda phage, M13, Cosmid, and YAC.Gene Cloning: Recombinant DNA, Bacterial Transformation and selection of recombinant clones, PCR-mediated gene cloning; Gene Construct; construction of genomic and cDNA libraries, screening DNA libraries to obtain gene of interest by genetic selection; complementation, colony hybridization;

### Unit: 4 Genetic Transformation: concept and methods

Concept of Genetic Transformation;

Methods of gene transfer- Agrobacterium-mediated, Direct gene transfer by Electroporation, Microinjection, Microprojectile bombardment; In-planta transformation;

Selection of transgenics- selectable marker and reporter genes (Luciferase, GUS, GFP).

Genetically Modified plants and applications

Improvements for vitamin, Edible oil quality, Insect Resistant plant, Disease resistant, Pharmaceutical uses

## CC 14.2: Practical

Contact Hour Per Week : 2

Examination duration : 3 Hours

Maximum marks: 30 (Exp. 20, Viva-5, Record-5)

1. Preparation of MS medium.
2. Sterilization of media, glass wares etc, Explant surface sterilization
3. Aseptically inoculation methods using leaf, shoot tip and nodal explants
4. Isolation of plasmid
5. Extraction of plant genomic DNA

### Suggested Readings

1. *Bhojwani*, S.S. and *Dantu*, P.K. 2013. Plant Tissue Culture: An Introductory Text
2. Smith R. H. Plant Tissue Culture, Techniques and Experiments Third Edition
3. Jha, T. and Ghosh, B . 2016. **Plant Tissue Culture** - *Basic and Applied*. 2nd Edition Platinum Publisher
4. Brown, T. A. Gene Cloning and DNA Analysis: An Introduction, 6th Edition, , Wiley-Blackwel
5. Primrose, S, B. Principles of Gene Manipulation & Genomics – 7th Edition –, Richard Twyman– Blackwell
6.. Glick, Bernard, R., Pasternak, J. J and Patten, C. L. Molecular Biotechnology: Principles and Applications of Recombinant DNA-

## CC14.1: Ecology and Biostatistics

Contact Hour per Week : 4
Credits : 4
Examination duration : 3 Hours
Maximum marks : 70 (Terminal- 50, Sessional- 20)

**Unit 1:**

**Introduction to ecology and ecosystem**

- Structural and functional aspects of ecosystem, its types.
- Habitat and niche concept; food chain and food web; trophic levels and ecological pyramids.
- Concept of energy flow: mechanism with models (Lindemann's model and universal model).
- Ecological succession: types and stages of succession; concept of sere and climax community.

**Unit 2:**

**Population and community ecology**

- Principles and concepts of population: population attributes - density, growth and growth forms; life strategies, r and k strategies; age distribution; population fluctuation; biotic potential.
- Population interaction: types - interspecific and intraspecific; positive and negative interactions; competitive exclusion principle - Gause's experiments and Park's rule; Lotka-Volterra equation and model.
- Population regulation: laws of limiting factors; density dependant and density independent factors.
- Concept of community: types and structures of community; concept of abundance; dominance and dominance index; diversity; species richness and heterogeneity; ecotone and edge effect.
- Concept of ecological species: keystone species, umbrella species, flagship species, indicators, founder and dominant species.

**Unit 3:**

**Biodiversity, conservation and environmental pollution**

- Biodiversity: concept, types and values.
- Conservation of biodiversity - sanctuary, national park, biosphere reserve, megadiversity zones, biodiversity hotspots, present status of biodiversity in India.
- Conservation strategies ( ex-situ and in-situ), Acts and Schedules of wildlife; Project Tiger, man-animal conflict
- Pollution: types (air, water, soil); sources, effects and remedial measures.

**Unit 4:**

**Biostatistics**

- Concept of biostatistics: laws of probability, sampling, data arrangement.
- Measures of central tendency: mean, median and mode.
- Measures of dispersion: hypothesis and its testing (chi square test, students' t test), correlation, regression)
- Data analysis using EXCEL programme.

## CC1.2: Practical

Contact Hour Per Week : 2
Examination duration : 3 Hours
Maximum marks : 30

- Estimation of following parameters of different water samples:
  a) Dissolved oxygen and carbon dioxide.
  b) Total alkalinity and chloride.
  c) Salinity.
  d) pH.
- Measurement of transparency of water using Secchi disc.
- Estimation of the water holding capacity and pH of the soil sample.
- Study of zooplankton (*Cyclops*, Zoea larva, Nauplius, Megalopa, *Mysis*, *Lucifer*, Medusa of *Obelia/Aurelia*), nekton (*Pristis*, *Torpedo*, *Hippocampus*, *Exocetus*, *Hemiramphus*), and benthos (*Chiton, Pennatula, Murex, Metridium, Asterias*).
- Field study on biodiversity and submission of report (on any ecosystem).
- Visit to zoological park and submission of report.
- Problems based on Biostatistics Unit by chi square test, students' t test.
- Sessional activities.

