

# SCHEME & SYLLABUS

## Bachelor in Medical

(Choice Based Credit System)



Department of Life Sciences and Allied Health Sciences  
(UISH)

Sant Baba Bhag Singh University  
2020

## **ABOUT THE DEPARTMENT**

The department of Life Sciences formerly known as the Department of Natural Sciences was established in the year 2015 with only two UG programmes. Over the years this department has flourished and is offering various Programmes and courses at graduate, post-graduate and doctorate level in field of Botany, Zoology, Biotechnology, Biochemistry, Microbiology and Laboratory Sciences. The department is nurtured by the highly qualified and dedicated Faculty, honoured by various international and national awards. The department is blessed to have specialized faculties in various fields of Life Sciences viz. Plant physiology, Plant Biochemistry, Plant Microbe interaction, Stress Physiology, Chemical ecology, Microbial Physiology, Industrial Microbiology, Clinical microbiology, Microbial Biotechnology, Animal Biotechnology, Fisheries, Parasitology, Molecular biology, Entomology, Sericulture, Animal toxicology, Endocrinology, Biochemistry and Biodiversity.

## **SALIENT FEATURES OF THE DEPARTMENT**

1. At SBBS University the focus of Department is on conducting innovative teaching, fundamental multidisciplinary research in life sciences.
2. The department is disseminating various educational missions via e-learning platform in the form of SWAYAM, Virtual lab etc.
3. The department is equipped with a number of instruments and facilities like, UV- Visible Spectrophotometer, High Speed Centrifuge, Deep Freezer, Laminar Air flow, Air Samplers, Autoclave, Incubator, Photo actometer, Air condition Labs, WiFi, Library etc.
4. The department has organized a large number of conferences, seminars, symposia and workshops. National and International eminent scientists of the country have been associated with the Department as visiting and honorary professors.

## **B.Sc. in Medical (Bachelor of Science in Medical)**

### **VISION**

Empower every student to be innovative, creative and acquire skills in the field of Life Sciences. The Department aspires to attain distinction in providing cutting edge learning experience, intellectual freedom, and critical research opportunities in order to become first choice of students and researchers.

### **MISSION**

- To provide a high-quality education to under graduates.
- To build public understanding of the living world through educational outreach activities.
- To produce trained learners, to face the challenges of the scientific world with a global perspective.

### **ELIGIBILITY CRITERIA**

10+2 or its equivalent examination in any stream conducted by a recognized Board/University/Council

### **DURATION**

3 Years

### **CAREER PATHWAYS**

The program is designed to meet the growing requirement of qualified professionals in field of IT industry and education. B.Sc. graduates are hired both by Government and private organizations. They may join Post Graduation Courses further.

- Government Jobs: Prepare students for various government jobs such as banking sector, civil services etc.
- Higher Studies: This pathway prepares students for Higher Studies and helps in their research also.
- Entrepreneurship: To set up new ventures

### **PROGRAMME EDUCATIONAL OBJECTIVE (PEO)**

**PEO1.**To provides a hands-on experience of the latest techniques that are in current usage both in the advanced research laboratories and in Industry.

**PEO2.**To improve critical and analytical abilities.

**PEO3.**To inculcate scientific ideas in the students for new discoveries in the fields of the biological sciences.

**PEO4.**To facilitate higher education and professional skills amongst students

### **PROGRAMME OUTCOMES (PO)**

**PO1.**Apply the knowledge and skills appropriate to discipline for the advanced research.

**PO2.**Develop competency to think creatively, critically and objectively with core and inter-disciplinary excellence.

**PO3.**Have collaborative and multidisciplinary skills to work as an effective member or leader to achieve goals.

**PO4.**Be the government professionals, scientists, and mentors of the future.

### **PROGRAMME SPECIFIC OUTCOMES (PSO)**

**PSO1.**Graduates will be able to explain how organisms function at the level of gene, genetic data, cells, tissues, organ and organ system level..

**PSO2.**Graduates will be able to understand the physiological adaptations, development, reproduction and diversity of different forms of life.

**PSO3.**Graduates will understand the different morphological features of animals & plants. They will also understand the genetics and variations of different organisms.

**PSO4.**Graduates will be able to understand chemical nomenclature,classification, structure and reactivity of organic and inorganic matter

## ABOUT THE CHOICE BASED CREDIT SYSTEM (CBCS)

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill based courses. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. The basic idea is to look into the needs of the students so as to keep up-to-date with development of higher education in India and abroad. CBCS aims to redefine the curriculum keeping pace with the liberalization and globalization in education. CBCS allows students an easy mode of mobility to various educational institutions spread across the world along with the facility of transfer of credits earned by students.

**1. Curriculum Structure:** BCA degree programme will have a curriculum with Syllabus consisting of following type of courses:

**I. Ability Enhancement Courses (AEC):** The Ability Enhancement Courses (AEC) may be of two kinds: Ability Enhancement Compulsory Courses (AECC) and Skill Enhancement Courses (SEC). AECC courses are the courses based upon the content that leads to Knowledge enhancement; these are mandatory for all disciplines.

SEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.

A. Ability Enhancement Compulsory Courses (AECC):  
Environmental Science, English Communication/MIL Communication.

B. Skill Enhancement Courses (SEC): These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based knowledge.

**II. Core Courses (CR):** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course. These courses are employability enhancement courses relevant to the chosen program of study. Program core comprises of Theory, Practical, Project, Seminar etc. Project work is considered as a special course involving application of knowledge in solving/ analyzing/ exploring a real life situation/ difficult problem.

**III. Elective Courses:** Elective course is generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill. Accordingly, elective course may be categorized as:

- A. Discipline Specific Elective (DSE) Course: Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective.
- B. Project (I): An elective course designed to acquire special/advanced knowledge, such as supplement study/support study to a project work, and a candidate studies such a course on his own with an advisory support by a teacher/faculty member is called dissertation/project.

## 2. NOMENCLATURE USED:

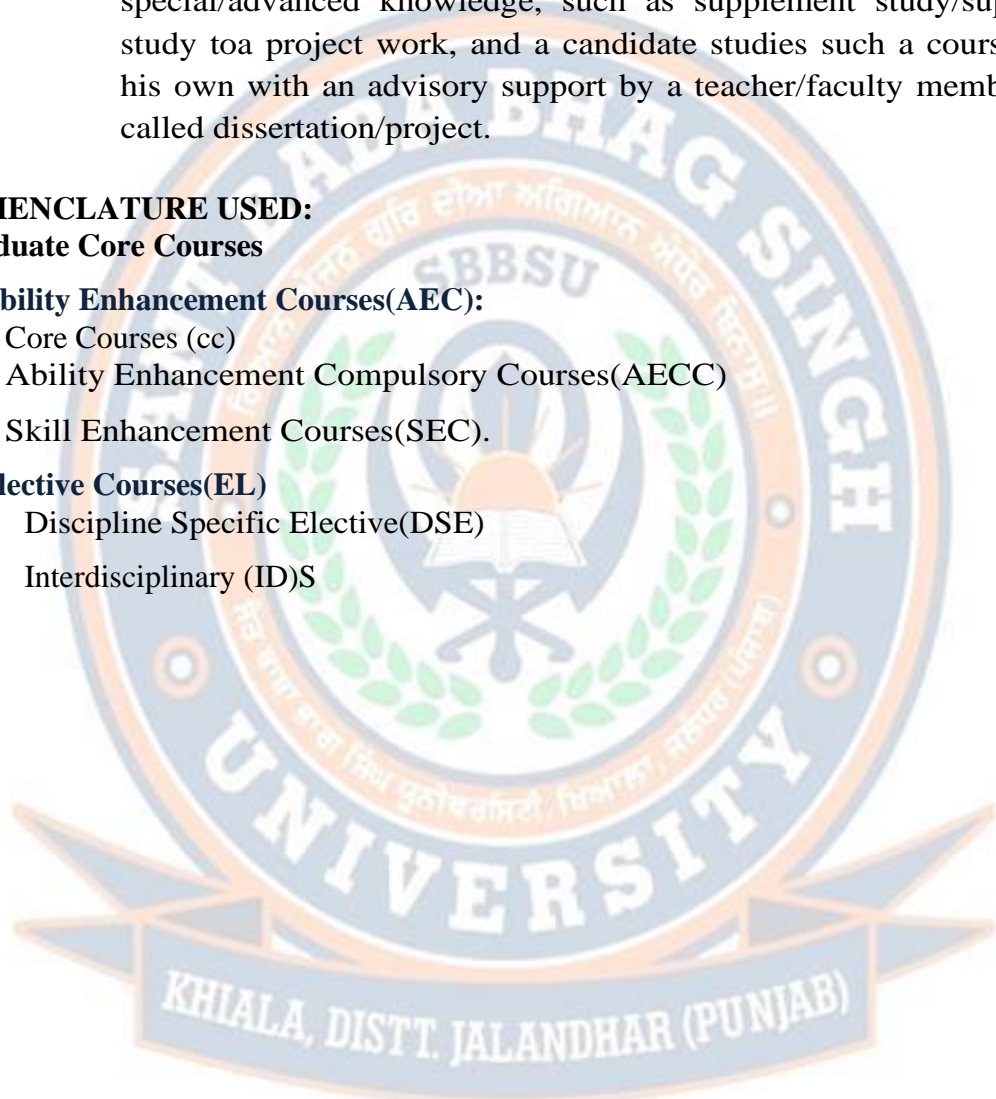
### A. Graduate Core Courses

#### A. Ability Enhancement Courses(AEC):

- i. Core Courses (cc)
- ii. Ability Enhancement Compulsory Courses(AECC)
- iii. Skill Enhancement Courses(SEC).

#### B. Elective Courses(EL)

- i. Discipline Specific Elective(DSE)
- ii. Interdisciplinary (ID)S



## Index

| S.No | Subject Code | Subject Name ( Scheme)  | Semester(I-VI) | Page No |
|------|--------------|---|----------------|---------|
|      | BOT101       | Plant Biodiversity  | 1              | 15-16   |
| 2.   | CHM101       | Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons | 1              | 16-18   |
| 3.   | ZOO101       | Animal Biodiversity   | 1              | 18-19   |
| 4.   | ENG101       | General English-I   | 1              | 19-21   |
| 5.   | PBI101       | General Punjabi-I   | 1              | 21-22   |
| 6.   | HCP101       | History and Culture of Punjab-I   |                | 23-24   |
| 7.   | BOT103       | Plant Biodiversity Practical  | 1              | 24-25   |
| 8.   | ZOO103       | Animal Biodiversity Practical   | 1              | 25-26   |
| 9.   | BOT102-      | Plant Ecology and Taxonomy  | 2              | 26-28   |
| 10.  | CHM102       | Chemical Energetics, Equilibria & Functional Groups Organic Chemistry-I       | 2              | 28-30   |
| 11.  | ZOO102       | Comparative Anatomy and Developmental Biology of Vertebrates                  | 2              | 30-31   |
| 12.  | ENG102       | General English-II  | 2              | 31-32   |
| 13.  | PBI102       | General Punjabi-II  | 2              | 32-33   |
| 14.  | HCP102       | History and Culture of Punjab-I   | 2              | 33-34   |
| 15.  | BOT104       | Plant Ecology and Taxonomy Practical  | 2              | 34-36   |
| 16.  | CHM104       | Chemical Energetics, Equilibrium & Functional Group Organic Chemistry-I Lab   | 2              | 36-37   |
| 17.  | ZOO104       | Comparative Anatomy and Developmental Biology of Vertebrates Practical        | 2              | 37-38   |
| 18.  | BOT201       | Anatomy and Embryology of Angiosperms   | 3              | 38-39   |

|     |        |   |   |       |
|-----|--------|---|---|-------|
| 19. | CHM201 | Solutions, Phase equilibrium, Conductance, Electrochemistry & Functional Group Organic Chemistry-II | 3 | 39-41 |
| 20. | ZOO201 | Animal Physiology and Biochemistry  | 3 | 41-42 |
| 21. | EVS001 | Environmental Science   | 3 | 43-44 |
| 22. | BOT203 | Anatomy and Embryology of Angiosperms Practical   | 3 | 44-45 |
| 23. | CHM203 | Solutions, Phase equilibrium, Conductance, Electrochemistry & Functional Group Organic y-II Lab     | 3 | 45-46 |
| 24. | ZOO203 | Animal Physiology and Biochemistry Practical  | 3 | 47    |
| 25. | BOT202 | Plant Physiology and Metabolism   | 4 | 48-49 |
| 26. | CHM202 | Coordination Chemistry, States of Matter & Chemical Kinetics  | 4 | 49-51 |
| 27. | ZOO202 | Genetics and Evolutionary Biology   | 4 | 51-52 |
| 28. | BOT204 | Plant Physiology and Metabolism Practical   | 4 | 52-53 |
| 29. | CHM204 | Coordination Chemistry, States of Matter & Chemical Kinetics Lab                                    | 4 | 53-54 |
| 30. | ZOO204 | Genetics and Evolutionary Biology Practical   | 4 | 55    |

### Skill Enhancement Courses (SEC)

| S.N. | Subject Name               | Subject Code | Semester     | Page Num. |
|------|----------------------------|--------------|--------------|-----------|
| 1.   | Medicinal Botany           | BOT 205      | Semester-III | 57        |
| 2.   | Medical Diagnostics        | ZOO205       | Semester-III | 58        |
| 3.   | Basic Analytical Chemistry | CHM 209      | Semester-III | 59-60     |
| 4.   | Floriculture               | BOT 206      | Semester-IV  | 60-61     |
| 5.   | Green Methods in Chemistry | CHM 210      | Semester-IV  | 61-62     |

|     |                                |         |             |       |
|-----|--------------------------------|---------|-------------|-------|
| 6.  | Ethnobotany                    | BOT 206 | Semester-IV | 62-63 |
| 7.  | Apiculture & Sericulture       | ZOO315  | Semester-V  | 63-64 |
| 8.  | Aquatic Biology                | ZOO 317 | Semester-V  | 64-65 |
| 9.  | Fuel Chemistry                 | CHM 313 | Semester-V  | 65-66 |
| 10. | Mushroom Culture<br>Technology | BOT 310 | Semester-VI | 67    |
| 11. | Aquarium Fish Keeping          | ZOO 314 | Semester-VI | 68    |
| 12. | Pharmaceutical Chemistry       | CHM 318 | Semester-VI | 68-69 |

### **Discipline Elective Courses (DSE)**

**(Semester- V-VI)**

**Any two of each subject in both semesters**

| <b>S.N.</b> | <b>Subject Name</b>  | <b>Subject Code</b> | <b>Semester</b> | <b>Page Num.</b> |
|-------------|--|---------------------|-----------------|------------------|
| 1.          | Cell and Molecular Biology   | BOT301              | Semester-V      | 71               |
| 2.          | Cell and Molecular Biology<br>Practical                                  | BOT303              | Semester-V      | 72               |
| 3.          | Analytical Techniques in<br>Plant Sciences                               | BOT305              | Semester-V      | 73               |
| 4.          | Analytical Techniques in<br>Plant Sciences Practical                     | BOT307              | Semester-V      | 74               |
| 5.          | Cell Biology,<br>Biotechnology, and<br>Reproductive biology              | ZOO301              | Semester-V      | 75-76            |
| 6.          | Cell Biology,<br>Biotechnology, and<br>Reproductive biology<br>Practical | ZOO303              | Semester-V      | 76               |
| 7.          | Applied Zoology  | ZOO305              | Semester-V      | 77               |

|     |   |        |             |       |
|-----|---|--------|-------------|-------|
| 8.  | Applied Zoology Practical   | ZOO307 | Semester-V  | 78    |
| 9.  | Aquatic Biology   | ZOO309 | Semester-V  | 79    |
| 10. | Aquatic Biology Practical   | ZOO311 | Semester-V  | 80    |
| 11. | Organometallics, bioinorganic chemistry, polynuclear hydrocarbons and uv, irspectroscop           | CHM305 | Semester-V  | 81-82 |
| 12. | Organometallics, bioinorganic chemistry, polynuclear hydrocarbons and uv, irspectroscopyPractical | CHM307 | Semester-V  | 83    |
| 13. | Industrial chemical and environment   | CHM309 | Semester-V  | 84-85 |
| 14. | Industrial chemical and environment practical   | CHM311 | Semester-V  | 86-87 |
| 15. | Green Chemistry   | CHM310 | Semester-VI | 87-89 |
| 16. | Green Chemistry Practical   | CHM312 | Semester-VI | 89-90 |
| 17. | Analytical Methods in Chemistry   | CHM314 | Semester-VI | 91-92 |
| 18. | Analytical Methods in Chemistry Practical   | CHM316 | Semester-VI | 93-94 |
| 19. | Chemistry of main group element, theories of acids and bases                                      | CHM306 | Semester-VI | 94-96 |
| 20. | Chemistry of main group element, theories of acids and bases practical                            | CHM308 | Semester-VI | 97    |
| 21. | Economic Botany and Biotechnology   | BOT302 | Semester-VI | 98    |

|     |   |         |             |         |
|-----|---|---------|-------------|---------|
| 22. | Economic Botany and Biotechnology Practical | BOT304  | Semester-VI | 99      |
| 23. | Bioinformatics                              | BOT 306 | Semester-VI | 100     |
| 24. | Bioinformatics Practical                    | BOT 308 | Semester-VI | 101     |
| 25. | Immunology and Biostatistics                | ZOO302  | Semester-VI | 102     |
| 26. | Immunology and Biostatistics Practical      | ZOO304  | Semester-VI | 103     |
| 27. | Reproductive Biology                        | ZOO306  | Semester-VI | 104     |
| 28. | Reproductive Biology Practical              | ZOO308  | Semester-VI | 105     |
| 29. | Insect, Vector and Diseases                 | ZOO310  | Semester-VI | 106     |
| 30. | Insect, Vector and Diseases Practical       | ZOO312  | Semester-VI | 107     |
| 31. | Instrumental methods of Chemical Analysis   | CHM326  | Semester-VI | 108-109 |
| 32. | Instrumental methods of Chemical Analysis   | CHM328  | Semester-VI | 109-110 |

- AECC refers to Ability Enhancement Compulsory Course
- SEC refers to Skill Enhancement Course
- DSE refers to Discipline Specific Elective
- PT Physical Training

## Course Scheme, B.Sc Medical

### SEMESTER I

#### I. Theory Subjects

| S. No. | Subject Code      | Subject Name  | Contact Hours (L:T:P) | Credits (L:T:P) | Total Contact Hours | Total Credit Hours | Type of course |
|--------|-------------------|---|-----------------------|-----------------|---------------------|--------------------|----------------|
| 1      | BOT101            | Plant Biodiversity  | 4:0:0                 | 4:0:0           | 4                   | 4                  | CC             |
| 2      | CHM101            | Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons | 4:0:0                 | 4:0:0           | 4                   | 4                  | CC             |
| 3      | ZOO101            | Animal Biodiversity   | 4:0:0                 | 4:0:0           | 4                   | 4                  | CC             |
| 4      | ENG101            | General English-I   | 3:0:0                 | 3:0:0           | 3                   | 3                  | AECC           |
| 5      | PBI101/<br>HCP101 | General Punjabi-I/History and Culture of Punjab                               | 3:0:0                 | 3:0:0           | 3                   | 3                  | AECC           |

#### II. Practical Subjects

| S. No | Subject Code      | Subject Name  | Contact Hours (L:T:P) | Credits (L:T:P) | Total Contact Hours | Total Credit Hours | Type of course |
|-------|-------------------|---|-----------------------|-----------------|---------------------|--------------------|----------------|
| 1     | BOT103            | Plant Biodiversity Practical  | 0:0:4                 | 0:0:2           | 4                   | 2                  | CC             |
| 2     | CHM103            | Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons Lab | 0:0:4                 | 0:0:2           | 4                   | 2                  | CC             |
| 3     | ZOO103            | Animal Biodiversity Practical   | 0:0:4                 | 0:0:2           | 4                   | 2                  | CC             |
| 4     | PT101/PT103/PT105 | Physical Training (NSO/NCC/NSS)   | 0:0:2                 | Non-credit      | 2                   | NC                 |                |

**CC: Core courses**

**AECC: Ability Enhancement Core Course**

**Total Contact hrs: 32**

**Total Credit Hours: 24**

## SEMESTER II

### I. Theory Subjects

| S. No. | Subject Code   | Subject Name  | Contact Hours (L:T:P) | Credits (L:T:P) | Total Contact Hours | Total Credit Hours | Type of course |
|--------|----------------|---|-----------------------|-----------------|---------------------|--------------------|----------------|
| 1      | BOT102         | Plant Ecology and Taxonomy  | 4:0:0                 | 4:0:0           | 4                   | 4                  | CC             |
| 2      | CHM102         | Chemical Energetics, Equilibria & Functional Groups Organic Chemistry-I | 4:0:0                 | 4:0:0           | 4                   | 4                  | CC             |
| 3      | ZOO102         | Comparative Anatomy and Developmental Biology of Vertebrates            | 4:0:0                 | 4:0:0           | 4                   | 4                  | CC             |
| 4      | ENG102         | General English-II  | 3:0:0                 | 3:0:0           | 3                   | 3                  | AECC           |
| 5      | PBI102/HCP 102 | General Punjabi-II/History and Culture of Punjab                        | 3:0:0                 | 3:0:0           | 3                   | 3                  | AECC           |

### II. Practical Subjects

| S. No | Subject Code       | Subject Name  | Contact Hours (L:T:P) | Credits (L:T:P) | Total Contact Hours | Total Credit Hours | Type of course |
|-------|--------------------|---|-----------------------|-----------------|---------------------|--------------------|----------------|
| 1     | BOT104             | Plant Ecology and Taxonomy Practical  | 0:0:4                 | 0:0:2           | 4                   | 2                  | CC             |
| 2     | CHM104             | Chemical Energetics, Equilibrium & Functional Group Organic Chemistry-I Lab | 0:0:4                 | 0:0:2           | 4                   | 2                  | CC             |
| 3     | ZOO104             | Comparative Anatomy and Dev. Bio of Vertebrates Practical                   | 0:0:4                 | 0:0:2           | 4                   | 2                  | CC             |
| 4     | PT102/PT10 4/PT106 | Physical Training (NSO/NCC/NSS)   | 0:0:2                 | Non-credit      | 2                   | NC                 | AECC           |

**CC: Core courses**

**AECC: Ability Enhancement Core Course**

**Total Contact hrs: 32**

**Total Credit Hours: 24**

### SEMESTER III

#### I. Theory Subjects

| S. No. | Subject Code | Subject Name  | Contact Hours (L:T:P) | Credits (L:T:P) | Total Contact Hours | Total Credit Hours | Type of course |
|--------|--------------|---|-----------------------|-----------------|---------------------|--------------------|----------------|
| 1      | BOT201       | Anatomy and Embryology of Angiosperms   | 4:0:0                 | 4:0:0           | 4                   | 4                  | CC             |
| 2      | CHM201       | Solutions, Phase equilibrium, Conductance, Electrochemistry & Functional Group Organic Chemistry-II | 4:0:0                 | 4:0:0           | 4                   | 4                  | CC             |
| 3      | ZOO201       | Animal Physiology and Biochemistry  | 4:0:0                 | 4:0:0           | 4                   | 4                  | CC             |
| 4      | EVS101       | Environmental Science   | 3:0:0                 | 3:0:0           | 3                   | 3                  | AECC           |
| 5      |              | Elective subject (Skill Enhancement)-I  | 2:0:0                 | 2:0:0           | 2                   | 2                  | SEC            |

#### II. Practical Subjects

| S. No | Subject Code | Subject Name  | Contact Hours (L:T:P) | Credits (L:T:P) | Total Contact Hours | Total Credit Hours | Type of course |
|-------|--------------|---|-----------------------|-----------------|---------------------|--------------------|----------------|
| 1     | BOT203       | Anatomy and Embryology of Angiosperms Practical   | 0:0:4                 | 0:0:2           | 4                   | 2                  | CC             |
| 2     | CHM203       | Solutions, Phase equilibrium, Conductance, Electrochemistry & Functional Group Organic y-II Lab | 0:0:4                 | 0:0:2           | 4                   | 2                  | CC             |
| 3     | ZOO203       | Animal Physiology and Biochemistry Practical  | 0:0:4                 | 0:0:2           | 4                   | 2                  | CC             |

**CC: Core courses**

**Total Contact hrs: 29**

**AECC: Ability Enhancement Core Course**

**Total Credit Hours: 23**

**SEC: Skill Enhancement Cours**

## SEMESTER IV

### I. Theory Subjects

| S. No. | Subject Code | Subject Name   | Contact Hours (L:T:P) | Credits (L:T:P) | Total Contact Hours | Total Credit Hours | Type of course |
|--------|--------------|--|-----------------------|-----------------|---------------------|--------------------|----------------|
| 1      | BOT202       | Plant Physiology and Metabolism                              | 4:0:0                 | 4:0:0           | 4                   | 4                  | CC             |
| 2      | CHM202       | Coordination Chemistry, States of Matter & Chemical Kinetics | 4:0:0                 | 4:0:0           | 4                   | 4                  | CC             |
| 3      | ZOO202       | Genetics and Evolutionary Biology                            | 4:0:0                 | 4:0:0           | 4                   | 4                  | CC             |
| 4      |              | Elective subject (Skill Enhancement)-II                      | 2:0:0                 | 2:0:0           | 2                   | 2                  | SEC            |

### II. Practical Subjects

| S. No | Subject Code | Subject Name   | Contact Hours (L:T:P) | Credits (L:T:P) | Total Contact Hours | Total Credit Hours | Type of course |
|-------|--------------|--|-----------------------|-----------------|---------------------|--------------------|----------------|
| 1     | BOT204       | Plant Physiology and Metabolism Practical                        | 0:0:4                 | 0:0:2           | 4                   | 2                  | CC             |
| 2     | CHM204       | Coordination Chemistry, States of Matter & Chemical Kinetics Lab | 0:0:4                 | 0:0:2           | 4                   | 2                  | CC             |
| 3     | ZOO204       | Genetics and Evolutionary Biology Practical                      | 0:0:4                 | 0:0:2           | 4                   | 2                  | CC             |

**CC:** Core courses

**AECC:** Ability Enhancement Core Course

**SEC:** Skill Enhancement Course

**Total Credit Hours: 20**

**Total Contact hrs: 26**

## SEMESTER V

### I. Theory Subjects

| S. No. | Subject Code | Subject Name                             | Contact Hours (L:T:P) | Credits (L:T:P) | Total Contact Hours | Total Credit Hours | Type of course |
|--------|--------------|--|-----------------------|-----------------|---------------------|--------------------|----------------|
| 1      | BOT          | Discipline Specific Elective-I           | 4:0:0                 | 4:0:0           | 4                   | 4                  | DSE            |
| 2      | CHM          | Discipline Specific Elective – I         | 4:0:0                 | 4:0:0           | 4                   | 4                  | DSE            |
| 3      | ZOO          | Discipline Specific Elective-I           | 4:0:0                 | 4:0:0           | 4                   | 4                  | DSE            |
| 4      |              | Elective subject (Skill Enhancement)-III | 2:0:0                 | 2:0:0           | 2                   | 2                  | SEC            |