## Reference Books :

1. Colinvaux, P. A. (1993). Ecology, 2nd edition. John Wiley and Sons, Inc.
2. Krebs, C. J. (2001). Ecology, 6th edition. Benjamin Cummings.
3. Odum, E. P. (2008). Fundamentals of Ecology, Indian edition. Brooks/Cole.
4. Ricklefs, R. E. (2000). Ecology, 5th edition. Chiron Press.
5. Smith, T. M. and Smith, R. L. (2015). Elements of Ecology, 9th edition. Pearson.
6. Santra, S. C. (2010). Fundamentals of Ecology and Environmental Biology. New Central Book Agency.
7. Mukherjee, B. (1996). Environmental Biology. Tata McGraw Hill.
8. Das, N. G. (2008). Statistical Methods, Vols. 1 and 2. McGraw Higher Ed.
9. Goon, A. M., Gupta, M. K. and Dasgupta, B. (2001). Basic Statistics. The World Press.

## CC 14.1: LINEAR ALGEBRA (ALGEBRA-III)

Contact Hours per Week : 4
Credit : 4
Examination Duration : 3 Hours
Maximum Marks : 70 (Terminal-50, Sessional-20)

**Unit1 :**

Vector spaces, subspaces, algebra of subspaces, quotient spaces, linear combination of vectors, linear span, linear independence, basis and dimension, dimension of subspaces.

**Unit2 :**

Linear transformations, null space, range, rank and nullity of a linear transformation, the algebra of linear transfortations, Isomorphism, Representation of a linear transformation by matrices, algebra of linear transformations. Isomorphisms.

**Unit3 :**

Eigenvalues, eigenvectors of a linear transformation, linear independence of eigenvectors corresponding to different eigenvalues, characteristic polynomials. Caley-Hamilton theorem, minimum polynomial, Jordan canonical form.

**Unit4 :**

Introduction to Inner Product spaces, Definitions and examples of Inner Product Spaces, Parallelogram law, Schwarz's inequality, triangular inequality.

**Reference Books:**

1. K. Hoffman, R. Kunze, Linear Algebra, Chapter[ 2(2.1 to 2.3), 3(3.1, 3.2, 3.3, 3.4), 6(6.1, 6.2, 6.3), 7(7.3), 8(8.1 to 8.5)]

2. David C. Lay, Linear Algebra and its Applications, 3rd Ed.
3. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, Linear Algebra, 4th Ed., Prentice-Hall of India Pvt. Ltd., New Delhi, 2004.
4. S. Lang, Introduction to Linear Algebra, 2nd Ed., Springer, 2005.
5. S. Kumaresan, Linear Algebra- A Geometric Approach, Prentice Hall of India,1999.
6. Kenneth Hoffman, Ray Alden Kunze, Linear Algebra, 2nd Ed., Prentice-Hall of India Pvt. Ltd., 1971.
7. A. R. Vashistha and J. N. Sharma, Linear Algebra.
8. Prasun Kr. Nayak : Linear Algebra (concept and Applications ) - Books & Allied Pvt. Ltd.

**CC 14.2 : Practical**

| | | |
|---|---|---|
| Contact Hours Per Week | : | 2 |
| Examination Duration | : | 3 Hours |
| Maximum Marks | : | 30 ( Expt-20, Viva-5, Record-5) |

1. Vector space and sub space, basic and dimension counter examples.
2. Linear transformation, identification of rank and nullity of a linear transformation.
3. Eigenvalues, eigenvectors of a linear transformation.
4. Application of Caley-Hamilton theorem, minimum polynomial.
5. Inner product spaces.