### II. Practical Subjects

| S. No | Subject Code | Subject Name                             | Contact Hours (L:T:P) | Credits (L:T:P) | Total Contact Hours | Total Credit Hours | Type of course |
|-------|--------------|--|-----------------------|-----------------|---------------------|--------------------|----------------|
| 1     | BOT          | Discipline Specific Elective-I Practical | 0:0:4                 | 0:0:2           | 4                   | 2                  | DSE            |
| 2     | CHM          | Elective Subject(Discipline)Lab-I        | 0:0:4                 | 0:0:2           | 4                   | 2                  | DSE            |
| 3     | ZOO          | Discipline Specific Elective-I Practical | 0:0:4                 | 0:0:2           | 4                   | 2                  | DSE            |

**DSE: Discipline Specific Elective**

**SEC: Skill Enhancement Courses**

**Total Contact hrs: 26**  
**Total Credit Hours: 20**

## SEMESTER VI

### I. Theory Subjects

| S. No. | Subject Code | Subject Name                            | Contact Hours (L:T:P) | Credits (L:T:P) | Total Contact Hours | Total Credit Hours | Type of course |
|--------|--------------|---|-----------------------|-----------------|---------------------|--------------------|----------------|
| 1      | BOT          | Discipline Specific Elective-II         | 4:0:0                 | 4:0:0           | 4                   | 4                  | DSE            |
| 2      | CHM          | Elective Subject(Discipline)-II         | 4:0:0                 | 4:0:0           | 4                   | 4                  | DSE            |
| 3      | ZOO          | Discipline Specific Elective-II         | 4:0:0                 | 4:0:0           | 4                   | 4                  | DSE            |
| 4      |              | Elective Subject (Skill Enhancement)-IV | 2:0:0                 | 2:0:0           | 2                   | 2                  | SEC            |
| 5      | SSC001       | Gender Equity                           | 3:0:0                 | 3:0:0           | 3                   | 3                  | ID             |

### II. Practical Subjects

| S. No | Subject Code | Subject Name                              | Contact Hours (L:T:P) | Credits (L:T:P) | Total Contact Hours | Total Credit Hours | Type of course |
|-------|--------------|---|-----------------------|-----------------|---------------------|--------------------|----------------|
| 1     | BOT          | Discipline Specific Elective-II Practical | 0:0:4                 | 0:0:2           | 4                   | 2                  | DSE            |
| 2     | CHM          | Elective Subject(Discipline) lab-II       | 0:0:4                 | 0:0:2           | 4                   | 2                  | DSE            |
| 3     | ZOO          | Discipline Specific Elective-II Practical | 0:0:4                 | 0:0:2           | 4                   | 2                  | DSE            |

**DSE:Discipline Specific Elective**  
**SEC: Skill Enhancement Courses**

**Total Contact hrs: 29**  
**Total Credit Hours: 23**

### Course Scheme Summary

| Sem          | L         | T        | P         | Contact hrs/wk | Credits    | CC        | AEC       | SEC      | DSE       | ID       |
|--------------|-----------|----------|-----------|----------------|------------|-----------|-----------|----------|-----------|----------|
| 1            | 18        | 0        | 14        | 32             | 24         | 18        | 6         |          |           |          |
| 2            | 18        | 0        | 14        | 32             | 24         | 18        | 6         |          |           |          |
| 3            | 17        | 0        | 12        | 29             | 23         | 18        | 3         | 2        |           |          |
| 4            | 14        | 0        | 12        | 26             | 20         | 18        |           | 2        |           |          |
| 5            | 14        | 0        | 12        | 26             | 20         |           |           | 2        | 18        |          |
| 6            | 17        | 0        | 12        | 29             | 23         |           |           | 2        | 18        | 1        |
| <b>Total</b> | <b>98</b> | <b>0</b> | <b>76</b> | <b>174</b>     | <b>134</b> | <b>72</b> | <b>15</b> | <b>8</b> | <b>36</b> | <b>1</b> |



# Core Courses (I-IV)



## PLANT BIODIVERSITY

|                              |  |
|------------------------------|--|
| <b>Course Code</b>           | <b>BOT101</b>  |
| <b>Course Title</b>          | <b>Plant Biodiversity</b>  |
| <b>Type of course</b>        | Theory   |
| <b>L T P</b>                 | 4      0      0  |
| <b>Credits</b>               | 4  |
| <b>Course prerequisite</b>   | 10+2 Medical   |
| <b>Course Objective (CO)</b> | To make students aware about biodiversity among different groups of plants, characteristic features of each group and to give preliminary knowledge of microbes  |
| <b>Course outcomes</b>       | <p>1. The understudy will have the option to recognize significant gatherings of plants and analyze the attributes of lower (for example green growth and parasites) and higher (angiosperms and gymnosperms) plants.</p> <p>2. Understudies will have the option to utilize the proof based relative plant science way to deal with clarify the development of life form and comprehend the hereditary assorted variety on the earth.</p> |

### UNIT-I

**Microbes:** Viruses – Discovery, general structure, replication (general account), DNA virus (T-phage); Lytic and lysogenic cycle, RNA virus (TMV); Economic importance; Bacteria – Discovery, General characteristics and cell structure; Reproduction – vegetative, asexual and recombination (conjugation, transformation and transduction); Economic importance.

**Algae:** General characteristics; Ecology and distribution; Range of thallus organization and reproduction; Classification of algae; Morphology and life-cycles of the following: *Nostoc*, *Chlamydomonas*, *Oedogonium*, *Vaucheria*, *Fucus*, *Polysiphonia*. Economic importance of algae

### UNIT-II

**Fungi:** Introduction- General characteristics, ecology and significance, range of thallus organization, cell wall composition, nutrition, reproduction and classification; True Fungi- General characteristics, ecology and significance, life cycle of *Rhizopus* (Zygomycota) *Penicillium*, *Alternaria* (Ascomycota), *Puccinia*, *Agaricus* (Basidiomycota); Symbiotic Associations- Lichens: General account, reproduction and significance; Mycorrhiza: ectomycorrhiza and endomycorrhiza and their significance

### UNIT-III

**Introduction to Archegoniate:** Unifying features of archegoniates, Transition to land habit, Alternation of generations.

**Bryophytes:** General characteristics, adaptations to land habit, Classification, Range of thallus organization. Classification (up to family), morphology, anatomy and reproduction of *Marchantia* and *Funaria*. (Developmental details not to be included). Ecology and economic importance of bryophytes with special mention of *Sphagnum*.

### UNIT-IV

**Pteridophytes:** General characteristics, classification, Early land plants (*Cooksonia* and *Rhynia*). Classification (up to family), morphology, anatomy and reproduction of

*Selaginella*, *Equisetum* and *Pteris*. (Developmental details not to be included). Heterospory and seed habit, stelar evolution. Ecological and economical importance of Pteridophytes.

**Gymnosperms:** General characteristics, classification. Classification (up to family), morphology, anatomy and reproduction of *Cycas* and *Pinus*. (Developmental details not to be included). Ecological and economical importance.

**Text and Reference books:**

| Sr No. | Book Title  | Author         | Publisher                       |
|--------|---|----------------|---------------------------------|
| 1      | Diversity of Microbes and Cryptogams                        | H.N.Srivastava | Pradeep Publisher               |
| 2      | Text Book of Thallophytes                                   | O.P.Sharma     | McGraw Hill Publishing Co.      |
| 3      | Text Book of Pteridophyta                                   | O.P.Sharma     | McMillan India Ltd              |
| 4      | Cryptogamic Botany, Vol. II, Bryophytes & Pteridophytes     | G.M Smith      | Tata McGraw Publisher           |
| 5      | Botany for degree students B.Sc 1st Year                    | V K Aggarwal   | S.Chand Publishing              |
| 6      | A Text book of Botany-I                                     | S.P. Jain      | Rastogi Publishers              |
| 7      | University Botany-I, Algae, Fungi, Bryophyta & Pteridophyta | S.M.Reddy      | New Age International Publisher |

## Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons

|                             |   |
|-----------------------------|---|
| <b>Course Code</b>          | <b>CHM101</b>   |
| <b>Course Title</b>         | <b>Atomic structures , bonding , general organic and chemistry and aliphatic hydrocarbons</b>   |
| <b>Type of course</b>       | Theory  |
| <b>L T P</b>                | 4 0 0   |
| <b>Credits</b>              | 4   |
| <b>Course prerequisite</b>  | 10+2 Non Medical or Medical   |
| <b>Course Objective</b>     | The aim of the subject is to enhance the knowledge of students about Stereochemistry of organic compounds, basic concepts and reactions of organic chemistry.   |
| <b>Course Outcomes (CO)</b> | <ol style="list-style-type: none"><li>1. Explains de-Broglie's dual behaviour of matter and Heisenberg's uncertainty principle and solve numerical problem</li><li>2. Explain the significance of quantum numbers.</li><li>3. Compare the reactivities of various alkyl and aryl halide</li><li>4. Describe the molecular orbital theory of homonuclear diatomic molecules.</li></ol> |

### Unit-I

Atomic Structure: Review of: Bohr's theory and its limitations, dual behavior of matter and radiation, de Broglie's relation, Heisenberg Uncertainty principle. Hydrogen atom spectra. Need of a new approach to Atomic structure. What is Quantum mechanics? Time independent Schrodinger equation and meaning of various terms in it. Significance of  $\psi$  and  $\psi^2$ , Schrödinger equation for hydrogen atom. Radial and angular parts of the hydrogenic wavefunctions (atomic orbitals) and their variations for 1s, 2s, 2p, 3s, 3p and 3d orbitals (Only graphical representation). Radial and angular nodes and their significance. Radial distribution functions and the concept of the most probable distance with special reference to 1s and 2s atomic orbitals. Significance of quantum numbers, orbital angular momentum and quantum numbers  $m_l$  and  $m_s$ . Shapes of s, p and d atomic orbitals, nodal planes. Discovery of spin, spin quantum number ( $s$ ) and magnetic spin quantum number ( $m_s$ ). Rules for filling electrons in various orbitals, Electronic configurations of the atoms. Stability of half-filled and completely filled orbitals, concept of exchange energy. Energies of atomic orbitals, Anomalous electronic configurations.

### Unit-II

Chemical Bonding and Molecular Structure Ionic Bonding: 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.

Covalent bonding: VB Approach: Shapes of some inorganic molecules and ions on the basis of VSEPR 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.

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 (including idea of s-p mixing) and heteronuclear diatomic molecules such as CO, NO and NO<sup>+</sup>. Comparison of VB and MO approach

### Unit-III

Fundamentals of Organic Chemistry: Physical Effects, Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyper-conjugation. Cleavage of Bonds: Homolysis and Heterolysis. Structure, shape and reactivity of organic molecules: Nucleophiles and electrophiles. Reactive Intermediates: Carbocations, Carbanions and free radicals. Strength of organic acids and bases: Comparative study with emphasis on factors affecting pK values. Aromaticity: Benzenoids and Hückel's rule.

Stereochemistry: Conformations with respect to ethane, butane and cyclohexane. Interconversion of Wedge Formula, Newmann, Sawhorse and Fischer representations. Concept of chirality (upto two carbon atoms). Configuration: Geometrical and Optical isomerism; Enantiomerism, Diastereomerism and Meso compounds). Threo and erythro; D and L; cis - trans nomenclature; CIP Rules: R/ S (for upto 2 chiral carbon atoms) and E / Z Nomenclature (for upto two C=C systems).

### Unit-IV

Aliphatic Hydrocarbons Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure. Alkanes: (Upto 5 Carbons). Preparation: Catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis, from Grignard reagent. Reactions: Free radical Substitution :Halogenation. Alkenes: (Upto 5 Carbons) Preparation: Elimination reactions: Dehydration of alkenes and dehydrohalogenation of alkyl halides (Saytzeff's rule); cis alkenes (Partial catalytic hydrogenation) and trans alkenes (Birch reduction). Reactions: cis-addition (alk. KMnO<sub>4</sub>) and trans-addition (bromine), Addition of HX (Markownikoff's and anti-Markownikoff's addition), Hydration, Ozonolysis, oxymercuration-demercuration, Hydroboration-oxidation Alkynes: (Upto 5 Carbons) Preparation: Acetylene from CaC<sub>2</sub> 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<sub>4</sub>, ozonolysis and oxidation with hot alk. KMnO<sub>4</sub>.

### Text and Reference Books

| S. No | Name                              | Author(S)          | Publisher             |
|-------|-----------------------------------|--------------------|-----------------------|
| 1     | Concise Inorganic Chemistry       | I.D. Lee           | ELBS                  |
| 2     | Inorganic Chemistry               | A.G. Sharpe        | ELBS                  |
| 3     | Organic Chemistry                 | Morrison and Boyd  | Prentice Hall         |
| 4     | Fundamentals of Organic Chemistry | Solomons           | John Wiley            |
| 5     | Stereochemistry                   | P.S. Kalsi         | New age International |
| 6     | Organic reaction mechanism        | Singh and Mukharje | New age International |

## ANIMAL BIODIVERSITY

|                              |   |
|------------------------------|---|
| <b>Course Code</b>           | <b>ZOO101</b>   |
| <b>Course Title</b>          | <b>Animal Biodiversity</b>  |
| <b>Type of course</b>        | Theory  |
| <b>L T P</b>                 | 4      0      0   |
| <b>Credits</b>               | 4   |
| <b>Course prerequisite</b>   | 10+2 Medical  |
| <b>Course Objective (CO)</b> | 1.To enable the students to develop an appreciation for the biodiversity of invertebrate species and to impart knowledge about co-existence of different forms of living organisms ranging from acellular to multicellular animals. Classification and general characters of the following phyla up to classes. |
| <b>Course Outcomes (CO)</b>  | 1. Understand the evolution, history of phylum that help in further research work.<br><br>2. Understand the economical importance of different classes.   |

### UNIT-I

**Kingdom Protista:**General characters and classification up to classes; Locomotory Organelles and locomotion in Protozoa

**Phylum Porifera:**General characters and classification up to classes; Canal System in *Sycon*

**Phylum Cnidaria:**General characters and classification up to classes; Polymorphism in Hydrozoa

**Phylum Platyhelminthes:**General characters and classification up to classes; Life history of *Taenia solium*

### UNIT-II

**Phylum Nematelminthes:**General characters and classification up to classes; Life history of *Ascaris lumbricoides* and its parasitic adaptations

**Phylum Annelida:**General characters and classification up to classes; Metamerism in Annelida

**Phylum Arthropoda:**General characters and classification up to classes; Vision in Arthropoda, Metamorphosis in Insects

**Phylum Mollusca:**General characters and classification up to classes; Torsion in gastropods

### UNIT-III

**Phylum Echinodermata:** General characters and classification up to classes; Water-vascular system in Asterozoa

**Protochordates:**General features and Phylogeny of Protochordata

**Agnatha:**General features of Agnatha and classification of cyclostomes up to classes

**Pisces:** General features and Classification up to orders; Osmoregulation in Fishes

#### UNIT-IV

**Amphibia:**General features and Classification up to orders; Parental care

**Reptiles:**General features and Classification up to orders; Poisonous and non-poisonous snakes, Biting mechanism in snakes

**Aves:**General features and Classification up to orders; Flight adaptations in birds

**Mammals:** Classification up to orders; Origin of mammals.

#### Text and Reference Books:

| S. No. | Title                                     | Author(s)                            | Publisher                  |
|--------|---|--------------------------------------|----------------------------|
| 1      | Invertebrate Zoology                      | P.S. Dhami                           | R Chand and Company        |
| 2      | Cell Biology                              | V K Aggarwal                         | S.Chand Publishing         |
| 3      | A Text Book of Invertebrate Zoology       | Gurcharn Singh                       | Campus Books International |
| 4      | Cell Biology                              | C B Pawar                            | Himalaya Publishing House  |
| 5      | Modern's Zoology (Vol-I)                  | Ashok Sabharwal and Dr. S K Malhotra | Modern Publisher           |
| 6      | Modern Text Book of Zoology Invertebrates | Prof. R. L. Kotpal                   | Rastogi Publisher          |
| 7      | Zoology                                   | P S Dhami                            | Pradeep Publishers         |

## GENERAL ENGLISH-I

|                              |  |
|------------------------------|--|
| <b>Course Code</b>           | <b>ENG101</b>  |
| <b>Course Title</b>          | <b>General English-I</b>   |
| <b>Type Course</b>           | Theory   |
| <b>L T P</b>                 | 3 0 0  |
| <b>Credits</b>               | 3  |
| <b>Course Pre-requisite</b>  | 10+2 any stream  |
| <b>Course Objective (CO)</b> | <ol style="list-style-type: none"> <li>1. The students will critically read and analyze the prescribed texts.</li> <li>2. The students will demonstrate effective word choice, vocabulary, idioms, grammar and sentence structure allowing accurate communication of meaning in written work.</li> <li>3. The students will recognize the correct usage of present/past/future tenses in contextualized speech.</li> </ol> |
| <b>Course Outcomes (CO)</b>  | <ol style="list-style-type: none"> <li>1. Students will heighten their awareness of correct usage of English grammar in writing and speaking.</li> <li>2. Students will improve their speaking ability in English both in terms of fluency and comprehensibility.</li> <li>3. Students will attain and enhance competence in the four modes of literacy: writing, speaking, reading &amp; listening.</li> </ol>            |

### UNIT-I

Tales of Life :

- a. The Umbrella (Henry Rene Albert Guy de Maupassant)
- b. The Story Teller (H.H. Munro Saki)
- c. The Lament (Anton Pavlovich Chakhov)

Prose for Young Learners:

- a. Universal Declaration Of Human Rights (U.N. Charter)
- b. Symptoms (Jerome K. Jerome)

Exploring Tenses in English:

- a. Present and Past
- b. Present Perfect and Past

### UNIT-II

Tales of Life:

- a. The Luncheon (William Somerset Maugham)
- b. The Shroud (Prem Chand)

Prose for Young Learners:

- a. On Spendthrifts (A.G. Gardinar)

- b. The Power of Women(Richard Gardon)
  - c. A Dialogue On Democracy (Albert Sydney Horby)
- Exploring Tenses in English:

- a. Future
- b.

**Text and Reference Books:**

| S.No | Author(S)                                   | Title                    | Publisher  |
|------|---|--------------------------|--|
| 1    | Singh, S                                    | Tales of Life            | Press and Publication Department, Guru Nanak Dev University, Amritsar. |
| 2    | Tewari, A. K,<br>Midha, V.K,<br>Sharma, R.K | Prose For Young Learners | Publication Bureau, Guru Nanak Dev University, Amritsar                |
| 3    | Murphy, R                                   | English Grammar in Use   | Cambridge University Press   |



## GENERAL PUNJABI-I

|                            |  |
|----------------------------|--|
| <b>Course Code</b>         | PBI101   |
| <b>Course Title</b>        | General Punjabi-I  |
| <b>Type of Course</b>      | Theory   |
| <b>L T P</b>               | 3 0 0  |
| <b>Credits</b>             | 3  |
| <b>Course Prerequisite</b> | 10+2 in any stream   |
| <b>Course Objectives</b>   | 1. i vidAwrQIAwDuinkpMjwbIkvIAwDIjIvnIqoNjwxUhoxyg[<br>2. i vidAwrQIAwNMAwDuinkpMjwbIkvIqwdIivSYgqjwxkwrI ho jwvygI[<br>3. i vidAwrQIAwiv`cryKwic`qrWdwAlocnwqmkAiDAYnkrndwhunrauqpMnhovygw[ |

### iekweI- a

- AwDuinkpMjwbIkvIqwdIivSYgqjwxkwrI**: BweIvIrisMG (rauNru^, smW, ie`Cw bl qyfUMGIAWSwmW), DnIrwmcwiqRk(rwDwsMdyS, isdkWvwilAWdybyVypwrny), pRo.pUrnisMG(purwxypMjwbNMAwvzwW), &IrozDIn Sr&(kurbwnI, ^YrpMjwbIdI), pRo.mohnisMG(Awaun`cIey, nvWkOqk), nMdlwlnUrpurI(cuMmcuMmr`Ko, mzdUr), AMimRqwpRIqm(bwrWmwh, sMXogivXog), fw. hrBjnisMG(qyryhzUrmyrIhwizrIdIdwsqW), iSvkumwrbtwlvI(ibrhoNdIrVHk, z^m), surjIqpwr(cONkShIdW `c ausdwAwi^rIBwSx, Zz1)
- pMjwbDymhwnklwkwr (lyK)**: ky.AY~l. sihgl, bVygulwmAlI KW, soBwisMG, ipRQvIrwjKpUr, BweIsmuMdisMG[

### iekweI- A

- pMjwbIDunIivauNq :aucwrnAMg, aucwrnsQwnqyivDIAW, svr, ivAMjn[
- BwSwvMngIAW: BwSwdwtkswlIrUp, BwSwAqyaup- BwSwdwAMqr, pMjwbIaupBwSwvWdypCwxicMnH[

### pusqksUcI

#### pwt- pusqkW

| lyKk  | swl  | Pusqk             | pbilSr   |
|---|------|-------------------|--|
| sMpwdk, iF`loN;<br>h.s.AqysrgoDIAw;<br>p.s. | 2014 | do rMg            | pblIkySnibaUro,<br>gurUunwnkdYvXUnIvristI,<br>AMimRqsr |
| gwrGI; b.                                   | 1995 | pMjwbDymhwnklwkwr | pblIkySnibaUro,<br>gurUunwnkdYvXUnIvristI,<br>AMimRqsr |

**sMbMiDqpusqkW**

|  |      |                     |                             |
|--|------|---------------------|-----------------------------|
| lyKk   | swl  | Pusqk               | pbilSr                      |
| isMG; h.   | 1966 | pMjwbIbwry          | pMjwbIXUnIvrstI,<br>pitAwlw |
| isMG; qIrQ (fw.)                                   | 2014 | pMjwbIAiDAwpn       | AY~s. jI. pbilSr,<br>jlMDr  |
| syKoN; suKivMdrisMG<br>(fw.) AqysyKoN;<br>mndIpkOr | 2015 | pMjwbIBwSwdwAiDAwpn | kilAwxIpbilSr,<br>luiDAwxw  |

**ATOMIC STRUCTURES, BONDING, GENERAL ORGANIC AND CHEMISTRY AND**

|                             |  |
|-----------------------------|--|
| <b>Course Code</b>          | <b>CHM 103-19</b>  |
| <b>Course Title</b>         | <b>Atomic structures , bonding , general organic and chemistry and aliphatic hydrocarbons</b>  |
| <b>Type of course</b>       | PRACTICAL  |
| <b>L T P</b>                | 0:0:4  |
| <b>Credits</b>              | 2  |
| <b>Course prerequisite</b>  | 10+2 with chemistry as core subject  |
| <b>Course Objective</b>     | The aim of this course is to impart practical knowledge to the students about the separation of organic molecules and estimation of inorganic salt and metal ions.             |
| <b>Course outcomes (CO)</b> | Explains de-Broglie's dual behaviour of matter and Heisenberg's uncertainty principle and solve numerical problem. Compare the reactivities of various alkyl and aryl halides. |

**ALIPHATIC HYDROCARBONS PRACTICAL****LIST OF EXPERIMENTS*****Volumetric Analysis***

1. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.
2. Estimation of oxalic acid by titrating it with KMnO<sub>4</sub>.
3. Estimation of water of crystallization in Mohr's salt by titrating with KMnO<sub>4</sub>.
4. Estimation of Fe (II) ions by titrating it with K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> using internal indicator.
5. Estimation of Cu (II) ions iodometrically using Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub>.

***Organic Chemistry*** Detection of extra elements (N, S, Cl, Br, I) in organic compounds

(containing upto two extra elements)

1. Separation of mixtures by Chromatography: Measure the R<sub>f</sub> value in each case (combination of two compounds to be given)

(a) Identify and separate the components of a given mixture of two amino acids (glycine, aspartic acid, glutamic acid, tyrosine or any other amino acid) by paper chromatography

(b) Identify and separate the sugars present in the given mixture by paper chromatography.

**Text and Reference Books:**

| S. No | Name  | Author(S)  | Publisher                        |
|-------|---|--|----------------------------------|
| 1     | Vogel's Qualitative Inorganic Analysis (7 <sup>th</sup> Edition). | G Svehla   | Prentice Hall                    |
| 2     | Laboratory Manual in Organic Chemistry                            | R.K. Bansal,   | Wiley Eastern                    |
| 3     | Advanced Experimental Chemistry. Vol. I                           | Physical, J.N. Gurtu and R. Kapoor                     | S. Chand & CO.                   |
| 4     | Vogel's Qualitative Inorganic Analysis                            | Svehla   | Orient Longman                   |
| 5     | Vogel's Textbook of Quantitative Inorganic Analysis (revised),    | J. Basseff, R.C. Dennerly, G.H. Jeffery and J. Mendham | ELBS                             |
| 6     | Advanced Practical Physical Chemistry                             | J.B. Yadav   | KRISHNA Prakashan Media (P) Ltd, |

## HISTORY AND CULTURE OF PUNJAB -I

|                               |  |
|-------------------------------|--|
| <b>Course code</b>            | <b>HCP101</b>  |
| <b>Course title</b>           | <b>History and Culture of Punjab -I</b>  |
| <b>Type of course</b>         | Theory   |
| <b>L T P</b>                  | 3:0:0  |
| <b>Credits</b>                | 3  |
| <b>Course prerequisite</b>    | Students who have not studied Punjabi in 10/12 <sup>th</sup> class   |
| <b>Course objectives (CO)</b> | <ol style="list-style-type: none"> <li>1. The Student will acquire the knowledge about Punjab and its Historical Resources.</li> <li>2. The Student will understand the Harppan Culture and different Vedic Periods.</li> <li>3. The Students will analyze the Alexander’s invasions.</li> </ol> |
| <b>Course outcomes (CO)</b>   | Intellectual Skills Students will be able to—Acquire General knowledge and subject expertise   |

### UNIT I

Ancient Punjab: Physical features, Political, Social, Economic, Geographical, Religious impact on History, Historical Sources: Literacy, Archaeological, Harappan Culture: Extent and Town Planning.

### UNIT II

Harppan Culture: Social, Economic and Religious life; Causes and Disappearance, Rig Vedic Age: The rise of Indo Aryans, Main features of the life in Early Vedic Age, Later Vedic Age: Political, Economic, Social, and Religious life of Later Vedic Aryans.

### UNIT III

Caste system: Origin and Evolution, The Epics: Historical importance of Ramayan and Mahabharat, Political condition on eve Alexander’s Invasion.

### UNIT IV

Impact of Alexander’s Invasion on Social and Culture Life., Position of Women: Harppan, Early Vedic and Later Vedic Age.

Important Historical places of Punjab: Mohenjodaro, Harappa, kotla Nihang khan, Sanghol, Banawali, Taxila, Hastinapur, Indraprastha, Srinagar, Sakala, Purusapura

### Text and References Books:

| S.NO. | Author's       | Title                         | Publisher              |
|-------|----------------|-------------------------------|------------------------|
| 1     | Sukhdev Sharma | History And Culture Of Punjab | New Academic Publisher |
| 2     | Romila Thapar  | A History of India, Vol. I    | Penguin Books          |

### PLANT BIODIVERSITY PRACTICAL

|                              |   |
|------------------------------|---|
| <b>Course Code</b>           | <b>BOT103</b>   |
| <b>Course Title</b>          | <b>Plant Biodiversity Practical</b>   |
| <b>Type of course</b>        | Practical   |
| <b>L T P</b>                 | 0 0 4   |
| <b>Credits</b>               | 2   |
| <b>Course prerequisite</b>   | 10+2 Medical  |
| <b>Course Objective (CO)</b> | To make students aware about biodiversity among different groups of plants, characteristic features of each group and to give preliminary knowledge of microbes   |
| <b>Course Outcomes (CO)</b>  | <ol style="list-style-type: none"> <li>1. The understudies will have the option to show the information in getting research and tending to useful issues.</li> <li>2. Understudies will have the option to exhibit the trial strategies and techniques for their zone of specialization in Botany.</li> </ol> |

### LIST OF EXPERIMENTS

1. Ems/Models of viruses – T-Phage and TMV, Line drawing/Photograph of Lytic and Lysogenic Cycle.
2. Types of Bacteria from temporary/permanent slides/photographs; EM bacterium; Binary Fission; Conjugation; Structure of root nodule.
3. Gram staining
4. Study of vegetative and reproductive structures of *Nostoc*, *Chlamydomonas* (electron micrographs), *Oedogonium*, *Vaucheria*, *Fucus*\* and *Polysiphonia* through temporary preparations and permanent slides. (\* *Fucus*- Specimen and permanent slides)
5. *Rhizopus* and *Penicillium*: Asexual stage from temporary mounts and sexual structures through permanent slides.
6. *Alternaria*: Specimens; photographs and tease mounts.
7. *Puccinia*: Herbarium specimens of Black Stem Rust of Wheat and infected Barberry leaves; section/tease mounts of spores on Wheat and permanent slides of both the hosts.
8. *Agaricus*: Specimens of button stage and full grown mushroom; Sectioning of gills of *Agaricus*.
9. Lichens: Study of growth forms of lichens (crustose, foliose and fruticose)
10. Mycorrhiza: ecto mycorrhiza and endo mycorrhiza (Photographs)

11. **Marchantia**- morphology of thallus, w.m. rhizoids and scales, v.s. thallus through gemma cup, w.m. gemmae (all temporary slides), v.s. antheridiophore, archegoniophore, l.s. sporophyte (all permanent slides).
12. **Funaria**- morphology, w.m. leaf, rhizoids, operculum, peristome, annulus, spores (temporary slides); permanent slides showing antheridial and archegonial heads, l.s. capsule and protonema. **Selaginella**- morphology, w.m. leaf with ligule, t.s. stem, w.m. strobilus, w.m. microsporophyll and megasporophyll (temporary slides), l.s. strobilus (permanent slide).
13. **Equisetum**- morphology, t.s. internode, l.s. strobilus, t.s. strobilus, w.m. sporangiophore, w.m. spores (wet and dry)(temporary slides); t.s rhizome (permanent slide).
14. **Pteris**- morphology, t.s. rachis, v.s. sporophyll, w.m. sporangium, w.m. spores (temporary slides), t.s. rhizome, w.m. prothallus with sex organs and young sporophyte (permanent slide).
15. **Cycas**- morphology (coralloid roots, bulbil, leaf), t.s. coralloid root, t.s. rachis, v.s. leaflet, v.s. microsporophyll, w.m. spores (temporary slides), l.s. ovule, t.s. root (permanent slide).
16. **Pinus**- morphology (long and dwarf shoots, w.m. dwarf shoot, male and female), w.m. dwarf shoot, t.s. needle, t.s. stem, l.s./t.s. male cone, w.m. microsporophyll, w.m. microspores (temporary slides), l.s. female cone, t.l.s.&r.l.s. stem (permanent slide).

#### Text and Reference Books:

| Sr No. | Book Title  | Author                               | Publisher          |
|--------|---|--------------------------------------|--------------------|
| 1      | Diversity of Microbes and Cryptogams                    | H.N.Srivastava                       | Pradeep Publisher  |
| 2      | Text Book of Thallophytes                               | O.P.Sharma                           | Tata McGraw Hill   |
| 3      | Text Book of Pteridophyta                               | O.P.Sharma                           | McMillan India Ltd |
| 4      | The Fungi   | P.D. Sharma                          | Rastogi Publisher  |
| 5      | Cryptogamic Botany, Vol. II, Bryophytes & Pteridophytes | G.M Smith                            | Tata McGraw Hill   |
| 6      | Biology   | P H Raven, G B Johnson, SIR R Singer | Tata McGraw Hill   |
| 7      | Gymnosperms   | SP Bhatnagar and A Moitra            | S Chand            |

## ANIMAL BIODIVERSITY PRACTICAL

|                             |   |
|-----------------------------|---|
| <b>Course Code</b>          | <b>ZOO103</b>   |
| <b>Course Title</b>         | <b>Animal Biodiversity Practical</b>  |
| <b>Type of course</b>       | Practical   |
| <b>L T P</b>                | 0 0 4   |
| <b>Credits</b>              | 2   |
| <b>Course prerequisite</b>  | 10+2 Medical  |
| <b>Course Objective</b>     | Classification up to orders and study of the specimens mentioned against each phylum with ecological note   |
| <b>Course Outcomes (CO)</b> | <p>1. Able to compare and contrast structural features in members of 35 animal phyla.</p> <p>(A) Demonstrate skills in library and field research, data and information gathering, collation and 35 animal phyla suitable for the preparation of a scientific report.</p> |

### LIST OF SUGGESTED LAB EXERCISES:

(A) Study of the following specimens:

*Amoeba, Euglena, Plasmodium, Paramecium, Sycon, Hyalonema, and Euplectella, Obelia, Physalia, Aurelia, Tubipora, Metridium, Taenia solium, Male and female Ascaris lumbricoides, Aphrodite, Nereis, Pheretima, Hirudinaria, Palaemon, Cancer, Limulus, Palamnaeus, Scolopendra, Julius, Periplaneta, Apis, Chiton, Dentalium, Pila, Unio, Loligo, Sepia, Octopus, Pentaceros, Ophiura, Echinus, Cucumaria and Antedon, Balanoglossus, Herdmania, Branchiostoma, Petromyzon, Sphyrna, Pristis, Torpedo, Labeo, Exocoetus, Anguilla, Ichthyophis/Ureotyphlus, Salamandra, Bufo, Hyla, Chelone, Hemidactylus, Chamaeleon, Draco, Vipera, Naja, Crocodylus, Gavialis, Any six common birds from different orders, Sorex, Bat, Funambulus, Loris*

2. Study of the following permanent slides:

T.S. and L.S. of *Sycon*, Study of life history stages of *Taenia*, T.S. of Male and female *Ascaris*

(A) Key for Identification of poisonous and non-poisonous snakes

An “**animal album**” containing photographs, cut outs, with appropriate write up about the above mentioned taxa. Different taxa/ topics may be given to different sets of students for this purpose.

### Text and Reference Books:

| S. No. | Title                               | Author(s)      | Publisher                  |
|--------|-------------------------------------|----------------|----------------------------|
| 1      | Invertebrate Zoology                | P.S. Dhani     | R Chand and Company        |
| 2      | Cell Biology                        | V K Aggarwal   | S.Chand Publishing         |
| 3      | A Text Book of Invertebrate Zoology | Gurcharn Singh | Campus Books International |
| 4      | Cell Biology                        | C B Pawar      | Himalaya Publishing House  |

### PLANT ECOLOGY AND TAXONOMY

|                              |  |
|------------------------------|--|
| <b>Course Code</b>           | <b>BOT102</b>  |
| <b>Course Title</b>          | <b>Plant Ecology and Taxonomy</b>  |
| <b>Type of course</b>        | Theory   |
| <b>L T P</b>                 | 4 0 0  |
| <b>Credits</b>               | 2  |
| <b>Course prerequisite</b>   | 10+2 Medical   |
| <b>Course Objective (CO)</b> | To make student understand basics of ecosystem, its working and components also diversity in angiosperm families.  |
| <b>Course Outcomes (CO)</b>  | 1. Comprehend central ideas of biotic and abiotic components.<br>2. Examine the phytogeography or phytogeographical division of India.<br>3. Examine the energy sources of ecological system |

#### UNIT-I

**Introduction to Ecology:** History of Ecology; Basic concepts in Ecology; Subdivisions of Ecology; Terminology related to Ecology; Scope of Ecology

**Ecological factors:** Soil: Origin, formation, composition, soil profile. Water: States of water in the environment, precipitation types. Light and temperature: Variation Optimal and limiting factors; Shelford law of tolerance. Adaptation of hydrophytes and xerophytes.

Plant communities: Characters; Ecotone and edge effect; Succession; Processes and types.

#### UNIT-II

**Ecosystem:** Structure; energy flow trophic classification; Food chains and food webs, Ecological pyramids production and productivity; Biogeochemical cycling; Cycling of carbon, nitrogen and phosphorus.

**Phytogeography:** Principle biogeographical zones; Endemism

#### UNIT-III

**Introduction to plant taxonomy:** Identification, Classification, Nomenclature.

Identification Functions of Herbarium, important herbaria and botanical gardens of the world and India, Documentation: Flora, Keys: single access and multi-access, Taxonomic evidences from palynology, cytology, phytochemistry and molecular data

**Taxonomic hierarchy:** Ranks, categories and taxonomic groups

#### UNIT-IV

**Botanical nomenclature:** Principles and rules (ICN); ranks and names; binominal system, typification, author citation, valid publication, rejection of names, principle of priority and its limitations.

**Classification:** Types of classification-artificial, natural and phylogenetic. Bentham and Hooker (upto series), Engler and Prantl (upto series).

Biometrics, numerical taxonomy and cladistics : Characters; variations; OTUs, character weighting and coding; cluster analysis; phenograms, cladograms (definitions and differences).

**General characters Angiosperms:** Important angiosperm families- habit, habitat, characters, important plants, economic importance. (Brassicaceae, Malvaceae, Fabaceae, Rosaceae Umbelliferae, Rutaceae, Asteraceae, Asclepiadaceae, Solanaceae, Euphorbiaceae, Lamiaceae, Liliaceae, Gramineae)

#### Text and Reference Books:

| S. No. | Title                                   | Author                       | Publisher   |
|--------|---|------------------------------|---|
| 1      | Concepts of Ecology                     | Kormondy, E.J                | Prentice Hall, U.S.A. 4 <sup>th</sup> edition.              |
| 2      | Ecology and Environment                 | Sharma, P.D                  | Rastogi Publications, Meerut, India. 8 <sup>th</sup> ed     |
| 3      | Plant Systematics                       | Simpson, M.G.                | Academic Press, San Diego, CA, U.S.A.                       |
| 4      | Plant Systematics: Theory and Practice. | Singh, G.                    | Oxford & IBH Pvt. Ltd., New Delhi. 3 <sup>rd</sup> edition. |
| 5      | An Introduction to Plant Taxonomy       | Jeffrey, C.                  | Cambridge University Press, London                          |
| 6      | Fundamental of Plant Systematics        | Radford, A.E.,               | Harper and Row, New York                                    |
| 7      | Principles of Angiosperm Taxonomy       | Davis, P.H. and Heywood, V.H | Oliver and Boyd, London.                                    |

### Chemical Energetic, Equilibrium and Functional Group Organic chemistry – I

|                              |   |
|------------------------------|---|
| <b>Course Code</b>           | <b>CHM102</b>   |
| <b>Course Title</b>          | Chemical Energetic, Equilibrium and Functional Group Organic chemistry – I  |
| <b>Type of course</b>        | Theory  |
| <b>L T P</b>                 | 4 0 0   |
| <b>Credits</b>               | 4   |
| <b>Course prerequisite</b>   | 10+2 Medical  |
| <b>Course Objective (CO)</b> | The aim of this course is to impart basic knowledge about properties and importance of natural bio-macromolecules .   |
| <b>Course Outcomes (CO)</b>  | 1. Identify thermodynamic property of any system to apply it for various systems.<br>2.Acquire the knowledge of phase equilibria of various systems<br>3. Demonstrate an understanding of completely miscible, partially miscible and immiscible liquids. |

#### Unit-I

Chemical Energetics: Review of thermodynamics and the Laws of Thermodynamics. Important principles and definitions of thermo-chemistry. Concept of standard state and standard enthalpies of formations, integral and differential enthalpies of solution and dilution. Calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data. Variation of enthalpy of a reaction with temperature – Kirchoff's equation. Statement of Third Law of thermodynamics and calculation of absolute entropies of substances.

#### Unit-II

Chemical Equilibrium: Free energy change in a chemical reaction. Thermodynamic derivation of the law of chemical equilibrium. Distinction between  $G$  and  $G^\circ$ , Le Chatelier's principle. Relationships between  $K_p$ ,  $K_c$  and  $K_x$  for reactions involving ideal gases.

Ionic Equilibria: 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.

### Unit-III

Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure. Aromatic hydrocarbons Preparation (Case benzene): from phenol, by decarboxylation, from acetylene, from benzenesulphonic acid. Reactions: (Case benzene): Electrophilic substitution: nitration, 39alogenations and sulphonation. Friedel-Craft's reaction (alkylation and acylation) (upto 4 carbons on benzene). Side chain oxidation of alkyl benzenes (upto 4 carbons on benzene).

Alkyl and Aryl Halides, Alkyl Halides (Upto 5 Carbons) Types of Nucleophilic Substitution (SN1, SN2 and Sni) reactions Preparation: from alkenes and alcohols. Reactions: hydrolysis, nitrite & nitro formation, nitrile & isonitrile formation. Williamson's ether synthesis: Elimination vs substitution. Aryl Halides Preparation: (Chloro, bromo and iodo-benzene case): from phenol, Sandmeyer & Gattermann reactions. Reactions (Chlorobenzene): Aromatic nucleophilic substitution (replacement by -OH group) and effect of nitro substituent. Benzyne Mechanism:  $\text{KNH}_2/\text{NH}_3$  (or  $\text{NaNH}_2/\text{NH}_3$ ). Reactivity and Relative strength of C-Halogen bond in alkyl, allyl, benzyl, vinyl and aryl halides.

### Unit-IV

Alcohols, Phenols and Ethers (Up to 5 Carbons) Alcohols: Preparation: Preparation of 1°, 2° and 3° alcohols: using Grignard reagent, Ester hydrolysis, Reduction of aldehydes, ketones, carboxylic acid and esters. Reactions: With sodium, HX (Lucas test), esterification, oxidation (with PCC, alk.  $\text{KMnO}_4$ , acidic dichromate, conc.  $\text{HNO}_3$ ). Oppeneauer oxidation Diols: (Upto 6 Carbons) oxidation of diols. Pinacol-Pinacolone rearrangement.

Phenols: (Phenol case) Preparation: Cumene hydroperoxide method, from diazonium salts. Reactions: Electrophilic substitution: Nitration, 39alogenations and sulphonation. Reimer-Tiemann Reaction, Gattermann-Koch Reaction, Houben-Hoesch Condensation, Schotten-Baumann Reaction.

Ethers (aliphatic and aromatic): Cleavage of ethers with HI.

Aldehydes and ketones (aliphatic and aromatic): (Formaldehyde, acetaldehyde, acetone and benzaldehyde) Preparation: from acid chlorides and from nitriles. Reactions – Reaction with HCN, ROH,  $\text{NaHSO}_3$ ,  $\text{NH}_2$ -G derivatives. Iodoform test. Aldol Condensation, Cannizzaro's reaction, Wittig reaction, Benzoin condensation. Clemensen reduction and Wolff Kishner reduction. Meerwein-Ponndorf-Verley reduction.

### Text and Reference Books

| S. No | Name   | Author(S)         | Publisher                          |
|-------|--|-------------------|------------------------------------|
| 1     | Organic reaction mechanism, 3 <sup>rd</sup> ed. Latest edition | V. K. Ahluwalia   | Narosa publishing house, New Dehli |
| 2     | Organic Chemistry  | Morrison and Boyd | Prentice Hall                      |

|   |                                    |              |                   |
|---|------------------------------------|--------------|-------------------|
| 3 | Fundamentals of Organic Chemistry  | Solomons     | John Wiley        |
| 4 | The Elements of Physical Chemistry | P.w.Aikins   | Oxford            |
| 5 | Physical Chemistry                 | R.A. Alberty | Wiley Eastern Ltd |

### COMPARATIVE ANATOMY AND DEVELOPMENTAL BIOLOGY OF VERTEBRATES

|                              |  |
|------------------------------|--|
| <b>Course Code</b>           | <b>ZOO102</b>  |
| <b>Course Title</b>          | <b>Comparative Anatomy and Developmental Biology of Vertebrates</b>  |
| <b>Type of course</b>        | Theory   |
| <b>L T P</b>                 | 4      0      0  |
| <b>Credits</b>               | 4  |
| <b>Course prerequisite</b>   | 10+2 Medical   |
| <b>Course Objective (CO)</b> | To enable the students to draw a comparative account of the morphology, general anatomy and physiology of the vertebrates  |
| <b>Course Outcomes (CO)</b>  | 1. Figure out how to utilize the near strategy to examine and basically assess the structure and capacity of vertebrate frameworks. This data will empower you look at the developmental history of vertebrate species and evaluate the practical importance of morphological adjustments.<br>2. Compare and contrast the fertilization process in mammals and plants. |

#### UNIT-I

**Integumentary System:** Derivatives of integument w.r.t. glands and digital tips

**Digestive System:** Brief account of alimentary canal and digestive glands

**Respiratory System:** Brief account of Gills, lungs, air sacs and swim bladder

**Circulatory System:** Evolution of heart

#### UNIT-II

**Nervous System:** Comparative account of brain

**Sense Organs:** Types of receptors

**Urinogenital System:** Succession of kidney, Evolution of urinogenital ducts

#### UNIT-III

**Early Embryonic Development:** Gametogenesis: Spermatogenesis and oogenesis w.r.t. mammals, vitellogenesis in birds; Fertilization: external (amphibians), internal (mammals), blocks to polyspermy; Early development of frog and humans (structure of mature egg and its

membranes, patterns of cleavage, fate map, up to formation of gastrula);types of morphogenetic movements; Fate of germ layers; Neurulation in frog embryo.

#### UNIT-IV

**Late Embryonic Development:** Implantation of embryo in humans, Formation of human placenta and functions, other types of placenta on the basis of histology; Metamorphic events in frog life cycle and its hormonal regulation.

**Control of Development:** Fundamental processes in development (brief idea) – Gene activation, determination, induction, Differentiation, morphogenesis, intercellular communication, cell movements and cell death.

#### Text and Reference Books:

| Sr No. | Title   | Author(s)                      | Publisher               |
|--------|---|--------------------------------|-------------------------|
| 1      | Vertebrates' Comparative Anatomy, Function and Evolution. IV Edition. | K.V Kardong                    | McGraw-Hill             |
| 2      | Comparative Anatomy of the Vertebrates. IX Edition                    | G.C. Kent and R.K Carr         | McGraw-Hill             |
| 3      | Analysis of Vertebrate Structure                                      | M. Hilderbrand and G.E. Gaslow | John Wiley and Sons     |
| 4      | Biology of Vertebrates  | H.E. Walter and L.P. Sayles    | Khosla Publishing House |

## GENERAL ENGLISH-II

|                              |   |
|------------------------------|---|
| <b>Course Code</b>           | <b>ENG102</b>   |
| <b>Course Title</b>          | <b>General English-II</b>   |
| <b>Type Course</b>           | Theory  |
| <b>L T P</b>                 | 3 0 0   |
| <b>Credits</b>               | 3   |
| <b>Course Pre-requisite</b>  | <b>10+2</b>   |
| <b>Course Objective (CO)</b> | To develop understanding of the significance of English as a subject in the present context, to feel pleasure and to develop the understanding of the significance of basic competencies in language acquisition. This course will enable students to understand the foreign language as well as the use of language and to enable students to acquire language skills such as listening, speaking, reading, and writing and integrate them for communicative purposes. |
| <b>Course Outcomes (CO)</b>  | 1.Students will improve their speaking ability in English both in terms of fluency and comprehensibility.<br>2.Students will increase their reading speed and comprehension of academic articles.   |

### 1. Tales of Life

- a. The Doll's House( Katherine Mansfield)
- b. Eveline (James Joyce)
- c. Toba Tek Singh (Saadat Hassan Manto)
- d. The Taboo (Victor Astafyev)
- e. A Strand of Cotton (Suneet Chopra)

### 2. Prose for Young Learners

- a. Beauty And The Beast(R.K.Narayan)
- b. With A Song On Their Lips (Hugh & Colleen Gantzer)
- c. My Financial Careers (Stephen Leacock)
- d. The School For Sympathy (E.V. Lucas)

- e. AIDS (U.N.Report)
- (A) Exploring Grammar
  - a. Modals
  - b. Passive
  - c. Reported Speech
  - d. Questions and Auxiliary verbs

**Text and Reference Books:**

| S.No. | Author(S)                                   | Year | Title                    | Publisher  |
|-------|---|------|--------------------------|--|
| 1     | Singh, S                                    | 2008 | Tales of Life            | Press and Publication Department, Guru Nanak Dev University, Amritsar. |
| 2     | Tewari, A. K,<br>Midha, V.K,<br>Sharma, R.K | 2011 | Prose For Young Learners | Publication Bureau, Guru Nanak Dev University, Amritsar                |
| 3     | Murphy, R                                   | 2015 | English Grammar in Use   | Cambridge University Press   |

**GENERAL PUNJABI-II**

|                            |   |
|----------------------------|---|
| <b>Course Code</b>         | <b>PBI102</b>   |
| <b>Course Title</b>        | <b>General Punjabi-II</b>   |
| <b>Type of Course</b>      | Theory  |
| <b>L T P</b>               | 3 0 0   |
| <b>Credits</b>             | 3   |
| <b>Course Prerequisite</b> | 10+2  |
| <b>Course Objective</b>    | 1. iividAwrQIAwDuinkpMjwbIkhwxIkwrWdIjIvnIqoNjwxUhoxy[<br>2. iividAwrQIAWnUMAwDuinkpMjwbIkhwxIdIivSYgqjwxkwrI ho<br>jwvygI[<br>3. iividAwrQIAWiv`cryKwic`qrWdwAlocnwqmKaiDAYnkrndwhunrau<br>qpMnhovygw[<br>4. iividAwrQImuhwvry, AkwxWdIFu`kvINvrqoNkrnWis`Kjwxgy |

**iekweI- a**

- pMjwbIin`kIkhwxI:** BUaw (nwnkisMG), bwZIdI DI (gurmuKisMGmuswi&r), pymIdyinAwxy (sMqisMGsyKoN), bwgWdwrwKw (sujwnisMG), qYNkIdrdnwAwieAw (krqwrismGdu`gl), DrqIhyTlwbOld (kulvMqisMGivrK), dUjIvwrjybk`tIgeI (nvqyjisMG), lCmI (pRympRkwS), bu`qiSkN (AjIqkOr), b`s kMfktr (dlIpkOritvwxw) [
- pMjwbDymhwnkIkwR (lyK):** sqISgujrwI, gurcrnisMG, TwkurisMG, blrwjswhnI, suirMdrkOr [

**iekweI- A**

- SdbxqrAqySbdrcnw: pirBwSwAqymu`FlysMklp
- (a) pYrHwrcnw, muhwvryAqyAKwx [ (A) pYrHwpVHkypRSnWdyau~qrDyxw [

**pusqksUcI**

**pwt- pusqkW**

|  |      |                   |   |
|--|------|-------------------|---|
| LyKk   | Swl  | pusqk             | pbilSr  |
| sMpwdk, If`loN;<br>h.s.AqysrgoDIAw,<br>p.s+. | 2014 | do rMg            | pblIkySnibaUro,<br>gurUunwnkdyvXUnIvrstI,<br>AmimRqsr |
| gwrgrI, b.                                   | 1995 | pMjwbDymhwnklwkwr | pblIkySnibaUro,<br>gurUunwnkdyvXUnIvrstI,<br>AmimRqsr |

### **sMbMiDqpusqkW**

|                               |      |                     |                             |
|-------------------------------|------|---------------------|-----------------------------|
| LyKk                          | Swl  | psqk                | pbilSr                      |
| isMG, h.                      | 1966 | pMjwbIbwry          | pMjwbIXUnIvrstI,<br>pitAwlw |
| isMG, q.                      | 2014 | pMjwbIAiDAwPn       | AY~s. Ji. PbilSrZ,<br>jLMDr |
| syKoN, s.s.Aqy<br>syKoN, m.k. | 2015 | pMjwbIBwSwdwAiDAwPn | kilAwXipbilSrZ,<br>luiDAwxw |

## **HISTORY AND CULTURE OF PUNJAB –II**

|                               |  |
|-------------------------------|--|
| <b>Course ode</b>             | <b>HCP102</b>  |
| <b>Course title</b>           | <b>History And Culture Of Punjab –II</b>   |
| <b>Type of course</b>         | Theory   |
| <b>L T P</b>                  | 3:0:0  |
| <b>Credits</b>                | 3  |
| <b>Course prerequisite</b>    | Students who have not studied Punjabi in 10/12 <sup>th</sup> class   |
| <b>Course objectives (CO)</b> | <ol style="list-style-type: none"> <li>1. The Student will acquire the knowledge Of Mauryan Empire.</li> <li>2. The Student will understand the impact of Buddhism &amp; Jainism on Punjab.</li> <li>3. To aware the learners Depiction of Punjab in the accounts of Chinese travelers.</li> </ol> |
| <b>Course Outcomes (co)</b>   | This study programme will enhance the knowledge of students about the Sikh history of Punjab from 1469-1606.   |

### **UNIT-I**

The Mauryan Empire: Social, Economic and Religious life, Buddhism and Jainism: Impact on Punjab with special reference to 4th Buddhist Council., The Kushanas: Impact of Kanishka's rule on Punjab.

### **UNIT-II**

Gandhara School of Art: Salient features, The Guptas: Cultural and Scientific Developments. Position of Women: Under the Mauryas, the Guptas and the Vardhanas.

### **UNIT-III**

Depiction of Punjab in the accounts of Chinese travelers. Fahien and Hwen Tsang. Main developments in literature, Education: Significant Developments: Taxila.

#### UNIT IV

Society and Culture on the eve of the Turkish invasion of Punjab, Punjab in the Kitab-ul-Hind of Alberuni, Important Historical places: Lahore, Multan Bathinda, Uchh, Jalandhar, Thanesar, Kangra, Taxila, Kundalvana, Pehowa, Thatta.