**DSE-II: PROJECT**

Contact Hours per Week  :          4
Credit                  :          4
Examination (Viva voce) Duration:  3 Hours
Maximum Marks           :    100

The students will complete the project work under the guidance of members of faculty. Regular monitoring of the steps or process indicated below is essential. Weightage as indicated against each step is to be assigned through seminar/workshop mode.

| Identification of problem | Review of literature | Methodology | Analysis | Findings | Viva-voice | Total |
|---|---|---|---|---|---|---|
| 10 | 10 | 10 | 15 | 25 | 20 | 100 |

**DSE II: Seminar and Project**

Contact Hours per Week  :    4
Credit                  :    4
Examination Duration    :    3 Hours
Maximum Marks           :    100

| Identification of problem | Review of literature | Methodology | Analysis | Findings | Viva-voce | Total |
|---|---|---|---|---|---|---|
| 10 | 10 | 10 | 25 | 25 | 20 | 100 |

**DSE II: PROJECT/SEMINAR**

Contact Hours per Week  :    4
Credit                  :    4
Examination Duration    :    3 Hours
Maximum Marks           :    100

| Survey and Identification of related topic | Review of literature | Project work | Report | Viva-voce | Total |
|---|---|---|---|---|---|
| 10 | 10 | 40 | 20 | 20 | 100 |

## DSE-II: Seminar and Project

Contact Hours per Week : 4
Credit : 4
Examination Duration : 3 Hours
Maximum Marks : 100

| Identification of problem | Review of literature | Methodology | Analysis | Findings | Viva-voce | Total |
|---|---|---|---|---|---|---|
| 10 | 10 | 10 | 25 | 25 | 20 | 100 |

## Mathematics-DSE-II: Seminar and Project

Contact Hours per Week : 4
Credit : 4
Examination Duration : 3 Hours
Maximum Marks : 100

| Identification of problem | Review of literature | Methodology | Analysis | Findings | Viva-voce | Total |
|---|---|---|---|---|---|---|
| 10 | 10 | 10 | 25 | 25 | 20 | 100 |

## PE-8 Vision of Indian Education

| Semester-VIII | Credits-4 |
|---|---|
| Total Marks:100 | Contact Hours: |
| (Internal: 30, External: 70) | 4 hours per week |

### Introduction

Education is essentially a normative endeavor, hence is intentional. It intends, rather deliberately, to socialize children into a value frame or normative structure. That is why

history reveals that every education system, at different historical periods, had been guided by certain value concerns. In contemporary times, the education system in India derives its values from the Constitution of India. While socializing children education has to negotiate within the frame of Constitutional values. Indian Constitution envisioned a humane society based on freedom, equality and justice, and this led to evolving many institutions to realize the vision. In this regard, education has been considered as an agency of social transformation and classroom as the shape of the envisioned destiny. Since teachers ought to play crucial role in realizing the vision, they are to be informed the Constitutional vision so as to develop normative perspectives regarding education and thereby emerging concerns and issues. This normative perspective a teacher holds in turn guides his/her actions and acquires a meaning to action.

Education being an operational area, every citizen perceives several issues related to it through personal experience. The student-teachers need to understand the main issues that touch their functioning as also situate themselves in context. Such an understanding on at least a few issues and concerns will equip student teachers to be ready for dealing with other issues and concerns in the field. This is very relevant as it may not be possible to bring under scrutiny all issues and concerns. Since, concerns and issues cannot and should not be 'informed' like 'ready to cook facts', the course is designed in such a fashion that prospective teachers would be encouraged to come to terms with concerns and issues that would emerge out of their reasoned engagement with contemporary educational reality in the light of professed humanistic values.

### Objectives

The course will enable the student teachers to:

- Understand evolution of education in India from Vedic period to post Independence era.
- Develop understanding on issues and concerns relating to Elementary education and implementation of the RTE Act 2009.
- Develop understanding on issues and concerns relating to secondary/sr. secondary education and implementation of the RMSA and other schemes.
- Understand school education in India with reference to global educational development and role of international organizations for promoting education.
- Formulate vision for school education on basis of new social order and technological advancement.

### Unit I - Education in India: Historical perspectives

- Education during Vedic and Post Vedic period and its relevance to present education.
- Educational development in the Pre-independence period: Macaulay's Minutes, Wood's Despatch, Hunter Commission, Wardha Scheme of Basic Education, Sargent Report.
- Bengal Renaissance: Concept, causes and its impact on education; contribution of Raja Rammohan Roy, Derozio and Vidyasagar in Education.
- Education and Constitution a) Preamble and various Articles on Education in Indian Constitution.
- Educational development in Post-Independence Period: Recommendations of University Education Commission (1948), Secondary Education Commission (1952), Education Commission (1964-66), NPE 1968, NPE 1986/1992 with reference to school education.

### Unit II: Elementary Education: Concerns and Issues

- Universalization of Elementary Education: Concept, need and dimensions.

- Policy and programmes for Universalisation of Elementary Education (UEE): DPEP, SSA, RTE Act 2009.
- Educational policies regarding Elementary Education in Five year Plans.
- Issues of quality in elementary education and strategies.