#### Text and References Books:

| S.NO. | Author's       | Title                                     | Publisher                   |
|-------|----------------|---|-----------------------------|
| 1     | Sukhdev Sharma | History And Culture Of Punjab             | New Academic Publisher      |
| 2     | Romila Thapar  | A History of India, Vol. I                | Penguin Books               |
| 3     | L.M.Joshi      | History and Culture of the Punjab, Vol. I | Punjabi University, Patiala |

#### PLANT ECOLOGY AND TAXONOMY PRACTICAL

|                              |   |
|------------------------------|---|
| <b>Course Code</b>           | <b>BOT104</b>   |
| <b>Course Title</b>          | <b>Plant Ecology and Taxonomy Practical</b>   |
| <b>Type of course</b>        | Practical   |
| <b>L T P</b>                 | 0 0 4   |
| <b>Credits</b>               | 2   |
| <b>Course prerequisite</b>   | 10+2 Medical  |
| <b>Course Objective (CO)</b> | To give practical knowledge about Ecosystem components and floral description of important angiosperm families.   |
| <b>Course Outcomes (CO)</b>  | 1. Analyze Plant systematics and perceive the significance of herbarium and Virtual herbarium<br>2. Evaluate the Important herbariums and botanical gardens in different areas.<br>3. Able to understand the characters of the families according to Bentham & Hooker's system of classification in botany. |

#### LIST OF EXPERIMENTS

1. Study of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, anemometer, psychrometer/hygrometer, rain gauge and lux meter.
2. Determination of pH, and analysis of two soil samples for carbonates, chlorides, nitrates, sulphates, organic matter and base deficiency by rapid field test.
3. Comparison of bulk density, porosity and rate of infiltration of water in soil of three habitats.
4. (a) Study of morphological adaptations of hydrophytes and xerophytes (four each). (b) Study of biotic interactions of the following: Stem parasite (*Cuscuta*), Root parasite (Orobanch), Epiphytes, Predation (Insectivorous plants)
5. Determination of minimal quadrat size for the study of herbaceous vegetation in the college campus by species area curve method. (species to be listed)

6. Quantitative analysis of herbaceous vegetation in the college campus for frequency and comparison with Raunkiaer's frequency distribution law
7. 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/Alyssum / Iberis*  
 Asteraceae –*Tagetes erecta/Ageratum conyzoides*  
 Solanaceae –*Solanum tuberosum, Withania*  
 Fabaceae-*Pisum sativum/Cassia fistula/Acacia nilotica*  
 Lamiaceae -*Salvia, Ocimum*  
 Liliaceae - *Asphodelus / Lilium / Allium.*  
 Gramineae-*Triticum*  
 Rosaceae-*Rosa indica*  
 Malvaceae-*Hibiscus Rosa sinensis*  
 Umbelliferae- *Coriandrum*  
 Asclepiadaceae- *Calotropis*  
 Euphorbiaceae- *Euphorbia*
8. Mounting of a properly dried and pressed specimen of any wild plant with herbarium label (to be submitted in the record book).

**Text and Reference Books:**

| S. No. | Title  | Author                       | Publisher                                       |
|--------|--|------------------------------|---|
| 1      | Concepts of Ecology                            | Kormondy, E.J                | Prentice Hall, U.S.A. 4th edition.              |
| 2      | Ecology and Environment                        | Sharma, P.D                  | Rastogi Publications, Meerut, India. 8th ed     |
| 3      | <i>Plant Systematics</i>                       | Simpson, M.G.                | Academic Press, San Diego, CA, U.S.A.           |
| 4      | <i>Plant Systematics: Theory and Practice.</i> | Singh, G.                    | Oxford & IBH Pvt. Ltd., New Delhi. 3rd edition. |
| 5      | An Introduction to Plant Taxonomy              | Jeffrey, C.                  | Cambridge University Press, London              |
| 6      | Fundamental of Plant Systematics               | Radford, A.E.,               | Harper and Row, New York                        |
| 7      | Principles of Angiosperm Taxonomy              | Davis, P.H. and Heywood, V.H | Oliver and Boyd, London.                        |



**Chemical energetic, Chemical Equilibrium and Functional Group organic chemistry**

|                              |   |
|------------------------------|---|
| <b>Course Code</b>           | <b>CHM104</b>   |
| <b>Course Title</b>          | Chemical energetic, Chemical Equilibrium and Functional Group organic chemistry-I   |
| <b>Type of course</b>        | Practical   |
| <b>L T P</b>                 | 0 0 4   |
| <b>Credits</b>               | 2   |
| <b>Course prerequisite</b>   | 10+2 Medical  |
| <b>Course Objective (CO)</b> | To enable the students practical knowledge about separation, purification, extraction of natural products and biomolecules.   |
| <b>Course Outcomes (CO)</b>  | 1. Accurately note down the melting and boiling point of organic compounds<br>2. Efficiently use of calorimeter in various experiments.<br>3. Find out the acidity, Basicity and PKa Value on pH meter. |

**Thermochemistry**

1. Determination of heat capacity of calorimeter for different volumes.
2. Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide.
3. Determination of enthalpy of ionization of acetic acid.
4. Determination of integral enthalpy of solution of salts ( $\text{KNO}_3$ ,  $\text{NH}_4\text{Cl}$ ).
5. Determination of enthalpy of hydration of copper sulphate.

**Ionic equilibria**

- a) Measurement of pH of different solutions like aerated drinks, fruit juices, shampoos and soaps (use dilute solutions of soaps and shampoos to prevent damage to the glass electrode) using pH-meter.
- b) Preparation of buffer solutions:
  - (i) Sodium acetate-acetic acid

(ii) Ammonium chloride-ammonium hydroxide  
Measurement of the pH of buffer solutions and comparison of the values with theoretical values.

1. Purification of organic compounds by crystallization (from water and alcohol) and distillation.
2. Criteria of Purity: Determination of melting and boiling points.
3. Preparations: Mechanism of various reactions involved to be discussed. Recrystallisation, determination of melting point and calculation of quantitative yields to be done.

(a) Bromination of Phenol/Aniline

(b) Benzoylation of amines/phenols

(c) Oxime and 2,4-dinitrophenylhydrazone of aldehyde/ketone

#### Text and Reference Books

| S. No | Name   | Author(S)  | Publisher                                    |
|-------|--|--|--|
| 1     | Electrochemical methods, Fundamentals and Methods                              | A.J. Bard, L.R. Faulkner,  | Wiley, 1980.                                 |
| 2     | Experimental Physical Chemistry  | C. Das, B. Behera  | Tata McGraw Hill Publishing Company Limited. |
| 3     | Vogel's Textbook of Practical Organic Chemistry (5 <sup>th</sup> Edition) 2003 | A.I. Vogel , A.R. Tatchell , B.S. Furnis , A.J. Hannaford , P.W.G. Smith | Pearson                                      |



**COMPARATIVE ANATOMY AND  
DEVELOPMENTAL BIOLOGY OF VERTEBRATES PRACTICAL**

|                             |   |
|-----------------------------|---|
| <b>Course Code</b>          | <b>ZOO104</b>   |
| <b>Course Title</b>         | <b>Comparative anatomy and developmental biology of vertebrates practical</b>   |
| <b>Type of course</b>       | Practical   |
| <b>L T P</b>                | 0    0    4   |
| <b>Credits</b>              | 2   |
| <b>Course prerequisite</b>  | 10+2 Medical  |
| <b>Course Objective</b>     | Study of skeletons of different vertebrates, different types of developmental stages of frog and reproductive organs of mammals.  |
| <b>Course Outcomes (CO)</b> | 1. Figure out how to utilize the similar technique to break down and fundamentally assess the structure and capacity of vertebrate frameworks.<br>2. Build up the abilities important to extensively evaluate the huge decent variety of vertebrates, both living and wiped out, and to thinkcritically about the proposed connections between gatherings.. |

**LIST OF EXPERIMENTS**

**1. Osteology:**

- a) Disarticulated skeleton of fowl and rabbit
- b) Carapace and plastron of turtle /tortoise
- c) Mammalian skulls: One herbivorous and one carnivorous animal.

2. Study of developmental stages of frogs, metamorphosis from tadpole to adult through permanent slides.
3. **Study of the different types of placenta-**  
Histological sections through permanent slides or photomicrographs.
4. Study of placental development in humans by ultrasound scans.
5. **Examination of gametes - frog/rat**  
Sperm and ova through permanent slides or photomicrographs.  
Study of histological section of testis and ovary through permanent slides.

**Text and Reference Books:**

| Sr No. | Title   | Author(s)                      | Publisher   |
|--------|---|--------------------------------|---|
| 1      | Vertebrates' Comparative Anatomy, Function and Evolution. IV Edition. | K.V Kardong                    | McGraw-Hill   |
| 2      | Comparative Anatomy of the Vertebrates. IX Edition                    | G.C. Kent and R.K Carr         | McGraw-Hill   |
| 3      | Analysis of Vertebrate Structure                                      | M. Hilderbrand and G.E. Gaslow | John Wiley and Sons   |
| 4      | Biology of Vertebrates  | H.E. Walter and L.P. Sayles    | Khosla Publishing House   |
| 5      | Developmental Biology, VIII Edition                                   | S.F. Gilbert                   | Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA. |
| 6      | An introduction to Embryology   | B.I. Balinsky                  | International Thomson Computer Press                                  |
| 7      | Patten's Foundations of Embryology                                    | Carlson, Bruce M               | McGraw Hill, Inc  |

## ANATOMY AND EMBRYOLOGY OF ANGIOSPERMS

|                             |   |
|-----------------------------|---|
| <b>Course Code</b>          | <b>BOT201</b>   |
| <b>Course Title</b>         | <b>Anatomy and Embryology of Angiosperms</b>  |
| <b>Type of course</b>       | Theory  |
| <b>L T P</b>                | 4 0 0   |
| <b>Credits</b>              | 4   |
| <b>Course Objective</b>     | <ul style="list-style-type: none"> <li>i. To study basic body plan of flowering plant, various tissue systems in higher plants, their structure, development and function.</li> <li>ii. To study structure, development and function of reproductive structures in flowering plants.</li> </ul> |
| <b>Course Outcomes (CO)</b> | 1. Comprehend Water connection of plants regarding different physiological procedures.<br>2. Analyze the chemical changes and scarcity symptoms in plants .<br>3. Classify aerobic and anaerobic respiration  |

### UNIT-I

**The basic body plan** of a flowering plant-modular type of growth.

**The Shoot System:** The shoot apical meristem and its histological organization; meristematic and permanent tissue, formation of internodes, branching pattern; monopodial and sympodial growth; canopy architecture; cambium and its functions; formation of secondary xylem; a general account of wood structure in relation to conduction of water and minerals; characteristics of growth rings, sapwood and heart wood; role of woody skeleton; secondary phloem-structurefunction relationships; periderm.

### UNIT-II

**Diversity in plant form** in annuals, biennials and perennials; trees-largest and longest-lived.

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

### UNIT-III

**The Root System:** The root apical meristem; differentiation of primary and secondary tissues and their roles; structural modification for storage, respiration, reproduction and for interaction with microbes.

**Vegetative Reproduction:** Various methods of vegetative propagation. Detailed study and types of grafting and budding, economic aspects.

### UNIT-IV

**Flower:** A modified shoot; structure, development and varieties of flower; functions; structure of anther and pistil; the male and female gametophytes; types of pollination; attractions and reward for pollinators; (sucking and foraging types); pollen-pistil interaction self incompatibility; double fertilization: formation of seed endosperm and embryo : fruit development and maturation.

**Significance of Seed:** Suspended animation; ecological adaptation; unit of genetic recombination with reference to reshuffling of genes and replenishment; dispersal strategies.

#### Text and reference books:

| Sr No. | Title                                       | Author                        | Publisher  |
|--------|---|-------------------------------|--|
| 1      | The Embryology of Angiosperms               | S SBhojwani and S P Bhatnagar | Vikas Publishing House, Delhi                              |
| 2      | Plant Propagation: Principles and Practices | H E Hartman and D E Kestler   | Prentice Hall of India Pvt. Ltd., New Delhi                |
| 3      | Plant Anatomy                               | J D Mauseth                   | Benjamin/Cummings Publishing Company Inc., California, USA |
| 4      | Anatomy of Seed Plants                      | K Peau                        | John Wiley & Sons, New York                                |

**Solutions , Phase Equilibrium, conductance, electrochemistry and functional group organic chemistry-II**

|                             |   |
|-----------------------------|---|
| <b>Course Code</b>          | <b>CHM 201</b>  |
| <b>Course Title</b>         | <b>Solutions , Phase Equilibrium, conductance, electrochemistry and functional group organic chemistry-II</b>   |
| <b>Type of course</b>       | CORE  |
| <b>L T P</b>                | 4:0:0   |
| <b>Credits</b>              | 4   |
| <b>Course prerequisite</b>  | BSc. 1 <sup>st</sup> with chemistry as core subject   |
| <b>Course Objective</b>     | The aim of this course is to impart knowledge to the students about basic of solution chemistry, phase equilibria, Electrochemistry and organic chemistry and natural polymers.   |
| <b>Course Outcomes (CO)</b> | 1.Carbohydrate and chiral approach, chiral drugs and medicinal chemistry.<br>2.Study of carbohydrates: Introduction of sugar, structure of triose tetrosa, panctose, hexoes, stereochemistry of glucose.<br>3.Acquire the knowledge of phase equilibria of various systems. |

**Unit-I**

Solutions: Thermodynamics of ideal solutions: Ideal solutions and Raoult's law, deviations from Raoult's law – non-ideal solutions. Vapour pressure-composition and temperature-composition curves of ideal and non-ideal solutions. Distillation of solutions. Lever rule. Azeotropes. Partial miscibility of liquids: Critical solution temperature; effect of impurity on partial miscibility of liquids. Immiscibility of liquids- Principle of steam distillation. Nernst distribution law and its applications, solvent extraction.

Phase Equilibrium: Phases, components and degrees of freedom of a system, criteria of phase equilibrium. Gibbs Phase Rule and its thermodynamic derivation. Derivation of Clausius – Clapeyron equation and its importance in phase equilibria. Phase diagrams of one-component systems (water and sulphur) and two component systems involving eutectics, congruent and incongruent melting points (lead-silver,  $\text{FeCl}_3\text{-H}_2\text{O}$  and Na-K only).

### **Unit-II**

Conductance: Conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes. Kohlrausch law of independent migration of ions Transference number and its experimental determination using Hittorf and Moving boundary methods. Ionic mobility. Applications of conductance measurements: determination of degree of ionization of weak electrolyte, solubility and solubility products of sparingly soluble salts, ionic product of water, hydrolysis constant of a salt. Conductometric titrations (only acid-base).

Electrochemistry: Reversible and irreversible cells. Concept of EMF of a cell. Measurement of EMF of a cell. Nernst equation and its importance. Types of electrodes. Standard electrode potential. Electrochemical series. Thermodynamics of a reversible cell, calculation of thermodynamic properties: G, H and S from EMF data. Calculation of equilibrium constant from EMF data. Concentration cells with transference and without transference. Liquid junction potential and salt bridge. pH determination using hydrogen electrode and quinhydrone electrode. Potentiometric titrations -qualitative treatment (acid-base and oxidation-reduction only).

### **Unit-III**

Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure. Carboxylic acids and their derivatives Carboxylic acids (aliphatic and aromatic) Preparation: Acidic and Alkaline hydrolysis of esters. Reactions: Hell – Vohlar - Zelinsky Reaction. Carboxylic acid derivatives (aliphatic): (Upto 5 carbons) Preparation: Acid chlorides, Anhydrides, Esters and Amides from acids and their interconversion. Reactions: Comparative study of nucleophilicity of acyl derivatives. Reformatsky Reaction, Perkin condensation. Amines and Diazonium Salts Amines (Aliphatic and Aromatic): (Upto 5 carbons)Preparation : from alkyl halides, Gabriel's Phthalimide synthesis, Hofmann Bromamide reaction. Reactions: Hofmann vs. Saytzeff elimination, Carbylamine test, Hinsberg test, with  $\text{HNO}_2$ , Schotten – Baumann Reaction. Electrophilic substitution (case aniline): nitration, bromination, sulphonation. Diazonium salts: Preparation: from aromatic amines. Reactions: conversion to benzene, phenol, dyes.

### **Unit-IV**

Amino Acids, Peptides and Proteins: Preparation of Amino Acids: Strecker synthesis using Gabriel's phthalimide synthesis. Zwitterion, Isoelectric point and Electrophoresis Reactions of Amino acids: ester of  $-\text{COOH}$  group, acetylation of  $-\text{NH}_2$  group, complexation with  $\text{Cu}^{2+}$  ions, ninhydrin test. Overview of Primary, Secondary, Tertiary and Quaternary Structure of proteins. Determination of Primary structure of Peptides by degradation Edmann degradation (N-terminal) and C-terminal (thiohydantoin and with carboxypeptidase enzyme).

Carbohydrates: Classification, and General Properties, Glucose and Fructose (openchain and cyclic structure), Determination of configuration of monosaccharides, absolute configuration of Glucose and Fructose, Mutarotation, ascending and descending in mono-saccharides. Structure

of disaccharides (sucrose, cellobiose, maltose, lactose) and polysaccharides (starch and cellulose) excluding their structure elucidation.

#### Text and Reference Books

| S. No | Name   | Author(S)  | Publisher                          |
|-------|--|--|------------------------------------|
| 1     | Natural Products: Chemistry and Biological Significance,             | Mann, J.; Davidson, R.S.; Hobbs, J.B.; Banthrope, D.V.; Harborne, J.B. | Longman, Esse                      |
| 2     | Organic reaction mechanism, 3 <sup>rd</sup> ed. Latest edition       | V. K. Ahluwalia  | Narosa publishing house, New Dehli |
| 3     | Organic Chemistry  | Morrison and Boyd  | Prentice Hall                      |
| 4     | Fundamentals of Organic Chemistry                                    | Solomons   | John Wiley                         |
| 5     | The Elements of Physical Chemistry                                   | P.w.Aikins   | Oxford                             |
| 6     | Physical Chemistry   | R.A. Alberty   | Wiley Eastern Ltd                  |
| 7     | Physical Electrochemistry- Fundamentals, Techniques and Applications | Eliezer Gileadi,   | Wiley-VCH                          |

#### ANIMAL PHYSIOLOGY AND BIOCHEMISTRY

|                             |  |
|-----------------------------|--|
| <b>Course Code</b>          | <b>ZOO-201</b>   |
| <b>Type of course</b>       | CORE   |
| <b>L T P</b>                | 4:0:0  |
| <b>Credits</b>              | 4  |
| <b>Course prerequisite</b>  | BSc. 1 <sup>st</sup> with chemistry as core subject  |
| <b>Course Objective</b>     | The aim of this course is to impart knowledge to the students about basic of solution chemistry, phase equilibria, Electrochemistry and organic chemistry and natural polymers.        |
| <b>Course Outcomes (CO)</b> | 1. Understand the deep concepts of assimilation, breath, excretion the functioning of nervous system<br>2. Interactions and interdependence of physiological and biochemical processes |

#### UNIT-I

**Nerve and muscle:** Structure of a neuron, Resting membrane potential, Graded potential, Origin of Action potential and its propagation in myelinated and non-myelinated nerve fibres, Ultra-structure of skeletal muscle, Molecular and chemical basis of muscle contraction

#### UNIT-II

**Digestion:** Physiology of digestion in the alimentary canal; Absorption of carbohydrates, proteins, lipids

**Respiration:** Pulmonary ventilation, Respiratory volumes and capacities, Transport of Oxygen and carbon dioxide in blood

**Excretion:** Structure of nephron, Mechanism of Urine formation, Counter-current Mechanism

**Cardiovascular system:** Composition of blood, Hemostasis, Structure of Heart, Origin and conduction of the cardiac impulse, Cardiac cycle

#### UNIT-III

**Reproduction and Endocrine Glands :**Physiology of male reproduction: hormonal control of spermatogenesis; Physiology of female reproduction: hormonal control of menstrual cycle. Structure and function of pituitary, thyroid, Parathyroid, pancreas and adrenal

#### UNIT –IV

**Carbohydrate Metabolism:** Glycolysis, Krebs Cycle, Pentose phosphate pathway, Gluconeogenesis, Glycogen metabolism, Review of electron transport chain

**Protein metabolism:** Transamination, Deamination and Urea Cycle

**Enzymes:** Introduction, Mechanism of action, Enzyme Kinetics, Inhibition and Regulation

#### Text and reference books:

| S.No | Title  | Author                                       | Publisher                                     |
|------|--|--|---|
| 1    | Principles of Anatomy and Physiology 8 <sup>th</sup> edition | Tortora, G.J. and Derrickson, B.H.           | John Wiley & Sons                             |
| 2    | Vander's Human Physiology, 11 <sup>th</sup> edition          | Widmaier, E.P., Raff, H. and Strang, K.T.    | McGraw Hill                                   |
| 3    | Textbook of Medical Physiology, 12 <sup>th</sup> edition     | Guyton, A.C. and Hall, J.E                   | Harcourt Asia Pvt. Ltd/ W.B. Saunders Company |
| 4    | Biochemistry, 6 <sup>th</sup> edition                        | Berg, J. M., Tymoczko, J. L. and Stryer, L   | W.H Freeman and Co.                           |
| 5    | Principles of Biochemistry, 6 <sup>th</sup> edition          | Nelson, D. L., Cox, M. M. and Lehninger, A.L | W.H. Freeman and Co.                          |



|                              |  |
|------------------------------|--|
| <b>Course Code</b>           | <b>EVS 001</b>   |
| <b>Course Title</b>          | <b>Environmental Science</b>   |
| <b>Type of course</b>        | Theory   |
| <b>L T P</b>                 | 3 0 0  |
| <b>Credits</b>               | 2  |
| <b>Course prerequisite</b>   | NA   |
| <b>Course Objective (CO)</b> | To make students aware about environment and need of maintaining it with best possible knowledge.  |
| <b>Course Outcomes (CO)</b>  | 1. Identifies simple observable features (e.g. shape, colour, texture, aroma) of leaves, trunk and bark of plants in immediate surroundings.<br>2. Suggests ways for hygiene, health, managing waste, disaster/emergency situations and protecting/saving resources (land, fuels, forests, etc.) and shows sensitivity for the disadvantaged/deprived. |

#### **UNIT-I**

**Introduction to Environment and Ecosystem:** Definition and scope and importance of multidisciplinary nature of environment. Need for public awareness, Concept of Ecosystem, Structure, interrelationship, producers, Consumers and decomposers, ecological pyramids-biodiversity and importance. Hot spots of biodiversity.

#### **UNIT-II**

**Environmental Pollution & Natural Resources:** Definition, Causes, effects and control measures of air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards. Solid waste Management: Causes, effects and control measure of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster Management: Floods, earthquake, cyclone and landslides, Natural Resources and associated problems, use and over exploitation, case studies of forest mresources and water resources.

### UNIT-III

**Social Issues and the Environment :** From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns. Case studies. Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies. Wasteland reclamation. Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of pollution) Act. Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation

### UNIT-IV

**Human Population and the Environment & Field Work:** Population growth, variation among nations. Population explosion –Family Welfare Programme. Environment and human health, Human Rights, Value Education, HIV/AIDS. Women and child Welfare. Role of Information Technology in Environment and human health. Case studies  
Visit to a local area to document environemntalassetsriver/forest/grassland/hill/mountain; Visit to a local polluted site-Urban/Rural/Industrial/Agricultural; Study of common plants, insects, birds; Study of simple ecosystems-pond, river, hill slopes, etc.

### Text and reference books:

| S. No | Title                                | Author(S)          | Publisher                |
|-------|--------------------------------------|--------------------|--------------------------|
| 1     | A Textbook for Environmental Studies | ErachBharucha      |                          |
| 2     | Environmental Biology,               | Agarwal, K.C. 2001 | Nidi Publ. Ltd. Bikaner. |
| 3     | Environmental Science,               | Miller T.G. Jr.    | Wadsworth                |

## ANATOMY AND EMBRYOLOGY OF ANGIOSPERMS PRACTICAL

|                             |  |
|-----------------------------|--|
| <b>Course Code</b>          | <b>BOT203</b>  |
| <b>Course Title</b>         | <b>Anatomy and Embryology of Angiosperms Practical</b>   |
| <b>Type of course</b>       | Practical  |
| <b>L T P</b>                | 0      0      4  |
| <b>Credits</b>              | 2  |
| <b>Course prerequisite</b>  | B.Sc1st year   |
| <b>Course Objective</b>     | To study plant anatomy and embryology through slides and specimens.  |
| <b>Course Outcomes (CO)</b> | 1.Explain the significance of Photosynthesis and respiration<br>2.Assess dormancy and germination in plants<br>3.Qualitative and quantitative determination of amino acids |

### LIST OF EXPERIMENTS

1. Study of any commonly occurring dicotyledonous plant (for example *Solanum nigrum* or *Kalanchoe*) to the body plan, organography and modular type of growth.
2. Life forms exhibited by flowering plants (by a visit to a forest or a garden, Study of tree-like habit in cycads, bamboo, banana, traveller's tree (*Revenalamadagascariensis*) and yucca and comparison with true trees as exemplified by conifers and dicotyledons.
3. L.S. Shoot tip to study the cytohistological zonation and origion of leaf primordia.
4. Monopodial and sympodial types of branching in stems (especially rhizomes).
5. Anatomy of primary and secondary growth in monocots and dicots using free hand razor technique (*Solanum*, *Boerhavia* *Helianthus*, *Mirabilis*, *Nyctanthus*, *Draceana*, *Maize*) hand

sections (or prepared slides). Structure of secondary phloem and xylem. Growth rings in wood, Microscopic study of wood in T.S., T.L.S. and R.L.S.

6. Field study of diversity in leaf shape, size, thickness, surface properties. Internal structure of leaf. Structure and development of stomata (using epidermal peels of leaf).

7. Anatomy of the root. Primary and secondary structure.

8. Examination of a wide range of flowers available in the locality and methods of their pollination.

9. Structure of anther, microsporogenesis (using slides) and pollen grains (using whole mounts). Pollen viability using in vitro pollen germination.

10. Structure of ovule and embryo sac development using serial sections) from permanent slides.

11. Nuclear and cellular endosperm. Embryo development in monocots and dicots (using permanent slides/dissections).

12. Simple experiments to show vegetative propagation (leaf cuttings in Bryophyllum. Sansevieria, Begonia; stem cuttings in rose, salix, money plant, Sugarcane and Bougainvillea).

13. Germination of non-dormant and dormant seeds.

**Text and reference books:**

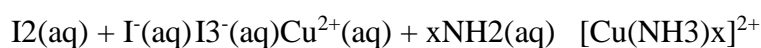
| Sr No. | Title                                       | Author                                | Publisher  |
|--------|---|---------------------------------------|--|
| 1      | The Embryology of Angiosperms               | S SBhojwani and S P Bhatnagar         | Vikas Publishing House, Delhi                              |
| 2      | Plant Propagation: Principles and Practices | H E Hartman and D E Kestler           | Prentice Hall of India Pvt. Ltd., New Delhi                |
| 3      | Plant Anatomy                               | J D Mauseth                           | Benjamin/Cummings Publishing Company Inc., California, USA |
| 4      | Anatomy of Seed Plants                      | K Peau                                | John Wiley & Sons, New York                                |
| 5      | The Principles of Pollination Biology       | K Pegeri and Vander Pijl              | Pergamon Press, Oxford                                     |
| 6      | Biology of Plants                           | P H Raven, R F Evert and S E Eichhorn | W.H.Freeman and Co., New York.                             |
| 7      | Trees: Their Natural History                | P Thomas                              | Cambridge University Press, Cambridge                      |



**Solutions , phase equilibrium, conductance, electrochemistry and functional organic chemistry-II PRACTICAL**

|                             |  |
|-----------------------------|--|
| <b>Course Code</b>          | <b>CHM 203</b>   |
| <b>Course Title</b>         | Solutions , phase equilibrium, conductance, electrochemistry and functional organic chemistry-II   |
| <b>Type of course</b>       | Practical  |
| <b>L T P</b>                | 0:0:4  |
| <b>Credits</b>              | 2  |
| <b>Course prerequisite</b>  | 10+2 with chemistry as core subject  |
| <b>Course Objective</b>     | To provide practical knowledge about conductometry , potentiometry and qualitative organic analysis.   |
| <b>Course outcomes (CO)</b> | 1.Carbohydrate and chiral approach, chiral drugs and medicinal chemistry.<br>2.Study of carbohydrates: Introduction of sugar, structure of triose tetrosa, panctose, hexoes, stereochemistry of glucose. |

**Distribution:** Study of the equilibrium of one of the following reactions by the distribution method:



**Phase equilibria**

Construction of the phase diagram of a binary system (simple eutectic) using cooling curves.

Determination of the critical solution temperature and composition of the phenol water system and study of the effect of impurities on it.

Study of the variation of mutual solubility temperature with concentration for the phenol water system and determination of the critical solubility temperature.

### Conductance

Determination of cell constant

Determination of equivalent conductance, degree of dissociation and dissociation constant of a weak acid.

Perform the following conductometric titrations:

- i. Strong acid vs. strong base
- ii. Weak acid vs. strong base

### Potentiometry

Perform the following potentiometric titrations:

- i. Strong acid vs. strong base
- ii. Weak acid vs. strong base
- iii. Potassium dichromate vs. Mohr's salt

Systematic Qualitative Organic Analysis of Organic Compounds possessing monofunctional groups (-COOH, phenolic, aldehydic, ketonic, amide, nitro, amines) and preparation of one derivative.

Separation of amino acids by paper chromatography.

Determination of the concentration of glycine solution by formylation method.

1. Titration curve of glycine
2. Action of salivary amylase on starch
3. Effect of temperature on the action of salivary amylase on starch.
4. Differentiation between a reducing and a non reducing sugar.

### Text and Reference Books

| S. No | Name  | Author(S)                               | Publisher                      |
|-------|---|---|--------------------------------|
| 01    | Vogel's Qualitative Inorganic Analysis      | Svehla                                  | Orient Longman                 |
| 02    | Laboratory Experiments on Organic Chemistry | R. Edemas, J.R. Johnson and C.F. Wilcox | The Macmillan Limited, London, |
|       | Laboratory Manual in Organic                | R.K. Bansal,                            | Wiley Eastern                  |

|    |                                 |                   |  |
|----|---------------------------------|-------------------|--|
|    | Chemistry                       |                   |  |
| 03 | Experimental Physical Chemistry | C. Das, B. Behera | Tata McGraw Hill Publishing Company Limited. |

### ANIMAL PHYSIOLOGY AND BIOCHEMISTRY PRACTICAL

|                             |  |
|-----------------------------|--|
| <b>Course Code</b>          | <b>ZOO203</b>  |
| <b>Course Title</b>         | <b>Physiology and Biochemistry Practical</b>   |
| <b>Type of course</b>       | Practical  |
| <b>L T P</b>                | 0 0 4  |
| <b>Credits</b>              | 2  |
| <b>Course prerequisite</b>  | B.Sc1st year   |
| <b>Course Objective</b>     | To study plant anatomy and embryology through slides and specimens.  |
| <b>Course Outcomes (CO)</b> | 1.Knowledge in the fundamentals of biochemistry of all the biomolecules like the carbohydrates ,proteins,lipids,nucleic acids,their classification structure and metabolism.<br>2.Understudies will pick up ability to execute the jobs of a science educator or clinical lab specialists with preparing as they have essential things |

#### LIST OF EXPERIMENTS

1. Preparation of hemin and hemochromogen crystals
2. Study of permanent histological sections of mammalian pituitary, thyroid, pancreas, adrenal gland.
3. Study of permanent slides of spinal cord, duodenum, liver, lung, kidney, bone, cartilage
4. Qualitative tests to identify functional groups of carbohydrates (Glucose, Fructose, Sucrose, Lactose),aminoacids and proteins and lipids in given sample.

5. Estimation of total carbohydrates by Dubois/anthrone method and total proteins by Lowry's method.
6. Study of activity of salivary amylase under optimum conditions.
7. Determination coagulation and bleeding time of blood in man/rat/rabbit.
8. Determination of blood groups of human blood sample.
9. Recording of blood pressure of man.
10. Analysis of urine for urea, chloride, glucose and uric acid.
11. Estimation of haemoglobin content.

**Text and reference books:**

| S.No | Title   | Author  | Publisher   |
|------|---|---|---|
| 1    | Principles of Anatomy and Physiology<br>8 <sup>th</sup> edition | Tortora, G.J. and<br>Derrickson, B.H.           | John Wiley & Sons                                   |
| 2    | Vander's Human Physiology, 11 <sup>th</sup> edition             | Widmaier, E.P., Raff,<br>H. and Strang, K.T.    | McGraw Hill   |
| 3    | Textbook of Medical Physiology, 12 <sup>th</sup><br>edition     | Guyton, A.C. and Hall,<br>J.E                   | Harcourt Asia Pvt. Ltd/<br>W.B. Saunders<br>Company |
| 4    | Biochemistry, 6 <sup>th</sup> edition                           | Berg, J. M., Tymoczko,<br>J. L. and Stryer, L   | W.H<br>Freeman and Co.                              |
| 5    | Principles of Biochemistry, 6 <sup>th</sup> edition             | Nelson, D. L., Cox, M.<br>M. and Lehninger, A.L | W.H. Freeman and Co.                                |

**PLANT PHYSIOLOGY AND METABOLISM**

|                              |   |
|------------------------------|---|
| <b>Course Code</b>           | <b>BOT202</b>   |
| <b>Course Title</b>          | <b>Plant Physiology and Metabolism</b>  |
| <b>Type of course</b>        | Theory  |
| <b>L T P</b>                 | 4 0 0   |
| <b>Credits</b>               | 4   |
| <b>Course prerequisite</b>   | 10+2 Medical  |
| <b>Course Objective (CO)</b> | To study underlying mechanism of basic plant metabolic and physiological processes.<br>To study concepts behind working of plant body.                          |
| <b>Course Outcomes (CO)</b>  | 1. Separate anabolic and catabolic pathways of digestion<br>2. Analyze the importance of Carbon consumption in photorespiration<br>3. Explain the ATP-Synthesis |

**UNIT-I**

**Plant-water relations:** Importance of water, physical properties of water, imbibitions, diffusion and osmosis, absorption, transport 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; Criteria of essentiality of elements; Role of essential elements; Transport of ions across cell membrane, active and passive transport, carriers, channels and pumps, Hydroponics.

## UNIT-II

**Translocation in phloem:** Composition of phloem sap, girdling experiment; Pressure flow model; Phloem loading and unloading.

**Photosynthesis:** Photosynthetic Pigments (Chl a, b, xanthophylls, carotene); Photosystem I and II, reaction center, antenna molecules; z-scheme, photophosphorylation, Electron transport and mechanism of ATP synthesis; C<sub>3</sub>, C<sub>4</sub> and CAM pathways of carbon fixation; Photorespiration.

## UNIT-III

**Carbohydrate metabolism:** Carbohydrates- classification, occurrence, structure of mono, oligo and polysaccharides (starch, cellulose, pectin). Carbohydrate breakdown-Glycolysis, anaerobic respiration, TCA cycle; Oxidative phosphorylation, electron transport mechanism (chemi-osmotic theory), redox potential, Glyoxylate cycle, Oxidative Pentose Phosphate Pathway.

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

## UNIT-IV

**Enzymes:** Structure and properties; Discovery and nomenclature, characteristics of enzymes, concept of holoenzyme, apoenzyme, coenzymes and cofactors regulation of enzyme activity. Mechanism of enzyme catalysis and enzyme inhibition.

**Plant growth development:** Definitions, phases of growth and development, kinetics of growth, seed dormancy, seed germination and factors of their regulation, plant movements, physiology of flowering, florigen concept, biological clocks, physiology of senescence, fruit ripening, Discovery and physiological roles of auxins, gibberellins, cytokinins, ABA, ethylene.

**Plant response to light and temperature:** Photoperiodism (SDP, LDP, Day neutral plants); Phytochrome (discovery and structure), red and far red light responses on photomorphogenesis; Vernalization.

### Text and reference books:

| S. No. | Title  | Author                       | Publisher           |
|--------|--|------------------------------|---------------------|
| 1      | Plant Physiology   | H N Srivastava               | Pradeep Publishers  |
| 2      | A Textbook of Plant Physiology, Biochemistry and Biotechnology | Dr S K Verma and Mohit Verma | S. Chand Publishing |
| 3      | Fundamentals of Plant Physiology                               | V K Jain                     | S. Chand Publishing |

|   |   |  |                         |
|---|---|--|-------------------------|
| 4 | Plant Physiology                                      | S N Pandey and B K Sinha                           | Vikas Publishing House  |
| 5 | Biochemistry and Molecular biology of Plants          | Bob B Buchanan, Wilhelm Grisse and Russell L Jones | Wiley International     |
| 6 | Experiments in Plant Physiology- A Laboratory Manual. | D Bajracharya                                      | Narosa Publishing House |

**Coordination chemistry, states of matter and chemical kinetics**

|                             |  |
|-----------------------------|--|
| <b>Course Code</b>          | <b>CHM 202</b>   |
| <b>Course Title</b>         | Coordination chemistry, states of matter and chemical kinetics   |
| <b>Type of course</b>       | CORE   |
| <b>L T P</b>                | 4:0:0  |
| <b>Credits</b>              | 4  |
| <b>Course prerequisite</b>  | BSc. 1 <sup>st</sup> with chemistry as core subject  |
| <b>Course Objective</b>     | The aim of this course is to impart knowledge to the students about basic of transition elements, their bonding, states of matter and chemical kinetics.   |
| <b>Course Outcomes (CO)</b> | 1.Gains knowledge about gamete formation, cleavage , gastrula formation and role of hormones in metamorphosis and regeneration in organisms.<br>2.Gives understudies knowledge into keeping up sound associations with their contrary sexual orientation and permits them tomake right decision about their life accomplice consequently forestalling innate/consanguial sicknesses. |

## Unit-I

Transition Elements (3d series): General group trends with special reference to electronic configuration, variable valency, colour, magnetic and catalytic properties, ability to form complexes and stability of various oxidation states (Latimer diagrams) for Mn, Fe and Cu. Lanthanoids and actinoids: Electronic configurations, oxidation states, colour, magnetic properties, lanthanide contraction, separation of lanthanides (ion exchange method only).

Coordination Chemistry: Valence Bond Theory (VBT): Inner and outer orbital complexes of Cr, Fe, Co, Ni and Cu (coordination numbers 4 and 6). Structural and stereoisomerism in complexes with coordination numbers 4 and 6. Drawbacks of VBT. IUPAC system of nomenclature.

## Unit-II

Crystal Field Theory: Crystal field effect, octahedral symmetry. Crystal field stabilization energy (CFSE), Crystal field effects for weak and strong fields. Tetrahedral symmetry. Factors affecting the magnitude of D. Spectrochemical series. Comparison of CFSE for *Oh* and *Td* complexes, Tetragonal distortion of octahedral geometry. Jahn-Teller distortion, Square planar coordination.

## Unit-III

Kinetic Theory of Gases: Postulates of Kinetic Theory of Gases and derivation of the kinetic gas equation. Deviation of real gases from ideal behaviour, compressibility factor, causes of deviation. van der Waals equation of state for real gases. Boyle temperature (derivation not required).

Maxwell Boltzmann distribution laws of molecular velocities and molecular energies (graphic representation – derivation not required) and their importance. Temperature dependence of these distributions. Most probable, average and root mean square velocities (no derivation). Collision cross section, collision number, collision frequency, collision diameter and mean free path of molecules. Viscosity of gases and effect of temperature and pressure on coefficient of viscosity (qualitative treatment only).

Liquids: Surface tension and its determination using stalagmometer. Viscosity of a liquid and determination of coefficient of viscosity using Ostwald viscometer. Effect of temperature on surface tension and coefficient of viscosity of a liquid (qualitative treatment only).

Solids: Forms of solids. Symmetry elements, unit cells, crystal systems, Bravais lattice types and identification of lattice planes. Laws of Crystallography - Law of constancy of interfacial angles, Law of rational indices. Miller indices. X-Ray diffraction by crystals, Bragg's law. Structures of NaCl, KCl and CsCl (qualitative treatment only). Defects in crystals.

## Unit-IV

Chemical Kinetics: 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. Concept of activation energy and its calculation from Arrhenius equation. Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular reactions. Comparison of the two theories (qualitative treatment only).

### Text and Reference Books

| S. No | Name                                     | Author(S)              | Publisher                 |
|-------|--|------------------------|---------------------------|
| 1     | Concise Inorganic Chemistry              | I.D. Lee               | ELBS                      |
| 2     | Inorganic Chemistry                      | A.G. Sharpe            | ELBS                      |
| 3     | Introduction to Ligand Field             | B.N. Figgis            | Wiley Eastern.            |
| 4     | Introduction to Liquid State             | P.A. Eglestaff         | Academic Press.           |
| 5     | The Elements of Physical Chemistry       | P.w.Aikins             | Oxford                    |
| 6     | Physical Chemistry, A Molecular Approach | MacQuarrie and Simon   | University Science Books, |
| 7     | Principles of Inorganic Chemistry        | Puri, Sharma and Kalia | Vishal publishers         |

### GENETICS AND EVOLUTIONARY BIOLOGY

|                              |  |
|------------------------------|--|
| <b>Course Code</b>           | <b>ZOO 202</b>   |
| <b>Course Title</b>          | <b>Genetics and Evolutionary Biology</b>   |
| <b>Type of course</b>        | Theory   |
| <b>L T P</b>                 | 4 0 0  |
| <b>Credits</b>               | 4  |
| <b>Course prerequisite</b>   | B.ScIst year   |
| <b>Course Objective (CO)</b> | To make student aware about genetic material, chromosomes, their structure and function, basis of genetics/inheritance and changes occurring in animal species during various evolutionary eras.   |
| <b>Course Outcomes (CO)</b>  | 1.Students will understand the concept of mendels laws in genetics, inheritance law and central dogma in biology.<br>2.Understanding of genetic basis of evolution, human karyotyping and speciation<br>3. Students learn the concepts of ductless gland or endocrine system and homeostasis a brief account of genes and evolution. |

#### UNIT-I

**Introduction to Genetics:**Mendel's work on transmission of traits, Genetic Variation, Molecular basis of Genetic Information

**Mendelian Genetics and its Extension:**Principles of Inheritance, Chromosome theory of inheritance, Incomplete dominance and codominance, Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, sex linked inheritance,extra-chromosomal inheritance

#### UNIT-II

**Linkage, Crossing Over and Chromosomal Mapping:**Linkage and crossing over, Recombination frequency as a measure of linkage intensity, two factor and three factor crosses, Interference and coincidence, Somatic cell genetics – an alternative approach to gene mapping

**Mutations:**Chromosomal Mutations: Deletion, Duplication, Inversion, Translocation, Aneuploidy and Polyploidy; Gene mutations: Induced versus Spontaneous mutations, Back versus Suppressor Mutations.

**Sex Determination:**Chromosomal mechanisms, dosage compensation

#### UNIT-III

**History of Life :**Major Events in History of Life

**Introduction to Evolutionary Theories:**Lamarckism, Darwinism, Neo-Darwinism

**Direct Evidences of Evolution:**Types of fossils, Incompleteness of fossil record, Dating of fossils, Phylogeny of horse

**Processes of Evolutionary Change:**Organic variations; Isolating Mechanisms; Natural selection (Example: Industrial melanism);Types of natural selection (Directional, Stabilizing, Disruptive), Artificial selection

#### UNIT-IV

**Species Concept :**Biological species concept (Advantages and Limitations); Modes of speciation (Allopatric,Sympatric)

**Macro-evolution:**Macro-evolutionary Principles (example: Darwin's Finches)

**Extinction :**Mass extinction (Causes, Names of five major extinctions, K-T extinction in detail), Role of extinction in evolution

#### Text and Reference Books:

| S.No | Title   | Author   | Publisher                |
|------|---|--|--------------------------|
| 1    | Principles of Genetics, 8 <sup>th</sup> edition           | Gardner, E.J., Simmons, M.J., Snustad, D.P.                        | Wiley India              |
| 2    | Principles of Genetics, 5 <sup>th</sup> edition           | Snustad, D.P., Simmons, M.J  | John Wiley and Sons Inc. |
| 3    | Concepts of Genetics, 10 <sup>th</sup> edition            | Klug, W.S., Cummings, M.R., Spencer, C.A                           | Benjamin Cummings        |
| 4    | Genetics- A Molecular Approach, 3 <sup>rd</sup> edition   | Russell, P. J.   | Benjamin Cummings.       |
| 5    | Introduction to Genetic Analysis, 9 <sup>th</sup> edition | Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. | W. H. Freeman and Co.    |
| 6    | Evolution, 3 <sup>rd</sup> edition                        | Ridley, M.   | Blackwell Publishing     |
| 7    | Evolutionary Biology                                      | Douglas, J. Futuyma  | Sinauer Associates.      |



### PLANT PHYSIOLOGY AND METABOLISM PRACTICAL

|                             |   |
|-----------------------------|---|
| <b>Course Code</b>          | <b>BOT204</b>   |
| <b>Course Title</b>         | <b>Plant Physiology and Metabolism Practical</b>  |
| <b>Type of course</b>       | Practical   |
| <b>L T P</b>                | 0 0 4   |
| <b>Credits</b>              | 2   |
| <b>Course prerequisite</b>  | 10+2 Medical  |
| <b>Course Objective</b>     | To impart knowledge about plant functions through simple physiological experiments  |
| <b>Course Outcomes (CO)</b> | 1. Separate anabolic and catabolic pathways of digestion<br>2. Analyze the importance of Carbon consumption in photorespiration<br>3. Explain the ATP-Synthesis |

#### LIST OF EXPERIMENTS

1. Determination of osmotic potential of plant cell sap by plasmolytic method.
2. To study the rate of transpiration from foliar surfaces.
3. Calculation of stomatal index and stomatal frequency of a mesophyte and a xerophyte.
4. Demonstration of Hill reaction.

5. Demonstrate the activity of catalase and study the effect of pH and enzyme concentration.
6. To study the effect of light intensity and bicarbonate concentration on O<sub>2</sub> evolution in photosynthesis.
7. Comparison of the rate of respiration in any two parts of a plant.
8. To obtain the action spectrum of chlorophyll pigment.
9. Separation of amino acids by paper chromatography.

**Demonstration experiments (any two)**

1. Bolting.
2. Effect of auxins on rooting.
3. Suction due to transpiration.
4. R.Q.

**Text and reference books:**

| S. No. | Title  | Author                       | Publisher           |
|--------|--|------------------------------|---------------------|
| 1      | Plant Physiology   | H N Srivastava               | Pradeep Publishers  |
| 2      | A Textbook of Plant Physiology, Biochemistry and Biotechnology | Dr S K Verma and Mohit Verma | S. Chand Publishing |

**COORDINATION CHEMISTRY, STATES OF MATTER AND CHEMICAL KINETICS  
PRACTICAL**

|                             |   |
|-----------------------------|---|
| <b>Course Code</b>          | CHM 204   |
| <b>Course Title</b>         | Coordination chemistry, states of matter and chemical kinetics  |
| <b>Type of course</b>       | Practical   |
| <b>L T P</b>                | 0:0:4   |
| <b>Credits</b>              | 2   |
| <b>Course prerequisite</b>  | BSc. 1st with chemistry as core subject   |
| <b>Course Objective</b>     | The aim of this course is to impart practical knowledge to the students about semi micro qualitative analysis and physical properties of solutions.   |
| <b>Course Outcomes (CO)</b> | 1. Compare the viscosity and surface tension of different liquids and solutions.<br>2. To understand the concept of hardness of water and its analysis by EDTA method.<br>3. Understand and master the technique of gravimetric analysis. |

**LIST OF EXPERIMENTS**

Semi-micro qualitative analysis (using H<sub>2</sub>S or other methods) of mixtures - not more than four ionic species (two anions and two cations, excluding insoluble salts) out of the following: Cations : NH<sub>4</sub><sup>+</sup>, Pb<sup>2+</sup>, Bi<sup>3+</sup>, Cu<sup>2+</sup>, Cd<sup>2+</sup>, Fe<sup>3+</sup>, Al<sup>3+</sup>, Co<sup>2+</sup>, Ni<sup>2+</sup>, Mn<sup>2+</sup>, Zn<sup>2+</sup>, Ba<sup>2+</sup>, Sr<sup>2+</sup>, Ca<sup>2+</sup>, K<sup>+</sup> Anions : CO<sub>3</sub><sup>2-</sup>, S<sup>2-</sup>, SO<sub>3</sub><sup>2-</sup>, S<sub>2</sub>O<sub>3</sub><sup>2-</sup>, NO<sub>3</sub><sup>-</sup>, CH<sub>3</sub>COO<sup>-</sup>, Cl<sup>-</sup>, Br<sup>-</sup>, I<sup>-</sup>, NO<sub>2</sub><sup>-</sup>, SO<sub>4</sub><sup>2-</sup>, PO<sub>4</sub><sup>3-</sup>, BO<sub>3</sub><sup>3-</sup>, C<sub>2</sub>O<sub>4</sub><sup>2-</sup>, F<sup>-</sup> (*Spot tests should be carried out wherever feasible*)

1. Estimate the amount of nickel present in a given solution as bis(dimethylglyoximate) nickel(II) or aluminium as oximate in a given solution gravimetrically.
2. Estimation of (i) Mg<sup>2+</sup> or (ii) Zn<sup>2+</sup> by complexometric titrations using EDTA.
3. Estimation of total hardness of a given sample of water by complexometric titration.

(I) Surface tension measurement (use of organic solvents excluded).

- a) Determination of the surface tension of a liquid or a dilute solution using a stalagmometer.
- b) Study of the variation of surface tension of a detergent solution with concentration.

(II) Viscosity measurement (use of organic solvents excluded).

- a) Determination of the relative and absolute viscosity of a liquid or dilute solution using an Ostwald's viscometer.
- b) Study of the variation of viscosity of an aqueous solution with concentration of solute.

(III) Chemical Kinetics

Study the kinetics of the following reactions.