### Unit-III: Secondary and Higher Secondary Education: Concerns and Issues

- Secondary Education: Concept, need and importance.
- Policy and programmes for development of Secondary and Higher Secondary Education: RMSA, ICT @ School, RashtriyaAvishkarAbhiyan.
- Issues of quality in Secondary and Higher Secondary education and strategies.
- Vocationalisation of Higher Secondary Education: Policy Initiatives, Programmes and strategies.

### Unit-IV: Global Perspectives in School Education

- International Commissions on Education: Learning to Be (1975); Learning: The Treasure Within (1996) with reference to aims of education, learning society and life long education.
- Role of International Agencies for development of education: UNICEF, World Bank, UNESCO.
- Global Monitoring Report on Millennium Development Goals (MDG) and Sustainable Development Goals (SDG) 2015.

## Unit V: Meeting the Emerging Challenges in School Education

- Changing Trends in socio-cultural, political and economic scenario: Their bearings on School Education.
- Emerging challenges in School organisation, Curricular Procsses, Learning Climate.
- Addressing Challenges ina) School Organisation (Physical Space and Personnel Management,Client Relationships in terms of management); b) CurricularProcesses(CurriculumTransaction,Contextualisation,Assesment); c) Learning climate(Resource utilisation, Teacher -Learner relationship,Peer relationships etc.).

## Suggested Activities:

- Prepare report on relevance of Vedic/ Buddhist/ Islamic educational ideas for present school education by studying original literature.
- Conduct surveys in the local area for examining status of implementations of the RTE Act 2009
- Visit five secondary schools nearby and prepare report on quality of teaching and learning as the RMSA guidelines.
- Read any educational project sponsored by the UNESCO and present to the class
- Study writings on analysis of education-development from news papers and make presentations

## Suggested Readings:

- Arial, J.C. &Agrawal S.P. (1992).Role of UNESCO in Educational, Vikas Publishing House, Delhi.
- Anand, C.L. et.al. (1983). Teacher and Education in Emerging in Indian Society, NCERT, New Delhi.
- Govt. of India (1986). National Policy on Education, Min. of HRD, New Delhi.
- Govt. of India (1992).Programme of Action (NPE).Min of HRD.
- Mani, R.S. (1964). Educational Ideas and Ideals of Gandhi and Tagore, New Book Society, New Delhi.

- Mistry, S.P. (1986).Non-formal Education-An Approach to Education for All, Publication, New Delhi.
- Mohanty, J., (1986). School Education in Emerging Society, sterling Publishers.
- Mukherji, S.M., (1966). History of Education in India, Acharya Book Depot, Baroda.
- Naik, J.P. & Syed, N., (1974). A Student's History of Education in India, MacMillan, New Delhi.
- NCERT (1986). School Education in India – Present Status and Future Needs, New Delhi.
- Ozial, A.O. 'Hand Book of School Administration and Management', London, Macmillan.
- RadhaKumudMookerji.Ancient Indian Education (Brahmanical and Buddhist), Cosmo Publications, New Delhi – 1999.

- Sainath P. (1996). Every body loves a good drought. Penguin Books New Delhi.
- Salamatullah, (1979).Education in Social context, NCERT, New Delhi.
- Sykes, Marjorie (1988): The Story of NaiTalim, NaitalimSamiti: Wardha.
- UNESCO; (1997).Learning the Treasure Within.
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- *Learning without Burden,* Report of the National Advisory Committee.Education Act. Ministry of HRD, Department of Education, October, 2004.
- *National Policy on Education. 1986.* Ministry of HRD, Department of Education, New Delhi.
- Seventh All India School Education Survey, NCERT: New Delhi. 2002
- UNDPA.*Human Development Reports.* New Delhi. Oxford: Oxford University Press.
- UNESCO. (2004) *Education for All: The Quality Imperative. EFA Global Monitoring Report.* Paris.
- Varghese, N.V. (1995). *School Effects on Achievement: A Study of Government and Private Aided Schools in Kerala.* In Kuldip Kumar (Ed.) School effectiveness and learning achievement at primary stage: International perspectives. NCERT. New Delhi.
- World Bank, (2004).*Reaching The Child: An Integrated Approach to Child Development.* Oxford University Press, Delhi.

**EPC 5: Guidance and Counselling**

| Semester-VIII | Credits-2 |
|---|---|
| Total Marks: 50 | Contact Hours: |
| (Internal: 15, External: 35) | 2 hours per week |

**Introduction**

We are social beings and therefore in some way or other we need the help and guidance of others. Due to explosion of knowledge, industrialization and changes in socio-economic set up the need of professional guidance is felt in the present day society. Teachers play vital role in this regard to guide the youngsters for successful living both in school and society. Therefore, the teachers need a basic knowledge of school guidance and counseling techniques to address the personal and social problems of the

students that may be encountered in the classroom. This course will help the student teacher to understand the role of guidance and counselling system in supporting the students in addressing their future and social challenges.