1. Initial rate method: Iodide-persulphate reaction
2. Integrated rate method:
  - a. Acid hydrolysis of methyl acetate with hydrochloric acid.
  - b. Saponification of ethyl acetate.
  - c. Compare the strengths of HCl and H<sub>2</sub>SO<sub>4</sub> by studying kinetics of hydrolysis of methyl acetate

### Text and Reference Books

| S. No | Name   | Author(S)                      | Publisher      |
|-------|--|--------------------------------|----------------|
| 1     | Vogel's Qualitative Inorganic Analysis                         | Svehla                         | Orient Longman |
| 2     | Vogel's Textbook of Quantitative Inorganic Analysis (revised), | J. Basseff, R.C. Dennery, G.H. | ELBS           |

|   |                              |                        |  |
|---|------------------------------|------------------------|--|
|   |                              | Jeffery and J. Mendham |  |
| 3 | Advanced Practical Chemistry | Physical               | J.B. Yadav<br>KRISHNA Prakashan Media (P) Ltd, |

### GENETICS AND EVOLUTIONARY BIOLOGY PRACTICAL

|                             |  |
|-----------------------------|--|
| <b>Course Code</b>          | <b>ZOO204</b>  |
| <b>Course Title</b>         | <b>Genetics and Evolutionary Biology Practical</b>   |
| <b>Type of course</b>       | Practical  |
| <b>L T P</b>                | 0 0 4  |
| <b>Credits</b>              | 2  |
| <b>Course prerequisite</b>  | 10+2 Medical   |
| <b>Course Objective</b>     | To impart knowledge about plant functions through simple physiological experiments   |
| <b>Course Outcomes (CO)</b> | 1.Gains knowledge about gamete formation, cleavage , gastrula formation and role of hormones in metamorphosis and regeneration in organisms.<br>2.Gives understudies knowledge into keeping up sound associations with their contrary sexual orientation and permits them tomake right decision about their life accomplice consequently forestalling innate/consanguial sicknesses. |

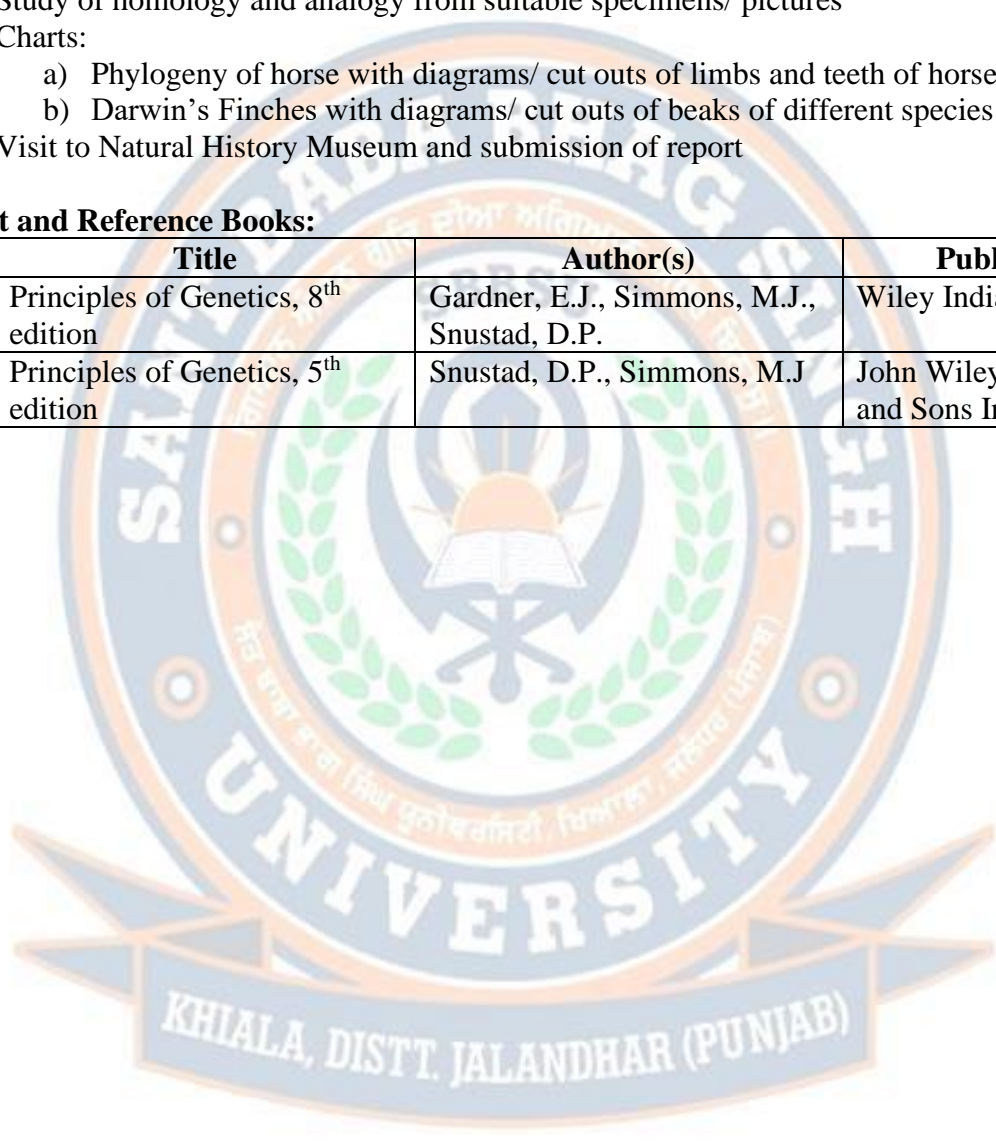
### LIST OF EXPERIMENTS

1. Study of Mendelian Inheritance and gene interactions (Non Mendelian Inheritance) using

- suitable examples. Verify the results using Chi-square test.
2. Study of Linkage, recombination, gene mapping using the data.
  3. Study of Human Karyotypes (normal and abnormal).
  4. Study of fossil evidences from plaster cast models and pictures
  5. Study of homology and analogy from suitable specimens/ pictures
  6. Charts:
    - a) Phylogeny of horse with diagrams/ cut outs of limbs and teeth of horse ancestors
    - b) Darwin's Finches with diagrams/ cut outs of beaks of different species
  7. Visit to Natural History Museum and submission of report

**Text and Reference Books:**

| S.No | Title   | Author(s)                                   | Publisher                |
|------|---|---|--------------------------|
| 1    | Principles of Genetics, 8 <sup>th</sup> edition | Gardner, E.J., Simmons, M.J., Snustad, D.P. | Wiley India              |
| 2    | Principles of Genetics, 5 <sup>th</sup> edition | Snustad, D.P., Simmons, M.J                 | John Wiley and Sons Inc. |



## Skill Enhancement Courses



### Medicinal Botany

|                             |  |
|-----------------------------|--|
| <b>Course Code</b>          | <b>BOT 205</b>   |
| <b>Course Title</b>         | <b>Medicinal Botany</b>  |
| <b>Type of course</b>       | <b>Skill Enhancement Courses</b>   |
| <b>L T P</b>                | 0 0 4  |
| <b>Credits</b>              | 2  |
| <b>Course prerequisite</b>  | B.Sc Medical II year   |
| <b>Course Objective</b>     | To understand medicinal plant with references to Botany.   |
| <b>Course Outcomes (CO)</b> | i) Understand different systems of traditional medicines<br><br>ii) Acquire knowledge on collection and processing of herbal drugs |

**Unit 1:** History, Scope and Importance of Medicinal Plants. Indigenous Medicinal Sciences; Definition and Scope-Ayurveda: History, origin, panchamahabhutas, saptadhatu and tridosha concepts, Rasayana, plants used in ayurvedic treatments, Siddha: Origin of Siddha

medicinal systems, Basis of Siddha system, plants used in Siddha medicine. Unani: History, concept: Umoor-e- tabiya, tumors treatments/ therapy, polyherbal formulations. **(10 Lectures)**

**Unit 2:** Conservation of endangered and endemic medicinal plants. Definition: endemic and endangered medicinal plants, Red list criteria; In situ conservation: Biosphere reserves, sacred groves, National Parks; Ex situ conservation: Botanic Gardens, Ethnomedicinal plant Gardens. Propagation of Medicinal Plants: Objectives of the nursery, its classification, important components of a nursery, sowing, pricking, use of green house for nursery production, propagation through cuttings, layering, grafting and budding. **(10 Lectures)**

**Unit 3:** Ethnobotany and Folk medicines. Definition; Ethnobotany in India: Methods to study ethnobotany; Applications of Ethnobotany: National interact, Palaeo-ethnobotany. folk medicines of ethnobotany, ethnomedicine, ethnoecology, ethnic communities of India. Application of natural products to certain diseases- Jaundice, cardiac, infertility, diabetics, Blood pressure and skin diseases. **(10 Lectures)**

### Text and Reference Books

| S.No | Title   | Author(s)        | Publisher                           |
|------|---|------------------|-------------------------------------|
| 1    | Medicinal Plants: Ethnobotanical Approach, Agrobios, India.                               | Trivedi P C,     | Tata McGraw-Hill Publishing Co. Ltd |
| 2    | Medicinal Plant Cultivation: A Scientific Approach, 2 <sup>nd</sup> edn. Agrobios, India. | Purohit and Vyas | Oxford University Press, New York   |

### MEDICAL DIAGNOSTICS

|                             |   |
|-----------------------------|---|
| <b>Course Code</b>          | <b>ZOO 205</b>  |
| <b>Course Title</b>         | Medical Diagnostics   |
| <b>Type of course</b>       | Skill Enhancement Courses   |
| <b>L T P</b>                | 2 0 0   |
| <b>Credits</b>              | 2   |
| <b>Course prerequisite</b>  | B.ScIst year  |
| <b>Course Objective</b>     | To make students familiar with latest techniques available to diagnose different diseases, their preventive measures and treatments.  |
| <b>Course Outcomes (CO)</b> | <p>i) To familiarize the students regarding various dimensions of Medical lab technology and career opportunities available in these fields.</p> <p>ii) To develop practical understanding among the students associated with Medical lab through classroom discussion/ participation and projects.</p> |

## UNIT-I

### Introduction to Medical Diagnostics and its Importance

## UNIT-II

**Diagnostics Methods Used for Analysis of Blood:** Blood composition, Preparation of blood smear and Differential Leucocyte Count(D.L.C) using Leishman's stain, Platelet count using haemocytometer, Erythrocyte Sedimentary Rate (E.S.R), Packed Cell Volume (P.C.V.)

**Diagnostic Methods Used for Urine Analysis:** Urine Analysis: Physical characteristics; Abnormal constituents.

## UNIT-III

**Non-infectious Diseases:** Causes, types, symptoms, complications, diagnosis and prevention of Diabetes (Type I and Type II), Hypertension (Primary and secondary), Testing of blood glucose using Glucometer/Kit

## UNIT-IV

**Infectious Diseases:** Causes, types, symptoms, diagnosis and prevention of Tuberculosis and Hepatitis

**Tumours:** Types (Benign/Malignant), Detection and metastasis; Medical imaging: X-Ray of Bone fracture, PET, MRI and CT Scan (using photographs).

### Text and reference books:

| S. No | Title  | Author(s)                   | Publisher                |
|-------|--|-----------------------------|--------------------------|
| 1     | Preventive and Social Medicine   | Park K                      | B.B. Publishers          |
| 2     | Textbook of Medical Laboratory Technology, II Edition                          | Godkar P.B. and Godkar D.P. | Bhalani Publishing House |
| 3     | A Laboratory Manual for Rural Tropical Hospitals, A Basis for Training Courses | Cheesbrough M               |                          |
| 4     | Textbook of Medical Physiology   | Guyton A.C. and Hall J.E    | Saunders                 |
| 5     | Pathologic Basis of Disease, VIII Edition                                      | Robbins and Cortan          | Saunders                 |



### BASIC ANALYTICAL CHEMISTRY

|                              |   |
|------------------------------|---|
| <b>Course Code</b>           | <b>CHM 209</b>  |
| <b>Course Title</b>          | <b>Basic analytical chemistry</b>   |
| <b>Type of course</b>        | Skill Enhancement Courses   |
| <b>L T P</b>                 | 0:0:4   |
| <b>Credits</b>               | 2   |
| <b>Course prerequisite</b>   | Bsc. Ist, IInd year with CHEMISTRY as core subject  |
| <b>Course Objective (CO)</b> | The aim of this course is to impart practical knowledge to the students about analytical methods of chemical analysis . |

**Course Outcomes (CO)**

- i) Employ a variety of analytical and instrumental methods to prepare, separate and quantify samples from various matrices.
- ii) Apply the scientific process, including statistical treatment of data, in the conduct and reporting of chemical analysis.

**UNIT I:**

Introduction: Introduction to Analytical Chemistry and its interdisciplinary nature. Concept of sampling. Importance of accuracy, precision and sources of error in analytical measurements. Presentation of experimental data and results, from the point of view of significant figures. Analysis of soil: Composition of soil, Concept of pH and pH measurement, Complexometric titrations, Chelation, Chelating agents, use of indicators. Determination of pH of soil samples. b. Estimation of Calcium and Magnesium ions as Calcium carbonate by complexometric titration. Analysis of water: Definition of pure water, sources responsible for contaminating water, water sampling methods, water purification methods. a. Determination of pH, acidity and alkalinity of a water sample. b. Determination of dissolved oxygen (DO) of a water sample.

**UNIT II:**

Analysis of food products: Nutritional value of foods, idea about food processing and food preservations and adulteration.

- a. Identification of adulterants in some common food items like coffee powder, asafoetida, chilli powder, turmeric powder, coriander powder and pulses, etc.
- b. Analysis of preservatives and colouring matter.

Chromatography: Definition, general introduction on principles of chromatography, paper chromatography, TLC etc.

- a. Paper chromatographic separation of mixture of metal ion ( $\text{Fe}^{3+}$  and  $\text{Al}^{3+}$ )
- b. To compare paint samples by TLC method.

**UNIT III:**

Ion-exchange: Column, ion-exchange chromatography etc. Determination of ion exchange capacity of anion / cation exchange resin (using batch procedure if use of column is not feasible). Analysis of cosmetics: Major and minor constituents and their function

- a. Analysis of deodorants and antiperspirants, Al, Zn, boric acid, chloride, sulphate.
- b. Determination of constituents of talcum powder: Magnesium oxide, Calcium oxide, Zinc oxide and Calcium carbonate by complexometric titration.

**Unit IV:**

Suggested Applications (Any one):

- a. To study the use of phenolphthalein in trase cases.
- b. To analyze arson accelerants.
- c. To carry out analysis of gasoline.

Suggested Instrumental demonstrations:

- a. Estimation of macro nutrients: Potassium, Calcium, Magnesium in soil samples by flame photometry.
- b. Spectrophotometric determination of Iron in Vitamin / Dietary Tablets.

c. Spectrophotometric Identification and Determination of Caffeine and Benzoic Acid in Soft drink

### Text and Reference Books

| S. No | Name  | Author(S)   | Publisher                   |
|-------|---|---|-----------------------------|
| 1     | Concise Inorganic Chemistry   | I.D. Lee  | ELBS                        |
| 2     | Inorganic Chemistry   | A.G. Sharpe   | ELBS                        |
| 3     | Vogel's Qualitative Inorganic Analysis (7 <sup>th</sup> Edition). ISBN-13:978-0582218666, | G Svehla  | Prentice Hall               |
| 4     | Vogel's Quantitative Chemical Analysis (6 <sup>th</sup> Edition), ISBN-13:978-0582226289, | J. Mendham, R.C. Denney, J.D. Barnes, M.J.K. Thomas | Prentice Hall               |
| 5     | Instrumental Analysis   | G.D. Christian and J.E.G. Reily                     | AllegnBecon, Latest edition |
| 6     | Instrumental Methods of Chemical Analysis   | G.W.Ewing,  | McGraw Hill Pub, 1975.      |

### FLORICULTURE

|                              |  |
|------------------------------|--|
| <b>Course Code</b>           | <b>BOT206</b>  |
| <b>Course Title</b>          | <b>Floriculture</b>  |
| <b>Type of course</b>        | Theory   |
| <b>L T P</b>                 | 2 0 0  |
| <b>Credits</b>               | 2  |
| <b>Course prerequisite</b>   | B.ScIIInd year   |
| <b>Course Objective (CO)</b> | To provide knowledge about commercial aspect of floriculture in India which may motivate students to take up it as professional occupation   |
| <b>Course Outcomes (CO)</b>  | i ) Discuss the historical development and current characteristics of the world floricultural industry.<br><br>ii) Apply the essential methods and technologies used in the production |

|  |   |
|--|---|
|  | of cut flower, cut foliage and tender pot plant products. |
|--|---|

### UNIT-I

**Introduction:** History of gardening; Importance and scope of floriculture and landscape gardening.

**Nursery Management and Routine Garden Operations:** Sexual and vegetative methods of propagation; Soil sterilization; Seed sowing; Pricking; Planting and transplanting; Shading; Stopping or pinching; Defoliation; Wintering; Mulching; Topiary; Role of plant growth regulators.

### UNIT-II

**Ornamental Plants:** Flowering annuals; Herbaceous perennials; Divine vines; Shade and ornamental trees; Ornamental bulbous and foliage plants; Cacti and succulents; Palms and Cycads; Ferns and Selaginellas; Cultivation of plants in pots; Indoor gardening; Bonsai.

### UNIT-III

**Principles of Garden Designs:** English, Italian, French, Persian, Mughal and Japanese gardens; Features of a garden (Garden wall, Fencing, Steps, Hedge, Edging, Lawn, Flower beds, Shrubbery, Borders, Water garden. Some Famous gardens of India.

**Landscaping Places of Public Importance:** Landscaping highways and Educational institutions.

### UNIT-IV

**Commercial Floriculture:** Factors affecting flower production; Production and packaging of cut flowers; Flower arrangements; Methods to prolong vase life; Cultivation of Important cut flowers (Carnation, Aster, Chrysanthemum, Dahlia, Gerbera, Gladiolous, Marigold, Rose, Liliun, Orchids).

**Diseases and Pests of Ornamental Plants.**

**Text and reference books:**

| S. No. | Title                 | Author                             | Publisher          |
|--------|-----------------------|------------------------------------|--------------------|
| 1      | Floriculture in India | Randhawa, G.S. and Mukhopadhyay, A | Allied Publishers. |



### GREEN METHODS IN CHEMISTRY

|                              |   |
|------------------------------|---|
| <b>Course Code</b>           | <b>CHM 210</b>  |
| <b>Course Title</b>          | <b>GREEN METHOD IN CHEMISTRY</b>  |
| <b>Type of course</b>        | <b>SAC (THEORY)</b>   |
| <b>L T P</b>                 | 4:0:0   |
| <b>Credits</b>               | 4   |
| <b>Course prerequisite</b>   | Bsc. Ist, IInd year with CHEMISTRY as core subject  |
| <b>Course Objective (CO)</b> | The aim of this course is to impart theoretical knowledge to the students Green chemistry and applications of green chemistry in organic synthesis. |

|                             |  |
|-----------------------------|--|
| <b>Course Outcomes (CO)</b> | <p>i) To equip the students as a valuable citizen in protecting our environment</p> <p>ii) To facilitate the student to be a good entrepreneur in energy resources</p> |
|-----------------------------|--|

### UNIT – I

Introduction: Definitions of Green Chemistry. Brief introduction of twelve principles of Green Chemistry, with examples, special emphasis on atom economy, reducing toxicity, green solvents, Green Chemistry and catalysis and alternative sources of energy, Greenenergy and sustainability.

### UNIT – II

The Real world Cases in Green Chemistry: Surfactants for carbon dioxide – Replacing smog producing and ozone depleting solvents with CO<sub>2</sub> for precision cleaning and dry cleaning of garments.

Designing of environmentally safe marine antifoulant.

### UNIT – III

Right fit pigment: Synthetic azo pigments to replace toxic organic and inorganic pigments. An efficient, green synthesis of a compostable and widely applicable plastic (poly lactic acid) made from corn.

### UNIT – IV

Preparation and characterization of biodiesel from vegetable oil. Extraction of D-limonene from orange peel using liquid CO<sub>2</sub> prepared from dry ice. Mechano- chemical solvent free synthesis of azomethine. Solvent free, microwave assisted one pot synthesis of phthalocyanine complex of copper(II).

### Text and Reference Books

| S. No | Name  | Author(S)                    | Publisher                             |
|-------|---|------------------------------|---------------------------------------|
| 1     | Green Chemistry- Theory and Practical, 1998 | Anastas, P.T. & Warner, J.K. | Oxford University Press               |
| 2     | Introduction to Green Chemistry, 2001       | Matlack, A.S.                | Marcel Dekker                         |
| 3     | Real-World cases in Green Chemistry, 2000   | Cann, M.C. & Connely, M.E.   | American Chemical Society, Washington |
| 4     | Introduction to Green Chemistry, 2002       | Ryan, M.A. & Tinnesand, M.   | American Chemical Society, Washington |



### Ethnobotany

|                             |   |
|-----------------------------|---|
| <b>Course Code</b>          | <b>BOT204</b>   |
| <b>Course Title</b>         | <b>Ethnobotany</b>  |
| <b>Type of course</b>       | Theory  |
| <b>L T P</b>                | 0 0 4   |
| <b>Credits</b>              | 2   |
| <b>Course prerequisite</b>  | 10+2 Medical  |
| <b>Course Objective</b>     | To impart knowledge about plant functions through simple physiological experiments  |
| <b>Course Outcomes (CO)</b> | i) Describe how the science of ethnobotany is applied in the understanding of relationships between plants and indigenous/traditional cultures. |

|  |  |
|--|--|
|  | ii) Develop the skills and methods used to collect, classify and preserve plant materials. |
|--|--|

### **Unit 1: Ethnobotany**

Introduction, concept, scope and objectives; Ethnobotany as an interdisciplinary science. The relevance of ethnobotany in the present context; Major and minor ethnic groups or Tribals of India, and their life styles. Plants used by the tribals: a) Food plants b) intoxicants and beverages c) Resins and oils and miscellaneous uses. (6 Lectures)

### **Unit 2: Methodology of Ethnobotanical studies**

a) Field work b) Herbarium c) Ancient Literature d) Archaeological findings e) temples and sacred places. (6 Lectures)

### **Unit 3: Role of ethnobotany in modern Medicine**

Medico-ethnobotanical sources in India; Significance of the following plants in ethno botanical practices (along with their habitat and morphology) a) *Azadirachta indica* b) *Ocimum sanctum* c) *Vitex negundo*. d) *Gloriosa superba* e) *Tribulus terrestris* f) *Pongamia pinnata* g) *Cassia auriculata* h) *Indigofera tinctoria*. Role of ethnobotany in modern medicine with special example *Rauwolfia serpentina*, *Trichopus zeylanicus*, *Artemisia*, *Withania*. Role of ethnic groups in conservation of plant genetic resources. Endangered taxa and forest management (participatory forest management). (10 Lectures)

### **Unit 4: Ethnobotany and legal aspects**

Ethnobotany as a tool to protect interests of ethnic groups. Sharing of wealth concept with few examples from India. Biopiracy, Intellectual Property Rights and Traditional Knowledge. (8 Lectures)

### **Text Book for references:**

- 1) S.K. Jain, Manual of Ethnobotany, Scientific Publishers, Jodhpur, 1995.
- 2) S.K. Jain (ed.) Glimpses of Indian. Ethnobotany, Oxford and I B H, New Delhi – 1981
- 3) Lone et al., Palaeoethnobotany
- 4) S.K. Jain (ed.) 1989. Methods and approaches in ethnobotany. Society of ethnobotanists, Lucknow, India.
- 5) S.K. Jain, 1990. Contributions of Indian ethnobotany. Scientific publishers, Jodhpur.
- 6) Colton C.M. 1997. Ethnobotany – Principles and applications. John Wiley and sons – Chichester
- 7) Rama Rao, N and A.N. Henry (1996). The Ethnobotany of Eastern Ghats in Andhra Pradesh, India. Botanical Survey of India. Howrah. 8) Rajiv K. Sinha – Ethnobotany The Renaissance of Traditional Herbal Medicine – INA – SHREE Publishers, Jaipur-1996 9)



### Apiculture and Sericulture

|                             |   |
|-----------------------------|---|
| <b>Course code</b>          | <b>ZOO315</b>   |
| <b>Course title</b>         | <b>Apiculture and Sericulture</b>   |
| <b>Type of course</b>       | Theory  |
| <b>LTP</b>                  | 2 0 0   |
| <b>Credits</b>              | 2   |
| <b>Course objective</b>     | To impart basic knowledge about rearing of honey bees and silkworms for commercial production of honey and silk.  |
| <b>Course outcomes (CO)</b> | <ul style="list-style-type: none"> <li>i) Explain the basic concepts of apiculture like systematic, colony organization, polymorphism, morphology and foraging.</li> <li>ii) Identify diseases of silk worms and honey bees.</li> </ul> |

## UNIT-I

**Biology of Bees:** Classification and Biology of Honey Bees; Social Organization of Bee Colony

**Rearing of Bees and Bee Economy:** Artificial Bee rearing (Apiary), Beehives – Newton and Langstroth; Products of Apiculture Industry and its uses

## UNIT-II

**Introduction and Biology of Silkworm:** Sericulture: Definition, history and present status

Mulberry and non-mulberry Sericulture; Life cycle of *Bombyx mori*

## UNIT-III

**Rearing of Silkworms:** Rearing house and rearing appliances; Disinfectants: Formalin, bleaching powder; Silkworm rearing technology: Early age and Late age rearing; Spinning, harvesting and storage of cocoons

## UNIT-IV

**Pests and Diseases of honey bees and silkworm:** Bee Diseases and Enemies; Pests of silkworm: Uzi fly, dermestid beetles and vertebrates; Pathogenesis of silkworm diseases: Protozoan, viral, fungal and bacterial

### Text and reference books:

| S. no. | Title                             | Author                             | Publisher                        |
|--------|-----------------------------------|------------------------------------|----------------------------------|
| 1      | Apiculture                        | P J Prost                          | Oxford and IBH, New Delhi        |
| 2      | Apiculture                        | D S Bisht                          | ICAR Publication                 |
| 3      | Beekeeping in India               | S Singh                            | ICAR Publication                 |
| 4      | Handbook of Practical Sericulture | S.R. Ullal and M.N. Narasimhanna   | CSB, Bangalore                   |
| 5      | Handbook of Silkworm Rearing      | Agriculture and Technical Manual-1 | Fuzi Pub. Co. Ltd., Tokyo, Japan |

## AQUATIC BIOLOGY

|                            |   |
|----------------------------|---|
| <b>Course Code</b>         | <b>ZO0317</b>   |
| <b>Course Title</b>        | <b>Aquatic Biology</b>  |
| <b>Type of course</b>      | Theory  |
| <b>L T P</b>               | 4 0 0   |
| <b>Credits</b>             | 4   |
| <b>Course prerequisite</b> | B.Sc Medical II year  |
| <b>Course Objective</b>    | To provide the knowledge of different types of habitats in ecosystem and their importance for the living being, so that we can make our environment a pollution free. |

|                             |  |
|-----------------------------|--|
| <b>Course Outcomes (CO)</b> | <p>i) Employ scientific methodologies such as experimentation and data analysis in the</p> <p>ii) area of aquatic biology Critically analyse, interpret and evaluate information relevant to aquatic</p> |
|-----------------------------|--|

### UNIT-I

Aquatic Biomes: Brief introduction of the aquatic biomes: Freshwater ecosystem (lakes, wetlands, streams and rivers), estuaries, intertidal zones, oceanic pelagic zone, marine benthic zone and coral reefs.

### UNIT-II

Freshwater Biology: Lakes: Origin and classification, Lake as an Ecosystem, Lake morphometry, Physico-chemical Characteristics: Light, Temperature, Thermal stratification, Dissolved Solids, Carbonate, Bicarbonates, Phosphates and Nitrates, Turbidity; dissolved gases (Oxygen, Carbon dioxide).

### UNIT-III

Nutrient Cycles in Lakes-Nitrogen, Sulphur and Phosphorous. Streams: Different stages of stream development, Physico-chemical environment, Adaptation of hill-stream fishes. Marine Biology: Salinity and density of Sea water, Continental shelf, Adaptations of deep sea organisms, Coral reefs, Sea weeds.

### UNIT-IV

Management of Aquatic Resources: Causes of pollution: Agricultural, Industrial, Sewage, Thermal and Oil spills, Eutrophication, Management and conservation (legislations), Sewage treatment; Water quality assessment- BOD and COD.

### Text and Reference Books:

| S. No | Title   | Author(s)         | Publisher |
|-------|---|-------------------|-----------|
| 1     | Bioresources Ecology 3rd Edition                            | Anathakrishnan    |           |
| 2     | Limnology, 2nd Edition                                      | Goldman           |           |
| 3     | Fundamentals of Ecology, 5th Edition                        | Odum and Barrett  |           |
| 4     | Chemical and biological methods for water pollution studies | Trivedi and Goyal |           |



|                            |   |
|----------------------------|---|
| <b>Course Code</b>         | <b>CHM 313</b>  |
| <b>Course Title</b>        | <b>FUEL CHEMISTRY</b>                                     |
| <b>Type of course</b>      | <b>SKILL ENHANCEMENT COURSE</b>                           |
| <b>L T P</b>               | <b>2:0:0</b>  |
| <b>Credits</b>             | <b>2</b>  |
| <b>Course prerequisite</b> | <b>Bsc. Ist, IInd year with CHEMISTRY as core subject</b> |

|                              |  |
|------------------------------|--|
| <b>Course Objective (CO)</b> | The aim of this course is to impart theoretical knowledge to the students in petroleum and fuel chemistry. |
| <b>Course Outcomes (CO)</b>  | i) Ability to characterize the fuels<br>ii) Understanding of thermodynamics and kinetics of combustion     |

#### **UNIT I:**

Review of energy sources (renewable and non-renewable). Classification of fuels and their calorific value.

Coal: Uses of coal (fuel and nonfuel) in various industries, its composition, carbonization of coal. Coal gas, producer gas and water gas—composition and uses. Fractionation of coal tar, uses of coal tar bases chemicals, requisites of a good metallurgical coke, Coal gasification (Hydro gasification and Catalytic gasification), Coal liquefaction and Solvent Refining.

#### **UNIT II:**

Petroleum and Petrochemical Industry: Composition of crude petroleum, Refining and different types of petroleum products and their applications. Fractional Distillation (Principle and process), Cracking (Thermal and catalytic cracking)

#### **UNIT III:**

Reforming Petroleum and non-petroleum fuels (LPG, CNG, LNG, bio-gas, fuels derived from biomass), fuel from waste, synthetic fuels (gaseous and liquids), clean fuels. Petrochemicals: Vinyl acetate, Propylene oxide, Isoprene, Butadiene, Toluene and its derivatives Xylene.

#### **UNIT IV:**

Lubricants: Classification of lubricants, lubricating oils (conducting and nonconducting) Solid and semisolid lubricants, synthetic lubricants. Properties of lubricant (viscosity index, cloud point, pore point) and determination.

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

| <b>S. No</b> | <b>Name</b>                                    | <b>Author(S)</b>          | <b>Publisher</b>                       |
|--------------|--|---------------------------|--|
| 1            | Principles of Instrumental Methods of analysis | D. A. Skoog and D.M. West | Saunders College Publ. Latest edition. |

|   |   |                         |                               |
|---|---|-------------------------|-------------------------------|
| 2 | Engineering Chemistry                     | Jain, P.C. & Jain, M.   | Dhanpat Rai & Sons, Delhi     |
| 3 | Instrumental methods of chemical analysis | B.K.sharma              | Krishna prakashan media LTD   |
| 4 | Industrial Chemistry                      | Sharma, B.K. & Gaur, H. | Goel Publishing House, Meerut |
| 5 | Industrial Chemistry Vol-I,               | Stocchi, E.             | Ellis Horwood Ltd. UK (1990). |



### MUSHROOM CULTURE TECHNOLOGY

|                            |  |
|----------------------------|--|
| <b>Course Code</b>         | <b>BOT310</b>  |
| <b>Course Title</b>        | Mushroom Culture Technology  |
| <b>Type of course</b>      | Theory   |
| <b>L T P</b>               | 2 0 0  |
| <b>Credits</b>             | 2  |
| <b>Course prerequisite</b> | B.ScInd year   |
| <b>Course Objective</b>    | To provide knowledge about commercial aspect of mushroom cultivation in India which may motivate students to take up it as |

|                             |   |
|-----------------------------|---|
|                             | professional occupation   |
| <b>Course Outcomes (CO)</b> | <p>i) is able to distinguish the principal differences of mushroom cultivation from the cultivation of plants and animals; -</p> <p>ii) Can determine the most important (ca 12) species of cultivated mushrooms and knows the basic ways of the cultivation of each of them; -</p> |

### UNIT-I

**Introduction, history:** Nutritional and medicinal value of edible mushrooms; Poisonous mushrooms. Types of edible mushrooms available in India - *Volvariella volvacea*, *Pleurotus citrinopileatus*, *Agaricus bisporus*.

### UNIT-II

**Cultivation Technology :** Infrastructure: substrates (locally available) Polythene bag, vessels, Inoculation hook, inoculation loop, low cost stove, sieves, culture rack, mushroom unit (Thatched house) water sprayer, tray, small polythene bag. Pure culture: Medium, sterilization, preparation of spawn, multiplication. Mushroom bed preparation - paddy straw, sugarcane trash, maize straw, banana leaves. Factors affecting the mushroom bed preparation - Low cost technology, Composting technology in mushroom production.

### UNIT-III

**Storage and nutrition :** Short-term storage (Refrigeration - upto 24 hours) Long term Storage (canning, pickles, papads), drying, storage in salt solutions. Nutrition - Proteins - amino acids, mineral elements nutrition - Carbohydrates, Crude fibre content - Vitamins.

### UNIT-IV

**Food Preparation :** Types of foods prepared from mushroom. Research Centres - National level and Regional level. Cost benefit ratio - Marketing in India and abroad, Export Value.

### Text and Reference Books:

| S. No. | Title   | Author                       | Publisher                             |
|--------|---|------------------------------|---------------------------------------|
| 1      | Mushroom Cultivation                          | S C Tewari and Pankaj Kapoor | Mittal Publications                   |
| 2      | Mushroom Production and Processing Technology | V N Pathak                   | Agrobios India                        |
| 3      | Mushroom Cultivation and Uses                 | Suman and B C Sharma         | Agrobios India                        |
| 4      | Food and Nutrition                            | M Swaminathan                | Bangalore Printing and Publishing Co. |



### AQUARIUM FISH KEEPING

|                            |  |
|----------------------------|--|
| <b>Course Code</b>         | <b>ZOO314</b>  |
| <b>Course Title</b>        | <b>AQUARIUM FISH KEEPING</b>   |
| <b>Type of course</b>      | Theory   |
| <b>L T P</b>               | 2    0    0  |
| <b>Credits</b>             | 2  |
| <b>Course prerequisite</b> | B.ScIIInd year   |
| <b>Course Objective</b>    | To provide knowledge about commercial aspect of mushroom cultivation in India which may motivate students to take up it as |

|                             |   |
|-----------------------------|---|
|                             | professional occupation   |
| <b>Course Outcomes (CO)</b> | <p>i) Identify fresh water and marine ornamental fishes both indigenous and exotic.</p> <p>ii) Identify other organisms in an aquarium other than fishes like corals, crustaceans, molluscs and their maintenance in an aquarium.</p> |

### **Unit1: Introduction to Aquarium Fish Keeping**

The potential scope of Aquarium Fish Industry as a Cottage Industry, Exotic and Endemic species of Aquarium Fishes

### **Unit 2: Biology of Aquarium Fishes**

Common characters and sexual dimorphism of Fresh water and Marine Aquarium fishes such as Guppy, Molly, Sword tail, Gold fish, Angel fish, Blue morph, Anemone fish and Butterfly fish

### **Unit 3: Food and feeding of Aquarium fishes**

Use of live fish feed organisms. Preparation and composition of formulated fish feeds

### **Unit 4: Fish Transportation**

Live fish transport - Fish handling, packing and forwarding techniques.

### **Unit 5: Maintenance of Aquarium**

General Aquarium maintenance – budget for setting up an Aquarium Fish Farm as a Cottage Industry

## **PHARMACEUTICAL CHEMISTRY**

|                            |                                 |
|----------------------------|---------------------------------|
| <b>Course Code</b>         | <b>CHM 318</b>                  |
| <b>Course Title</b>        | <b>PHARMACEUTICAL CHEMISTRY</b> |
| <b>Type of course</b>      | <b>SKILL ENHANCEMENT COURSE</b> |
| <b>L T P</b>               | <b>2:0:0</b>                    |
| <b>Credits</b>             | <b>2</b>                        |
| <b>Course prerequisite</b> | <b>Bsc.</b>                     |

|                       |   |
|-----------------------|---|
| Course Objective (CO) | The aim of this course is to impart theoretical knowledge to the students in Drugs & Pharmaceuticals  |
| Course Outcomes (CO)  | 1. understand the chemistry of drugs with respect to their pharmacological activity<br>2. Understand the drug metabolic pathways, adverse effect and therapeutic value of drugs |

### UNIT I

Drugs & Pharmaceuticals :Drug discovery, design and development; Classification of drugs, Basic Retrosynthetic approach. Synthesis of the representative drugs of the following classes: analgesics agents, antipyretic agents, anti-inflammatory agents (Aspirin, paracetamol, Ibuprofen);

### UNIT-II

Antibiotics (Chloramphenicol); antibacterial and antifungal agents (Sulphonamides; Sulphanethoxazol, Sulphacetamide, Trimethoprim); antiviral agents (Acyclovir),

### UNIT –III

Central Nervous System agents (Phenobarbital, Diazepam), Cardiovascular (Glyceryl trinitrate), antilaprosy (Dapsone), HIV-AIDS related drugs (AZT- Zidovudine).

### UNIT –IV

Aerobic and anaerobic fermentation. Production of (i) Ethyl alcohol and citric acid, (ii) Antibiotics; Penicillin, Cephalosporin, Chloromycetin and Streptomycin, Production of Lysine, Glutamic acid, Vitamin B2, Vitamin B12 and Vitamin C.

### Text and Reference Books

| S. No | Name                                    | Author(S)             | Publisher                               |
|-------|---|-----------------------|---|
| 1     | Introduction to Medicinal Chemistry     | G.L. Patrick          | Oxford University Press, UK.            |
| 2     | Medicinal and Pharmaceutical Chemistry, | Hakishan, V.K. Kapoor | Vallabh Prakashan, Pitampura, New Delhi |

|   |   |  |                                  |
|---|---|--|----------------------------------|
| 3 | Principles of Medicinal Chemistry                               | William O. Foye, Thomas L., Lemke , David A. William | B.I. Waverly Pvt. Ltd. New Delhi |
| 4 | Medicinal Chemistry-the role of organic chemistry in drug, 1993 | 13. R. Ganellin, and S. M. Roberts                   | Academic Press                   |
| 5 | Medicinal Chemistry-principles and practice,1994                | F. D. King   | Royal Society of Chemistry       |



# Discipline Elective Courses

## (Semester-V-VI)

(Any two of each subject in both semesters)



### CELL AND MOLECULAR BIOLOGY

|                            |                                      |
|----------------------------|--------------------------------------|
| <b>Course Code</b>         | <b>BOT301</b>                        |
| <b>Course Title</b>        | <b>Cell and Molecular Biology</b>    |
| <b>Type of course</b>      | Discipline Elective Courses (Theory) |
| <b>L T P</b>               | 4 0 0                                |
| <b>Credits</b>             | 4                                    |
| <b>Course prerequisite</b> | B.Sc Medical II year                 |

|                             |   |
|-----------------------------|---|
| <b>Course Objective</b>     | To impart knowledge about details of cell structure, cell organelles and their functions along with structural and functional details of genetic material   |
| <b>Course Outcomes (CO)</b> | 1.Able to understand the chemical components and structure of cell membrane and cell wall.<br>2.Classify the enzymes and explain mechanism of action and structure<br>3.Gain an understanding the process of transcription,translation,and protein modifications. |

### UNIT-I

**Techniques in Biology:** Principles of microscopy; Light Microscopy; Phase contrast microscopy; Fluorescence microscopy; Confocal microscopy; Sample Preparation for light microscopy; Electron microscopy (EM)- Scanning EM and Scanning Transmission EM (STEM); Sample Preparation for electron microscopy; X-ray diffraction analysis.

### UNIT-II

**Cell as a unit of Life:** The Cell Theory; Prokaryotic and eukaryotic cells; Cell size and shape; Eukaryotic Cell components.

Cell Membrane and Cell Wall; The functions of membranes; Models of membrane structure; The fluidity of membranes; Membrane proteins and their functions; Carbohydrates in the membrane; Faces of the membranes; Selective permeability of the membranes; Cell wall. Cell Organelles: Mitochondria: Structure, marker enzymes, composition; Semiautonomous nature; Symbiont hypothesis; Proteins synthesized within mitochondria; mitochondrial DNA

### UNIT-III

**Cell Organelles:** Chloroplast Structure, marker enzymes, composition; semiautonomous nature, chloroplast DNA. ER, Golgi body & Lysosomes: Structures and roles. Peroxisomes and Glyoxisomes: Structures, composition, functions in animals and plants and biogenesis.

Nucleus: Nuclear Envelope- structure of nuclear pore complex; chromatin; molecular organization, DNA packaging in eukaryotes, euchromatin and heterochromatin, nucleolus and ribosome structure (brief).

### UNIT-IV

**Cell Cycle:** Overview of Cell cycle, Mitosis and Meiosis; Molecular controls. Genetic material: DNA: Miescher to Watson and Crick- historic perspective, Griffith's and Avery's transformation experiments, Hershey-Chase bacteriophage experiment, DNA structure, types of DNA, types of genetic material.

DNA replication (Prokaryotes and eukaryotes): bidirectional replication, semi-conservative, semi discontinuous RNA priming,  $\theta$  (theta) mode of replication, replication of linear, ds-DNA, replicating the 5' end of linear chromosome including replication enzymes.

Transcription (Prokaryotes and Eukaryotes)

Types of structures of RNA (Mrna, Trna, Rrna), RNA polymerase- various types; Translation (Prokaryotes and eukaryotes), genetic code.

Regulation of gene expression: Prokaryotes (Lac operon and Tryptophan operon) and in Eukaryotes.

### Text and Reference Books:

| S.No | Title   | Author(s)  | Publisher             |
|------|---|--|-----------------------|
| 1    | Genetics- A Molecular Approach, 3 <sup>rd</sup> edition   | Russell, P. J.   | Benjamin Cummings.    |
| 2    | Introduction to Genetic Analysis, 9 <sup>th</sup> edition | Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. | W. H. Freeman and Co. |
| 3    | Evolution, 3 <sup>rd</sup> edition                        | Ridley, M.   | Blackwell Publishing  |
| 4    | Evolutionary Biology                                      | Douglas, J. Futuyma  | Sinauer Associates.   |



### CELL AND MOLECULAR BIOLOGY PRACTICAL

|                            |   |
|----------------------------|---|
| <b>Course Code</b>         | <b>BOT303</b>                               |
| <b>Course Title</b>        | <b>Cell and Molecular Biology Practical</b> |
| <b>Type of course</b>      | Discipline Elective Courses (Practical)     |
| <b>L T P</b>               | 0 0 4                                       |
| <b>Credits</b>             | 2   |
| <b>Course prerequisite</b> | B.Sc Medical II year                        |

|                             |   |
|-----------------------------|---|
| <b>Course Objective</b>     | To impart practical knowledge about details of cell structure, cell organelles and their functions along with structural and functional details of genetic material   |
| <b>Course Outcomes (CO)</b> | 1. Classify the enzymes, its structure, function and action mechanism.<br>2. Understand the internal structure and function of cells & explain the growth of cells.<br>3. Understand the relation between the morphology and purpose of biomolecules. |

### LIST OF EXPERIMENTS

1. To study prokaryotic cells (bacteria), viruses, eukaryotic cells with the help of light and electron micrographs.
2. Study of the photomicrographs of cell organelles
3. To study the structure of plant cell through temporary mounts.
4. To study the structure of animal cells by temporary mounts-squamous epithelial cell and nerve cell.
5. Preparation of temporary mounts of striated muscle fiber
6. To prepare temporary stained preparation of mitochondria from striated muscle cells /cheek epithelial cells using vital stain Janus green.
7. Study of mitosis and meiosis (temporary mounts and permanent slides).
8. Study the effect of temperature, organic solvent on semi permeable membrane.
9. Demonstration of dialysis of starch and simple sugar.
10. Study of plasmolysis and deplasmolysis on Rhoeo leaf.
11. Measure the cell size (either length or breadth/diameter) by micrometry.
12. Study the structure of nuclear pore complex by photograph (from Gerald Karp)
13. Study of special chromosomes (polytene & lampbrush) either by slides or photographs.
14. Study DNA packaging by micrographs.

### Text and Reference Books:

| S.No | Title   | Author(s)  | Publisher             |
|------|---|--|-----------------------|
| 1    | Genetics- A Molecular Approach, 3 <sup>rd</sup> edition   | Russell, P. J.                                       | Benjamin Cummings.    |
| 2    | Introduction to Genetic Analysis, 9 <sup>th</sup> edition | Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and | W. H. Freeman and Co. |

|   |                                    |                     |                      |
|---|------------------------------------|---------------------|----------------------|
|   |                                    | Carroll, S.B.       |                      |
| 3 | Evolution, 3 <sup>rd</sup> edition | Ridley, M.          | Blackwell Publishing |
| 4 | Evolutionary Biology               | Douglas, J. Futuyma | Sinauer Associates.  |



### ANALYTICAL TECHNIQUES IN PLANT SCIENCES

|                            |  |
|----------------------------|--|
| <b>Course Code</b>         | <b>BOT305</b>                                  |
| <b>Course Title</b>        | <b>Analytical Techniques in Plant Sciences</b> |
| <b>Type of course</b>      | Discipline Elective Courses (Theory)           |
| <b>L T P</b>               | 4 0 0  |
| <b>Credits</b>             | 4  |
| <b>Course prerequisite</b> | B.Sc Medical II year                           |

|                             |  |
|-----------------------------|--|
| <b>Course Objective</b>     | To study various techniques used to study plant cell structure and functions   |
| <b>Course Outcomes (CO)</b> | 1. Know the details of Microscopy- Principles of light microscopy, electron microscopy (TEM and SEM).<br><br>2. Understand & perform Chromatography and cultural techniques in Botany. |

### UNIT-I

**Imaging and related techniques:** Principles of microscopy; Light microscopy; Fluorescence microscopy; Confocal microscopy; Use of fluorochromes: (a) Flow cytometry (FACS); (b) Applications of fluorescence microscopy: Chromosome banding, FISH, chromosome painting; Transmission and Scanning electron microscopy – sample preparation for electron microscopy, cryofixation, negative staining, shadow casting, freeze fracture, freeze etching.

### UNIT-II

**Cell fractionation:** Centrifugation: Differential and density gradient centrifugation, sucrose density gradient, CsCl<sub>2</sub>, gradient, analytical centrifugation, ultracentrifugation, marker enzymes.

**Radioisotopes:** Use in biological research, auto-radiography, pulse chase experiment.

**Spectrophotometry:** Principle and its application in biological research.

### UNIT-III

**Chromatography:** Principle; Paper chromatography; Column chromatography, TLC, GLC, HPLC, Ion-exchange chromatography; Molecular sieve chromatography; Affinity chromatography.

**Characterization of proteins and nucleic acids:** Mass spectrometry; X-ray diffraction; X-ray crystallography; Characterization of proteins and nucleic acids; Electrophoresis: AGE, PAGE, SDS-PAGE

### UNIT-IV

**Biostatistics:** Statistics, data, population, samples, parameters; Representation of Data: Tabular, Graphical; Measures of central tendency: Arithmetic mean, mode, median; Measures of dispersion: Range, mean deviation, variation, standard deviation; Chi-square test for goodness of fit.

## ANALYTICAL TECHNIQUES IN PLANT SCIENCES PRACTICAL

|                       |  |
|-----------------------|--|
| <b>Course Code</b>    | <b>BOT307</b>  |
| <b>Course Title</b>   | <b>Analytical Techniques in Plant Sciences Practical</b> |
| <b>Type of course</b> | Discipline Elective Courses (Practical)                  |
| <b>L T P</b>          | 0 0 4  |
| <b>Credits</b>        | 2  |

|                             |  |
|-----------------------------|--|
| <b>Course prerequisite</b>  | B.Sc Medical II year   |
| <b>Course Objective</b>     | To demonstrate basic techniques used in cell biology                       |
| <b>Course Outcomes (CO)</b> | Understand the methods used in Micrometry, Microtomy and Microphotography. |

#### LIST OF EXPERIMENTS

1. Study of Blotting techniques: Southern, Northern and Western, DNA fingerprinting, DNA sequencing, PCR through photographs.
2. Demonstration of ELISA.

|                    |               |
|--------------------|---------------|
| <b>Course Code</b> | <b>ZOO301</b> |
|--------------------|---------------|

3. To separate nitrogenous bases by paper chromatography.
4. To separate sugars by thin layer chromatography.
5. Isolation of chloroplasts by differential centrifugation.
6. To separate chloroplast pigments by column chromatography.
7. To estimate protein concentration through Lowry's methods.
8. To separate proteins using PAGE.
9. To separate DNA (marker) using AGE.
10. Study of different microscopic techniques using photographs/micrographs (freeze fracture, freeze etching, negative staining, positive staining, fluorescence and FISH).
11. Preparation of permanent slides (double staining).

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

| S.No | Title                                     | Author(s)  | Publisher                           |
|------|---|--|-------------------------------------|
| 1    | An Introduction to Practical Biochemistry | Plummer, D.T.  | Tata McGraw-Hill Publishing Co. Ltd |
| 2    | Plant Microtechnique and Microscopy       | Ruzin, S.E.  | Oxford University Press, New York   |
| 3    | Short Protocols in Molecular Biology      | Ausubel, F., Brent, R., Kingston, R. E., Moore, D.D., Seidman, J.G., Smith | John Wiley & Sons                   |
| 4    | Biostatistical Analysis.                  | Zar, J.H   | Pearson Publication                 |

### CELL BIOLOGY, BIOTECHNOLOGY AND REPRODUCTIVE BIOLOGY

|                              |   |
|------------------------------|---|
| <b>Course Title</b>          | <b>Cell Biology, Biotechnology and Reproductive Biology</b>   |
| <b>Type of course</b>        | Theory  |
| <b>L T P</b>                 | 4 0 0   |
| <b>Credits</b>               | 4   |
| <b>Course prerequisite</b>   | B.ScIIInd year  |
| <b>Course Objective (CO)</b> | <ol style="list-style-type: none"> <li>1. To enable the students to learn various aspects of cell biology and techniques of biotechnology.</li> <li>2. To aware the students about various reproductive processes and the modern techniques to assist these processes.</li> </ol> |
| <b>Course Outcomes (CO)</b>  | <ol style="list-style-type: none"> <li>1.To enable the students to learn various aspects of cell biology and techniques of biotechnology.</li> <li>2.To aware the students about various reproductive processes and the modern techniques to assist these.</li> </ol>             |

#### UNIT-I

**Introduction to cell and molecular biology:** Discovery of cell, basic properties, eukaryotic and prokaryotic cells, viruses. Structure and functions of Plasma membrane: Chemical composition of membrane, structure and function of membrane proteins, Fluid Mosaic Model, Membrane potential and nerve impulse

**Interaction between cell and their environment:** Interaction of cell with extracellular material, Tight Junctions, Gap Junctions and Plasmodesmata mediating intracellular communications, cell wall.

**Membrane Trafficking:** Endoplasmic Reticulum, Golgi complex, Types of vesicle transport and their functions, lysosomes.

**Cytoskeleton and Cell motility:** Study of cytoskeleton, microtubules, intermediate filaments, microfilaments.

#### UNIT-II

**Biotechnology:** Recombinant DNA technology and its applications, Cloning vectors: Plasmids, Cosmids, Phasmids, Lamda Bacteriophage, BAC, YAC, MAC and Expression vectors.

Restriction enzymes: Nomenclature, detailed study of Type II

Construction of genomic and cDNA libraries, Southern, Northern and Western Blotting, DNA sequencing (Sanger Method), Polymerase Chain Reaction.

#### UNIT-III

**Reproductive Endocrinology:** Gonadal hormones and mechanism of hormone action, steroids, glycoprotein hormones, and prostaglandins, regulation of gonadotrophin secretion in male and female; Reproductive System: Development and differentiation of gonads, genital ducts, external genitalia, mechanism of sex differentiation.

#### UNIT-IV

**Reproductive Health:** Infertility in male and female: causes, diagnosis and management; Assisted Reproductive Technology: sex selection, sperm banks, frozen embryos, in vitro fertilization, ET, EFT, IUT, ZIFT, GIFT, ICSI, PROST; Modern contraceptive technologies; Demographic terminology used in family planning

**Text and reference books:**

| S.No | Title                      | Author                          | Publisher  |
|------|----------------------------|---------------------------------|--|
| 1.   | Cell and Molecular Biology | P.K. Gupta                      | Rastogi publications   |
| 2.   | Knobil, E. et al. (eds).   | The Physiology of Reproduction. | Raven Press Ltd  |
| 3.   | Animal Physiology          | Mohan P. Arora                  | Himalyan Publishing, House                                     |
| 4.   | G Karp, EDP & De Robertis  | Cell and Molecular Biology      | EMF , WB Saunders, Co Philadelphia , 8 <sup>th</sup> Edn 1995. |
| 5.   | Albert                     | Essential Cell Biology          | , New York , 3 <sup>rd</sup> Edn , 1997                        |

**CELL BIOLOGY, BIOTECHNOLOGY AND REPRODUCTIVE BIOLOGY PRACTICAL**

|                       |   |
|-----------------------|---|
| <b>Course Code</b>    | <b>ZOO 303</b>  |
| <b>Course Title</b>   | <b>Cell Biology, Biotechnology and Reproductive Biology Practical</b> |
| <b>Type of course</b> | Practical   |
| <b>L T P</b>          | 0 0 4   |

|                             |  |
|-----------------------------|--|
| <b>Credits</b>              | 2  |
| <b>Course prerequisite</b>  | B.Sc II year   |
| <b>Course Objective</b>     | To impart practical knowledge about basic animal cell structure and cytological details of reproductive cells and organs   |
| <b>Course Outcomes (CO)</b> | 1. Comprehend the nature and essential ideas of cell science, hereditary qualities, scientific classification, physiology, environment and applied Zoology<br>2. Increases information about research methods, communication skills and abilities of critical thinking techniques<br>3. Idea driving hereditary issue, quality changes different causes related with natural errors in metabolism. |

**List of experiments:**

1. Study of cell cycle through model.
2. Cells present in human blood (WBC, RBC count and hemoglobin estimation)
3. Study the phenomenon of osmosis using blood.
4. Blood clotting and bleeding time
5. Erythrocyte sedimentation rate
6. Examination of histological sections from photomicrographs/ permanent slides of rat/human: testis, epididymis and accessory glands of male reproductive systems; Sections of ovary, fallopian tube, uterus (proliferative and secretory stages), cervix and vagina.