This course provides opportunity to the student teachers to increase their ability and master the basic skills of school guidance and counseling by practicing these skills during their sessions.

**Objectives**

The student teachers will be able to:

- Understand guidance and counselling in details
- Understand the mental health
- Develop the knowledge about adjustment and maladjustment.
- Acquire skill to develop tools and techniques.
- Understand the idea about Abnormal Behaviour and Mental illness.

**Unit I: Overview of Guidance and Counselling:**

- Definition & Functions
- Nature & Scope of Guidance and Counselling
- Difference between Guidance & Counselling
- Types of guidance and counselling
- Career& Vocational guidance
- Quality of a good counsellor

**Unit II: Mental Health:**

- Concept
- Characteristics
- Role of home & School
- Mental health of a teacher

**Unit III: Adjustment & Maladjustment:**

- Concept
- Purpose
- Techniques
- Criteria of good adjustment
- Causes, Prevention &Remedies of Maladjustment
- Maladjusted behaviours:

Truancy,Lying,Timidity,Stealing,Anxiety,Phobia,Hysteria,OCD,Depression, Suicidal tendency, Substance Abuse Disorder, Anti-social Behaviour.

### Unit IV: Tools &Techniques:
- Concept of Testing & Non-testing tools.
- Tests to measure-Personality, Attitude, Aptitude, Interest, Intelligence, Case study, Questionnaire, Opinionnaire, Interview, Observation, ARC & CRC.

### Unit V: Abnormal Behavior and Mental illness:
- Meaning & Concept of normality and abnormality
- Casual factors of Abnormal Behaviour – Biological & Psychological.
- Classification of mental illness(DSM-IV)

### Mode of Transaction:
Group discussion, Lecture-cum –discussion, pair and share, group work, Panel discussion, Symposium, assignments, School visits and sharing of experiences

### Suggested Activities:
### Project on:
Maladjusted behaviour (any one; on the basis of case study)- Truancy,Lying,Timidity,Stealing,Anxiety,Phobia,Hysteria,OCD,Depression,Suicidal tendency, Substance Abuse Disorder, Anti-social Behaviour.

### Suggested Readings:
- 1.Agrawal,R.(2010). Guidance and counselling. New Delhi : Shipra Publications.
- Ghosh,S.K. (2012). Sikshay sangati apasangati o nirdesana. Kolkata : Classique Books.
- Gibson,R.L&Mitchel, M. H. (2006). Introduction to counselling and guidance. New Delhi: Pearson,PrenticeHall.
- Nag,S&Dutt,G. (2014).Sangatibidhane paramarshadan onirdashana. Kolkata : Rita Book Agency.
- Pal,A.K.(2013). Guidance and counseling. New Delhi : AbhijeetPublications.
- Pal,D. (2014). Sikshay-brittite nirdeshana o paramarshadan. Kolkata
- : RitaPublications.
- Shrivastava,K.K. (2007). Principles of guidance and counseling. New Delhi : Kanishka Publishers Distributors.
- Nag, S. (2015). Guidance and counseling. Kolkata:Rita Publications.
- Mondal (2011). Nirdeshana O Poramorshodaner Ruparekha. Rita.

### EPC 6: Physical Education, Yoga and Health

| Semester-VIII | Credits-2 |
|---|---|
| Total Marks: 50 | Contact Hours: |
| (Internal: 15, External: 35) | 2 hours per week |

### Introduction:

The 'Global Recommendations on Physical Activity for Health' adopted by the WHO in 2010 focuses on primary prevention of Non-Communicable Diseases (NCDs) through Physical activity. In this 21st century, insufficient Physical activity is one of the leading risk factors for death worldwide. Health is a multidimensional concept and is influenced by biological, physical, psychological, social, economic, cultural and political factors. Physical Education has the potential to cover all these factors. The focus of this subject will be to educate the student teachers about the contribution of Physical Education, Yoga and Sports activities so that they can develop a positive attitude towards a healthy life-style through participation in Physical activities including Yoga and Sports and games to ensure, maintain and promote health and wellbeing throughout life.

### Objectives:

The course will enable the student teachers to:

- Understand the role and the benefits of physical activity, Yoga and Sports and games in healthy living.
- Understand the holistic concept of health.
- Develop positive attitude towards participation on a regular basis in Physical activity, Yoga and Sports and games to maintain and promote health.
- Know rules of First-Aid and Safety measures.
- Understand the process of evaluating Physical fitness, Sports skills and health.

### Unit I: Physical Education

- Basic concept, Meaning and definition of Physical Education; Its aim & objectives.
- Need & importance of physical education; Physical Education as an integral part of education;its relation with play, games & sports; Physical education activities for the growing ups as well for the grownups.
- Olympic Movements and various awards in the field of Sports in India.
- General concept of the effects of exercise and training.
- Physical fitness: Concept, components, development, strength, endurance and flexibility; Fitness tests; General physical fitness exercises.
- Play, games & sports as man's cultural heritage; Indigenous and self-defense activities; Formal activities, gymnastics and their impact on health; Minor games and Recreative activities.
- Fundamental skills of Athletics; Major Games.
- First Aid and Sports Injury management: Definition and principles of First Aid; Golden rules of First Aid; Different types of Wounds and Fracture, Sprain, Fracture, Muscle pull, Cramps, Dislocation, Bleeding-concept and their First Aid management; Artificial respiration and its various methods; Safety – at home, school, road & playground.

## Unit II: Yoga

- History of Yoga and Principles of Yogic Practices.
- Concept of Patanjali Yoga and Hatha Yoga.
- Technique of Kriya, Suryanamaskar andasana.
  - Kriya - Kapalbhati and Agnisara (Ref. Book: Asana Why and How-Swami Kuvalyananda).
  - Suryanamaskar (Ref. Book: Suryanamaskar, Bihar School of Yoga)
- Asanas: A. Meditative Posture
  - Padmasana, Bajrasana and Sukhasana.

  B.Cultural Posture
  - Supine– Pawanmuktasana, Uthitapadasana, Halasana.
  - Prone– Bhujangasana, Salvasana, Dhanurasana and Swarbangasaga.
  - Sitting– Usthrasana, Yoga mudrassana, Ardhamatsendrasana, Pachimothasana.
  - Standing– Tarasana, Padmasana, and Trikonasana.

  C.Relaxative Posture
  - Dandasana, Savasanaand Niralambasana.
- Methods of pranayama and its benefits: Suryabhedana, Chandrabhedana and Anulomevilome(Ref. Book for Asana: Asana why and how-Swami Kuvalyananda; Asana, Pranayama, Mudra and Bhandha-Swami SatyanandaSwraswati).
- Technique of Meditation (BasishthaSanghita).

## UnitIII: Health and Health Education

- Concept of health, Factors influencing health, importance, dimensions (physical, mental & social dimension) and determinants of health; Health needs of children and adolescents including differently-abled children.
- Management of stress and strain and life skills.
- Food and nutrition, food habits, timing of food, nutrients and their functions, diversity of Indian food, seasonal foods and festivals, economics of food, malnutrition, obesity.
- Dietary requirements of human body with special emphasis on the nutritional needs according to age, sex, occupation, pregnancy and also with reference to sports-personship; need for diet planning;Balanced diet.
- Concept and calculation of BMI.
- Hygiene: Personal Hygiene & its care and maintenance, Hygienic living
- Drug abuse: Alcohol and tobacco; adverse effects on performance & health.
- Harmful Effect of Communication Technologies: Mobile Phone, Internet etc.

## Suggested Activities:

- Project work on any Standard Athletic Meet or Tournament.
- Activities for development of physical fitness, i.e. strength, speed, endurance, flexibility Fundamental Sports Skills; Basics of track and field (Running, Jumping & Throwing in Athletics. Basic techniques of any two team games (Kabaddi / Kho-Kho, Basketball /Cricket, Hockey/ Volleyball / Football / Badminton / Throwball).
- Learning and performing of basic yogic activities, asanas and pranayam, Surya Namaskar and Meditation.

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**Guidelines for Assessment:**

| Sl. No. | Activities | Marks |
|---------|-----------|-------|
| 1 | **Practical Exam- I** - Physical fitness activity (Any Youth Fitness Test) | 10 |
| 2 | **Practical Exam –II-** Skill test on Major games, Athletics, yoga. | 15 |
| 3 | Written test | 20 |
| 4 | Project work on any Standard Athletic Meet or Tournament. | 05 |
| Total | | 50 |

**Suggested Readings:**

**Health Education:**

- K. Park, "Preventive and Social Medicine" BanarsidasBhanoth, Publishers Nagpur Road, Jabalpur, India.
- NCERT (2013). Training and resource materials on Adolescence Education, NCERT, New Delhi (This material is also available on www.aeparc.org.www.ncert.nic.in).
- NCERT (2014). Population Education: Source Material, NCERT, New Delhi.
- Stephen J. Williams, Paul R. Torrens, "Introduction to Health Service, Delmore Publications.

**Physical Education:**

- SarirSiksha, West Bengal State Book Board.
- Essential of Physical Education, Dr. M.L.Kamlesh
- Deborah A. Wuest, Charles A. Bucher, "Foundation of Physical Education Exercise Science and Sports" Tata McGraw Hill, Pvt. Ltd., New Delhi.
- John E. Mixton, Ann E. Jewett, "An Introduction to Physical Education, W.B. Saunders Company, London.
- John Cheffers, Tom Evaul, "Introduction to Physical Education-Concept of Human Movement Prentice Hall Engle Wood" New Jersy.
- Bette J., Logdson& Others, "Physical Education for Children", Lea &Febiger, Philadelphia.
- Roberts S. Weinberg & Daniel Gould, "Foundation of Sports and Exercise Psychology", Human Kinetics Publication.
- Jack H. Wilmore, David L. Costill, W. Larry Kenney, "Physiology of Sports and Exercise" Human Kinetics Publication.

**Yoga:**

- Swami SatyanandSaraswati, "Asana Pranayama Mudra Bandh", Bihar School of Yoga, Munger.
- M.M. Ghore, "Anotomy and Physiology of Yogic Practices" Lonavala Yoga Institute, Lonavala.
- Gharote M.L. (2004). Applied Yoga, Kaivalyadhama S.M.Y.M. Samiti, Lonvala.
- "Yogasana" Morarji Desai National Institute of Yoga, New Delhi.
- "Pranayama" Morarji Desai National Institute of Yoga, New Delhi.
- MDNIY (2010). "Yoga Teachers Manual for School Teachers, New Delhi.
- NCERT (2015). Yoga: A Healthy Way of Living Upper Primary Stage, New Delhi.
- NCERT (2015). Yoga: A Healthy Way of Living Secondary Stage, New Delhi.

## Requirements for effective curricular transactions:

1. Physical education and Sports activities be practiced in each Semester.
2. Examination / evaluation be conducted as per proposed semester.
3. Infrastructure as :
   - Separate Class rooms (minimum two) for the theory classes.
   - A space in the field where minimum 200 m track be laid out.
   - A Common hall (multipurpose facilities) for physical activity where minimum 100 students can practice at a time.
   - A multygym (minimum 16 stations) facility.
   - Minimum 12 Balls for each game and other equipment as required.
   - Facilities for conducting Yogic practices (Room, Mats etc.).
4. Separate Sports and equipment store room required.
5. Qualified Physical Education personnel will be required for curriculum transaction (at least two).
6. Books: Sufficient reference books to be preserved.
7. A laboratory for measurement and evaluation is required.

### EPC 7: Reading and Reflecting on Texts

| Semester-VIII | Credits-2 |
|---|---|
| Total Marks: 50 | Contact Hours: |
| (Internal: 15, External: 35) | 2 hours per week |

### Introduction

A number of studies have shown that the teachers as well as student teachers do not read books other than the textbooks they have to teach or the books related to the syllabi of the course they are pursuing. As the goal of any teacher education programme is to prepare teachers as reflective practitioners, one of the strategies to achieve this goal could be to provide opportunities to the student teachers to read the given texts and then to critically examine the ideas presented in the texts and organize debates/discussions around the 'ideas'. The given texts could be excerpts from short stories, novels, biographies, autobiographies, literary essays or educational, philosophical, psychological and sociological texts. The Teacher Education Institutions offering the B.Ed. programme can select 10-15 books available in their library for teaching the course in the light of its objectives listed below. The course shall be based on the use of multiple texts which address issues of multiculturalism, gender racism and texts which relate with current issues and contemporary trends. The literary, educational and scientific texts shall also form part of the course.

### Objectives

The course will enable the student teachers to:

- Understand the meaning, process, importance and characteristics of reading.
- Understand and apply different levels, types, techniques and methods of reading.
- Acquaint with the skills of reading different types of texts.
- Develop different types of reading skills through various activities and meta-cognition
- Learn the skills of reading comprehension and to enhance vocabulary.
- Acquaint with the problems of reading across curriculum.

### Unit I: Introduction to Reading and Reading Skills:

- Reading: Meaning and Process.
- Importance of Reading across Curriculum.
- Characteristics of Reading.
- Levels of Reading: literal, interpretative, critical and creative.
- Types of Reading: intensive and extensive reading, oraland silent Reading.
- Reading Techniques: Skimming and Scanning.

### Unit II: Reading the Text and Developing Reading Skills:

- Types of Texts: Narrative, expository, descriptive, suggestive, empirical, conceptual, ethnography, policy documents, field notes.
- Importance of Different Texts in Curriculum.
- Developing Critical Reading Skills.
- Developing Reflective Skills.
- Activities for Developing Reading Skills.
- Developing Metacognition for Reading.

## Unit III: Reading Comprehension:

- Developing Reading Comprehension.
- Developing Vocabulary for Reading.
- Problems of Reading.

**Mode of Transaction:**Lecture, Discussion, Exercises, Games, round table study circle, Reflective questioning, Creative literary activities, journaling, writing diary etc.

### Guidelines for Assessment

| Sl. No. | Activity | Marks |
|---------|----------|-------|
| 1 | Narrating any one story selected from Unit 1in own words; writing the summary of the story, extrapolation of the story; discussion on the ideas expressed | 10 |
| 2 | Converting any one situation from the text specified under Unit 1 into a dialogue followed by role-playing | 10 |
| 3 | Interpretation of the text, reflecting on the key ideas exposed in the texts specified under Unit 2 and preparing a write up based on any one text | 10 |
| 4 | Reflection on the ideas expressed in the selected essays/ excerpts specified under Unit 3 | 10 |
| 5 | Seminars and open forum for discussion based on themes related to selected texts from Unit 3 | 10 |
| Total | | 50 |

## FE 3: WORKING WITH COMMUNITY

| Semester-VIII | Credits-2 |
|---|---|
| Total Marks: 50 | Contact Hours: |
| (Internal: 15, External: 35) | 2 hours per week |

### Introduction:

School is a miniature community and a big gap is found between school and community. Mutual exchange and sharing of resources and facilities between the two is essential for national development. The student teachers need to have knowledge and awareness about the community and neighbourhood and the relationship between school and community. Considering the value of relationship between school and community and the facilitating role of teachers in this the B.Ed. curriculum has provision for fieldwork with community. The programme aims at enhancing their ability to enlist community support for School and contribute for national development. The programmes aim at acquainting them with social realities, developing dignity of labour among them and prepare them for sustainable development.

### Objectives:

The course will enable the student teachers to:

- Acquaint the student teachers with the factors working within the society, community i.e. knowledge of social realities
- Develop the dignity of labour among student – teachers
- Arouse their interest in the social and economic reconstruction of the country
- Make the student-teacher aware with the educational problems and needs of the society
- Prepare youth for sustainable development
- Develop the personality of the student-teacher through community service

Student teachers shall be provided exposure to community life for at least one week during which they shall live with the community members and act in terms of preparing school development plan, sharing cultural practices, holding cultural programmes and gaining community's perception about and aspirations from formal education system. The members of SMC/VMC should be associated in these activities.

The institution will form a committee, including faculty members, student teachers and community/SMC members for the smooth organization of this programme. The student

teachers shall prepare a detailed report of the programme, individually and/or in group during the activity and submit at the end of the programme.

### Transaction Mode:

Discussion, Rally, Competitions (Debates) Posters and Banner displays Working in community setting, Mass movement, *Nukkad*Performances, Local action group formation, surveys, interviews, action research, case study, dissemination of success stories etc.

**Suggested Activities**

1. Micro planning of a school community relationship
2. Study of the nature of community participation in a secondary school
3. Survey of community resources for participation in scholastic and co-scholastic activities of a school educational survey of a slum area
4. Report on social customs, traditions and superstition
5. Survey of a village/town with at least 20 households in order to study the socio-economic and educational status of the villager
6. Study of wastage and stagnation in local primary schools
7. Study of an area in regard to consumption of electricity and water and suggest remedial measures
8. Tree plantation programme in the campus/nearby village
9. Survey of parent's attitude towards education of their children
10. Organization of non-formal education centers for dropouts and out of school children in a locality
11. Organization of campus beautification programme
12. Identification of problems of parents with respect to education of their children
13. Aids awareness, electoral awareness, road safety, human rights, women rights etc. literacy programmes in the community
14. Cleanliness drives in the community and awareness about its needs
15. Developing healthy food habits among the community members
16. Training of community in some simple vocations for self-employment
17. Action research on local problems in consultation with the community
18. Micro – planning exercises for assessing the educational status of the community
19. Establishment of peace-committees and making them functional effectively
20. Critical review of implementation of rte act (2009).
21. Assistance and working with local community in actual relief work whenever needed
22. Training of community in first aid
23. Exploiting the community resources and finding means and ways of using them for school

Many more such exercises could be conceived. Any such activities could be planned at the institutional level and executed. It is suggested that these activities may be conducted individually or collectively under the supervision of teacher education.