**Text and reference books:**

| S.No | Title                      | Author                          | Publisher            |
|------|----------------------------|---------------------------------|----------------------|
| 1.   | Cell and Molecular Biology | P.K. Gupta                      | Rastogi publications |
| 2.   | Knobil, E. et al. (eds).   | The Physiology of Reproduction. | Raven Press Ltd      |

**APPLIED ZOOLOGY**

|                            |                        |
|----------------------------|------------------------|
| <b>Course Code</b>         | <b>ZOO305</b>          |
| <b>Course Title</b>        | <b>Applied Zoology</b> |
| <b>Type of course</b>      | Theory                 |
| <b>L T P</b>               | 4 0 0                  |
| <b>Credits</b>             | 4                      |
| <b>Course prerequisite</b> | B.Sc Medical II year   |

|                             |  |
|-----------------------------|--|
| <b>Course Objective</b>     | To aware students about the various types of parasites and their relationship with their hosts. To find out some organisms which are fatal to animals and try for the control measures against them.                                 |
| <b>Course Outcomes (CO)</b> | i) Learn the basic principles involved in the culture and breeding of common edible and ornamental fishes of Kerala and the art of aquarium keeping.<br><br>ii) Get a basic understanding of human genomics and reproductive biology |

### UNIT-I

Introduction to Host-parasite Relationship: Host, Definitive host, Intermediate host, Parasitism, Symbiosis, Commensalism, Reservoir, Zoonosis; Epidemiology of Diseases: Transmission, Prevention and control of diseases: Tuberculosis, Typhoid

### UNIT-II

Rickettsiae and Spirochaetes: Brief account of Rickettsia prowazekii, Borrelia recurrentis and Treponema pallidum; Parasitic Protozoa: Life history and pathogenicity of Entamoeba histolytica, Plasmodium vivax and Trypanosoma gambiense

### UNIT-III

Parasitic Helminthes: Life history and pathogenicity of Ancylostoma duodenale and Wuchereriabancrofti; Insects of Economic Importance: Biology, Control and damage caused by Helicoverpaarmigera, Pyrrillaperpusilla and Papiliodemoleus, Callosobruchuschinensis, Sitophilus oryzae and Triboliumcastaneum; Insects of Medical Importanc: Medical importance and control of Pediculus humanus corporis, Anopheles, Culex, Aedes, Xenopsyllacheopis

### UNIT-IV

Animal Husbandry: Preservation and artificial insemination in cattle; Induction of early puberty and synchronization of estrus in cattle; Poultry Farming: Principles of poultry breeding, Management of breeding stock and broilers, Processing and preservation of eggs

Fish Technology: Genetic improvements in aquaculture industry; Induced breeding and transportation of fish seed

#### Text and Reference Books:

| S.No | Title  | Author(s)                | Publisher               |
|------|--|--------------------------|-------------------------|
| 1    | Preventive and Social Medicine, 16 <sup>th</sup> Edition | Park, K.                 | B.B Publishers          |
| 2    | Medical Parasitology, 2 <sup>nd</sup> Edition            | Arora, D. R and Arora, B | CBS Publications        |
| 3    | Agricultural Pests of India and South East Asia          | Atwal, A.S               | Kalyani Publishers      |
| 4    | Agricultural Entomology                                  | Dennis, H                | Timber Press            |
| 5    | Reproduction in Farm Animals                             | Hafez, E. S. E           | Lea & Fabiger Publisher |



### APPLIED ZOOLOGY PRACTICAL

|                            |                                  |
|----------------------------|----------------------------------|
| <b>Course Code</b>         | <b>ZOO307</b>                    |
| <b>Course Title</b>        | <b>Applied Zoology Practical</b> |
| <b>Type of course</b>      | Practical                        |
| <b>L T P</b>               | 0 0 4                            |
| <b>Credits</b>             | 2                                |
| <b>Course prerequisite</b> | B.Sc Medical II year             |

|                             |  |
|-----------------------------|--|
| <b>Course Objective</b>     | To aware students about different techniques used in studying various types of causative agents of diseases. So that they can easily findout the symptoms of different diseases. |
| <b>Course Outcomes (CO)</b> | Aware about stem cell research and prenatal diagnostic techniques.   |

### LIST OF EXPERIMENTS

1. Study of Plasmodium vivax, Entamoeba histolytica, Trypanosoma gambiense, Ancylostoma duodenale and Wuchereriabancrofti and their life stages through permanent slides/photomicrographs or specimens.
2. Study of arthropod vectors associated with human diseases: Pediculus, Culex, Anopheles, Aedes and Xenopsylla.
3. Study of insect damage to different plant parts/stored grains through damaged products/photographs.
4. Identifying feature and economic importance of Helicoverpa (Heliothis) armigera, Papiliodemoleus, Pyrrillaperpusilla, Callosobruchuschinensis, Sitophilus oryzae and Triboliumcastaneum
5. Visit to poultry farm or animal breeding centre. Submission of visit report
6. Maintenance of freshwater aquarium

### Text and Reference Books:

| S.No | Title   | Author(s)                | Publisher        |
|------|---|--------------------------|------------------|
| 1    | Medical Parasitology, 2 <sup>nd</sup> Edition | Arora, D. R and Arora, B | CBS Publications |
| 2    | Agricultural Entomology                       | Dennis, H                | Timber Press     |

### AQUATIC BIOLOGY

|                            |                        |
|----------------------------|------------------------|
| <b>Course Code</b>         | <b>ZOO309</b>          |
| <b>Course Title</b>        | <b>Aquatic Biology</b> |
| <b>Type of course</b>      | Theory                 |
| <b>L T P</b>               | 4 0 0                  |
| <b>Credits</b>             | 4                      |
| <b>Course prerequisite</b> | B.Sc Medical II year   |

|                             |  |
|-----------------------------|--|
| <b>Course Objective</b>     | To provide the knowledge of different types of habitats in ecosystem and their importance for the living being, so that we can make our environment a pollution free.  |
| <b>Course Outcomes (CO)</b> | <p>i) Appreciate the multidisciplinary nature of the study of aquatic biology and engage</p> <p>ii) positively with people and ideas beyond their own discipline. Explore some of the unique environmental problems dealing with aquatic environments.</p> |

### UNIT-I

**Aquatic Biomes:** Brief introduction of the aquatic biomes: Freshwater ecosystem (lakes, wetlands, streams and rivers), estuaries, intertidal zones, oceanic pelagic zone, marine benthic zone and coral reefs.

### UNIT-II

**Freshwater Biology: Lakes:** Origin and classification, Lake as an Ecosystem, Lake morphometry, Physico-chemical Characteristics: Light, Temperature, Thermal stratification, Dissolved Solids, Carbonate, Bicarbonates, Phosphates and Nitrates, Turbidity; dissolved gases (Oxygen, Carbon dioxide).

### UNIT-III

**Nutrient Cycles in Lakes-Nitrogen, Sulphur and Phosphorous.** Streams: Different stages of stream development, Physico-chemical environment, Adaptation of hill-stream fishes. Marine Biology: Salinity and density of Sea water, Continental shelf, Adaptations of deep sea organisms, Coral reefs, Sea weeds.

### UNIT-IV

**Management of Aquatic Resources: Causes of pollution: Agricultural, Industrial, Sewage, Thermal and Oil spills, Eutrophication, Management and conservation (legislations), Sewage treatment; Water quality assessment- BOD and COD.**

### Text and Reference Books:

| S. No | Title   | Author(s)         | Publisher |
|-------|---|-------------------|-----------|
| 1     | Bioresources Ecology 3rd Edition                            | Anathakrishnan    |           |
| 2     | Limnology, 2nd Edition                                      | Goldman           |           |
| 3     | Fundamentals of Ecology, 5th Edition                        | Odum and Barrett  |           |
| 4     | Chemical and biological methods for water pollution studies | Trivedi and Goyal |           |



### AQUATIC BIOLOGY PRACTICAL

|                            |                                  |
|----------------------------|----------------------------------|
| <b>Course Code</b>         | <b>ZOO311</b>                    |
| <b>Course Title</b>        | <b>Aquatic Biology Practical</b> |
| <b>Type of course</b>      | Practical                        |
| <b>L T P</b>               | 0 0 4                            |
| <b>Credits</b>             | 2                                |
| <b>Course prerequisite</b> | B.Sc Medical II year             |

|                             |   |
|-----------------------------|---|
| <b>Course Objective</b>     | To give the training to the students regarding different techniques used in determination of various parameters of water and soil, so that we can check the their quality.                                  |
| <b>Course Outcomes (CO)</b> | i) Employ scientific methodologies such as experimentation and data analysis in the<br><br>ii)ss area of aquatic biology Critically analyse, interpret and evaluate information relevant to aquatic biology |

### LIST OF EXPERIMENTS

1. Determine the area of a lake using graphimetric and gravimetric method.
2. Identify the important macrophytes, phytoplanktons and zooplanktons present in a lake ecosystem.
3. Determine the amount of Turbidity/transparency, Dissolved Oxygen, Free Carbon dioxide, Alkalinity (carbonates & bicarbonates) in water collected from a nearby lake/ water body.
4. Instruments used in limnology (Secchi disc, Van Dorn Bottle, Conductivity meter, Turbidity meter, PONAR grab sampler) and their significance.
5. A Project Report on a visit to a Sewage treatment plant/Marine bioreserve/ Fisheries Institutes.

#### Text and Reference Books:

| S. No | Title                            | Author(s)      | Publisher |
|-------|----------------------------------|----------------|-----------|
| 1     | Bioresources Ecology 3rd Edition | Anathakrishnan |           |
| 2     | Limnology, 2nd Edition           | Goldman        |           |

### ORGANOMETALLICS, BIOINORGANIC CHEMISTRY, POLYNUCLEAR HYDROCARBONS AND UV, IR SPECTROSCOPY

|                     |  |
|---------------------|--|
| <b>Course Code</b>  | <b>CHM 305</b>   |
| <b>Course Title</b> | <b>Organometallics, bioinorganic chemistry, polynuclear hydrocarbons and uv, ir spectroscopy</b> |

|                              |  |
|------------------------------|--|
| <b>Type of course</b>        | <b>Discipline elective(theory)</b>   |
| <b>L T P</b>                 | 4:0:0  |
| <b>Credits</b>               | 4  |
| <b>Course prerequisite</b>   | Bsc. Ist, IInd year with CHEMISTRY as one core subject   |
| <b>Course Objective (CO)</b> | The aim of this course is to impart theoretical knowledge to the students about organometallic chemistry and organic spectroscopy.   |
| <b>Course Outcomes (CO)</b>  | 1.Explain the synthesis, structure, bonding, properties and reactivity of both main group & transition metal organyls<br>2.Work to a professional level of skills in a chemical synthesis laboratory |

### UNIT I

Chemistry of 3d metals : Oxidation states displayed by Cr, Fe, Co, Ni and Co. A study of the following compounds (including preparation and important properties); Peroxo compounds of Cr,  $K_2Cr_2O_7$ ,  $KMnO_4$ ,  $[Fe(CN)_6]$ , Sodium nitroprusside,  $[Co(NH_3)_6]Cl_3$ ,  $Na_3[Co(NO_2)_6]$ .

### UNIT -II

Organometallic Compounds Definition and Classification with appropriate examples based on nature of metal-carbon bond (ionic, s, p and multicentre bonds). Structures of methyl lithium, Zeiss salt and ferrocene. EAN rule as applied to carbonyls. Preparation, structure, bonding and properties of mononuclear and polynuclear carbonyls of 3d metals. p-acceptor behaviour of carbon monoxide. Synergic effects (VB approach)- (MO diagram of CO can be referred to for synergic effect to IR frequencies).

### UNIT – II

Bio-Inorganic Chemistry: A brief introduction to bio-inorganic chemistry. Role of metal ions present in biological systems with special reference to  $Na^+$ ,  $K^+$ ,  $Mg^{2+}$  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). Polynuclear and heteronuclear aromatic compounds: Properties of the following compounds with reference to electrophilic and Nucleophilic substitution: Naphthalene, Anthracene, Furan, Pyrrole, Thiophene, and Pyridine.  
Active methylene compounds: Preparation: Claisen ester condensation. Keto-enol tautomerism.  
Reactions: Synthetic uses of ethylacetoacetate (preparation of non-heteromolecules having

### UNIT IV

Application of Spectroscopy to Simple Organic Molecules Application of visible, ultraviolet and Infrared spectroscopy in organic molecules. Electromagnetic radiations, electronic transitions,  $\lambda_{max}$  &  $\epsilon_{max}$ , chromophore, auxochrome, bathochromic and hypsochromic shifts. Application of

electronic spectroscopy and Woodward rules for calculating  $\lambda_{max}$  of conjugated dienes and  $\alpha, \beta$ -unsaturated compounds. Infrared radiation and types of molecular vibrations, functional group and fingerprint region.

IR spectra of alkanes, alkenes and simple alcohols (inter and intramolecular hydrogen bonding), aldehydes, ketones, carboxylic acids and their derivatives (effect of substitution on  $>C=O$  stretching absorptions).

### Text and Reference Books

| S. No | Name   | Author(S)   | Publisher                              |
|-------|--|---|--|
| 1.    | Concise Inorganic Chemistry                                      | I.D. Lee  | ELBS                                   |
| 2.    | Inorganic Chemistry: Principles of Structure and Reactivity      | James E. Huheey, Ellen Keiter & Richard Keiter                        | Pearson Publication.                   |
| 3.    | Bioinorganic Chemistry   | Bertini, H. B. Grey, S. J. Lippard and J. S. Valentine                | Viva Books Pvt. Ltd., New Delhi (1998) |
| 4.    | Biological Inorganic Chemistry: An Introduction                  | Robert Crichton   | .Elsevier Science (2008)               |
| 5.    | Biological Inorganic Chemistry: Structure and Reactivity         | Harry B. Gray, Edward I. Stiefel et al.,                              | University Science Books.              |
| 6.    | Inorganic Chemistry  | G.L. Miessler & Donald A. Tarr  | Pearson Publication.                   |
| 7.    | Basic Inorganic Chemistry  | F.A. Cotton & G. Wilkinson:   | John Wiley & Sons                      |
| 8.    | Shriver & Atkin's Inorganic Chemistry (5 <sup>th</sup> Edition), | P Atkins, T. Overton, J. Rourke, M. Weller, F. Armstrong, M. Hagerman | Oxford University Press,               |
| 9.    | Organic Chemistry (Vol. I & II),                                 | I.L. Finar  | E.L.B.S.                               |
| 10.   | Applications of Absorption Spectroscopy of Organic Compounds,    | John R. Dyer:   | Prentice Hall.                         |
| 11.   | Spectroscopic Identification of Organic Compounds                | R.M. Silverstein, G.C. Bassler & T.C. Morrill                         | John Wiley & Sons                      |
| 12.   | Organic Chemistry,   | R.T. Morrison & R.N. Boyd   | Prentice Hall.                         |

|     |  |              |                 |
|-----|--|--------------|-----------------|
|     |  |              |                 |
| 13. | A Guide Book to Mechanism in Organic Chemistry | Peter Sykes: | Orient Longman. |



**ORGANOMETALLICS, BIOINORGANIC CHEMISTRY, POLYNUCLEAR  
HYDROCARBONS AND UV, IR SPECTROSCOPY**

|                       |  |
|-----------------------|--|
| <b>Course Code</b>    | <b>CHM 307</b>   |
| <b>Course Title</b>   | <b>Organometallics, bioinorganic chemistry, polynuclear hydrocarbons and uv, ir spectroscopy</b> |
| <b>Type of course</b> | Discipline elective(practical)   |
| <b>L T P</b>          | 0:0:4  |

|                             |   |
|-----------------------------|---|
| <b>Credits</b>              | 2   |
| <b>Course prerequisite</b>  | Bsc. Ist, IInd year with CHEMISTRY as one core subject  |
| <b>Course Objective</b>     | The aim of this course is to impart practical knowledge to the students about organometallic chemistry and organic qualitative analysis.                      |
| <b>Course Outcomes (CO)</b> | 1. Interpret the structures of various complexes and understand their properties<br>2. Impart knowledge about handling the apparatus for various experiments. |

1. Separation of mixtures by chromatography: Measure the R<sub>f</sub> value in each case. (Combination of two ions to be given)

Paper chromatographic separation of Fe<sup>3+</sup>, Al<sup>3+</sup> and Cr<sup>3+</sup>

**Or**

Paper chromatographic separation of Ni<sup>2+</sup>, Co<sup>2+</sup>, Mn<sup>2+</sup> and Zn<sup>2+</sup>.

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

(i) tetraamminecarbonatocobalt (III) nitrate

(ii) tetraamminecopper (II) sulphate

(iii) potassium trioxalatoferate (III) trihydrate

Compare the conductance of the complexes with that of M/1000 solution of NaCl, MgCl<sub>2</sub> and LiCl<sub>3</sub>

Systematic Qualitative Organic Analysis of Organic Compounds possessing monofunctional groups (-COOH, phenolic, aldehydic, ketonic, amide, nitro, amines) and preparation of one derivative.

#### Text and Reference Books

| S. No | Name  | Author(S)   | Publisher         |
|-------|---|---|-------------------|
| 1     | Vogel's Qualitative Inorganic Analysis (7 <sup>th</sup> Edition). | A.I. Vogel , G Svehla   | Prentice Hall     |
| 2     | Vogel's Quantitative Chemical Analysis (6 <sup>th</sup> Edition), | A.I. Vogel , J. Mendham, R.C. Denney, J.D. Barnes, M.J.K. Thomas    | Prentice Hall     |
| 3     | Advanced Practical Inorganic Chemistry                            | Ayodha Singh  | Campus Books 2002 |
| 4     | Textbook of Practical Organic Chemistry, 5th edition, 1996.       | Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, | Prentice-Hall     |

|   |                             |                                |                 |
|---|-----------------------------|--------------------------------|-----------------|
|   |                             | P.W.G                          |                 |
| 5 | Practical Organic Chemistry | Mann, F.G. & Saunders,<br>B.C. | Orient-Longman, |



### INDUSTRIAL CHEMICAL AND ENVIRONMENT

|                       |  |
|-----------------------|--|
| <b>Course Code</b>    | <b>CHM 309</b>                             |
| <b>Course Title</b>   | <b>Industrial chemical and environment</b> |
| <b>Type of course</b> | Discipline elective(theory)                |
| <b>L T P</b>          | 4:0:0                                      |
| <b>Credits</b>        | 4  |

|                             |   |
|-----------------------------|---|
| <b>Course prerequisite</b>  | Bsc. Ist, IInd year with CHEMISTRY as core subject  |
| <b>Course Objective</b>     | The aim of this course is to impart theoretical knowledge to the students in Industrial processes and environmental chemistry.                      |
| <b>Course Outcomes (CO)</b> | i) Understand the characteristics of some food starches.<br>ii) Study the manufacture of cement, dyes, Glass, Soap and Detergents by modern methods |

### UNIT I

**Industrial Gases and Inorganic Chemicals** Industrial Gases: Large scale production, uses, storage and hazards in handling of the following gases: oxygen, nitrogen, argon, neon, helium, hydrogen, acetylene, carbon monoxide, chlorine, fluorine, sulphur dioxide and phosphene. Inorganic Chemicals: Manufacture, application, analysis and hazards in handling the following chemicals: hydrochloric acid, nitric acid, sulphuric acid, caustic soda, common salt, borax, bleaching powder, sodium thiosulphate, hydrogen peroxide, potash alum, chrome alum, potassium dichromate and potassium permanganate.

### UNIT II

**Industrial Metallurgy** Preparation of metals (ferrous and nonferrous) and ultrapure metals for semiconductor technology. Environment and its segments Ecosystems. Biogeochemical cycles of carbon, nitrogen and sulphur. Air Pollution: Major regions of atmosphere. Chemical and photochemical reactions in atmosphere. Air pollutants: types, sources, particle size and chemical nature; Photochemical smog: its constituents and photochemistry. Environmental effects of ozone, Major sources of air pollution. Pollution by SO<sub>2</sub>, CO<sub>2</sub>, CO, NO<sub>x</sub>, H<sub>2</sub>S and other foul smelling gases. Methods of estimation of CO, No<sub>x</sub>, So<sub>x</sub> and control procedures. Effects of air pollution on living organisms and vegetation. Greenhouse effect and Global warming, Ozone depletion by oxides of nitrogen, chlorofluorocarbons and Halogens, removal of sulphur from coal. Control of particulates.

### UNIT III

**Water Pollution:** Hydrological cycle, water resources, aquatic ecosystems, Sources and nature of water pollutants, Techniques for measuring water pollution, Impacts of water pollution on hydrological and ecosystems. Water purification methods. Effluent treatment plants (primary, secondary and tertiary treatment). Industrial effluents from the following industries and their treatment: electroplating, textile, tannery, dairy, petroleum and petrochemicals, agro, fertilizer, etc. Sludge disposal. Industrial waste management, incineration of waste. Water treatment and purification (reverse osmosis, electro dialysis, ion exchange). Water quality parameters for waste water, industrial water and domestic water.

### UNIT IV

Energy & Environment: Sources of energy: Coal, petrol and natural gas. Nuclear Fusion / Fission, Solar energy, Hydrogen, geothermal, Tidal and Hydel, etc. Nuclear Pollution: Disposal of nuclear waste, nuclear disaster and its management.

Biocatalysis Introduction to biocatalysis: Importance in “Green Chemistry” and Chemical Industry.

### Text and Reference Books

| S. No | Name   | Author(S)   | Publisher                               |
|-------|--|---|---|
| 1     | Standard methods for the examination of water and waste water- 19 <sup>th</sup> Edn. 1995. | Andrew D. Eaton, Lenore, S. Clesceri and A. E. Greenberg, | EPS group, INC Roman,                   |
| 2     | Environmental Chemistry, , 2 <sup>nd</sup> edition, 1990.                                  | A. K. DE  | Wiley Eastern Ltd                       |
| 3     | Environmental Pollution Analysis, 1995   | S. M. Khopkar,  | Wiley Eastern Ltd.,                     |
| 4     | Physical Electrochemistry- Fundamentals, Techniques and Applications                       | Eliezer Gileadi,  | Wiley-VCH 2011.                         |
| 5     | Waste water treatment disposal and release-, INC second Edn., 1990.                        | Metcalf and eddy  | Tata Mc Graw Hill                       |
| 6     | Environmental pollution control and engineering, 1995.                                     | C. S. Rao   | Wiley Eastern Ltd.                      |
| 7     | Chemical and Biological methods for water pollution studies, 1986.                         | R. K. Trivedy, and P. K. Goel,                            | Environmental publications              |
| 8     | Environmental Chemistry, 1994.   | B. K. Sharma & H. Kaur                                    | Goel publishing House,                  |
| 9     | Principles of Instrumental Methods of analysis   | D. A. Skoog and D.M. West                                 | Saunder’s College Publ. Latest edition. |

### INDUSTRIAL CHEMICAL AND ENVIRONMENT PRACTICAL

|             |         |
|-------------|---------|
| Course Code | CHM 311 |
|-------------|---------|

|                             |  |
|-----------------------------|--|
| <b>Course Title</b>         | <b>Industrial chemical and environment</b>   |
| <b>Type of course</b>       | Discipline elective(practical)   |
| <b>L T P</b>                | 0:0:4  |
| <b>Credits</b>              | 2  |
| <b>Course prerequisite</b>  | Bsc. Ist, Iind year with CHEMISTRY as one core subject   |
| <b>Course Objective</b>     | The aim of this course is to impart practical knowledge to the students in Industrial processes and environmental chemistry. |
| <b>Course Outcomes (CO)</b> | i). Know the importance of chemical industry<br>ii)Study the nutritive aspects of food constituents.                         |

1. Determination of dissolved oxygen in water.
2. Determination of Chemical Oxygen Demand (COD)
3. Determination of Biological Oxygen Demand (BOD)
4. Percentage of available chlorine in bleaching powder.
5. Measurement of chloride, sulphate and salinity of water samples by simple titration method (AgNO<sub>3</sub> and potassium chromate).
6. Estimation of total alkalinity of water samples (CO<sub>3</sub><sup>2-</sup>, HCO<sub>3</sub><sup>-</sup>) using double titration method.
7. Measurement of dissolved CO<sub>2</sub>.
8. Study of some of the common bio-indicators of pollution.
9. Estimation of SPM in air samples.
10. Preparation of borax/ boric acid.

### Text and Reference Books

| S. No | Name   | Author(S)   | Publisher             |
|-------|--|---|-----------------------|
| 1     | Standard methods for the examination of water and waste water- 19th Edn. 1995. | Andrew D. Eaton, Lenore, S. Clesceri and A. E. Greenberg, | EPS group, INC Roman, |

|   |   |                                |   |
|---|---|--------------------------------|---|
| 2 | Environmental Pollution Analysis, 1995                              | S. M. Khopkar,                 | Wiley Eastern Ltd.,                     |
| 3 | Physical Electrochemistry-Fundamentals, Techniques and Applications | Eliezer Gileadi,               | Wiley-VCH 2011.                         |
| 4 | Waste water treatment disposal and release-, INC second Edn., 1990. | Metcalf and eddy               | Tata Mc Graw Hill                       |
| 5 | Environmental pollution control and engineering, 1995.              | C. S. Rao                      | Wiley Eastern Ltd.                      |
| 6 | Chemical and Biological methods for water pollution studies, 1986.  | R. K. Trivedy, and P. K. Goel, | Environmental publications              |
| 7 | Principles of Instrumental Methods of analysis                      | D. A. Skoog and D.M.West       | Saunder's College Publ. Latest edition. |



### GREEN CHEMISTRY

|                       |                             |
|-----------------------|-----------------------------|
| <b>Course Code</b>    | <b>CHM 310</b>              |
| <b>Course Title</b>   | <b>Green chemistry</b>      |
| <b>Type of course</b> | Discipline elective(theory) |
| <b>L T P</b>          | 4:0:0                       |

|                              |  |
|------------------------------|--|
| <b>Credits</b>               | 4  |
| <b>Course prerequisite</b>   | Bsc. Ist, IInd year with CHEMISTRY as core subject   |
| <b>Course Objective (CO)</b> | The aim of this course is to impart theoretical knowledge to the students<br>Green chemistry and applications of green chemistry in organic synthesis. |
| <b>Course Outcomes (CO)</b>  | i)To understand the overall background of green chemistry in agricultural<br><br>ii)A working understanding of the 12 principles of green chemistry.   |

### UNIT I

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. Principles of Green Chemistry and Designing a Chemical synthesis: Twelve principles of Green Chemistry with their explanations and examples and special emphasis on the following: 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, calculation of atom economy of the rearrangement, addition, substitution and elimination reactions. Prevention/ minimization of hazardous/ toxic products reducing toxicity. Risk = (function) hazard × exposure; waste or pollution prevention hierarchy.

### UNIT II

Green solvents– supercritical fluids, water as a solvent for organic reactions, ionic liquids, fluorinated biphasic solvent, PEG, solvent less processes, immobilized solvents and how to compare greenness of solvents. Energy requirements for reactions – alternative sources of energy: use of microwaves and 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; catalysis and green chemistry, comparison of heterogeneous and homogeneous catalysis, biocatalysis, asymmetric catalysis and photocatalysis.

Strengthening/ development of analytical techniques to prevent and minimize the generation of hazardous substances in chemical process

### UNIT I

Examples of Green Synthesis/ Reactions and some real world cases

1. Green Synthesis of the following compounds: adipic acid, catechol, disodium iminodiacetate (alternative to Strecker synthesis)

2. Microwave assisted reactions in water: Hofmann Elimination, methyl benzoate to benzoic acid, oxidation of toluene and alcohols; microwave assisted reactions in organic solvents Diels-Alder reaction and Decarboxylation reaction
3. Ultrasound assisted reactions: Sono chemical Simmons-Smith Reaction (Ultrasonic alternative to Iodine)
4. Surfactants for carbon dioxide – replacing smog producing and ozone depleting solvents with CO<sub>2</sub> for precision cleaning and dry cleaning of garments.
5. Designing of Environmentally safe marine antifoulant.
6. Rightfit pigment: synthetic azopigments to replace toxic organic and inorganic pigments.

#### UNIT IV

Future Trends in Green Chemistry Oxidation reagents and catalysts; Biomimetic, multifunctional reagents; Combinatorial green chemistry; Proliferation of solvent less reactions; co crystal controlled solid state synthesis (C<sup>2</sup>S<sup>3</sup>); Green chemistry in sustainable development.

#### Text and Reference Books

| S. No | Name  | Author(S)                                      | Publisher  |
|-------|---|--|--|
| 1     | Green Chemistry                             | V. K. Ahluwalia                                | New Age International                                  |
| 2     | Green Chemistry- Theory and Practical, 1998 | Anastas, P.T. & Warner, J.K.                   | Oxford University Press                                |
| 3     | Introduction to Green Chemistry, 2001       | Matlack, A.S.                                  | Marcel Dekker  |
| 4     | Real-World cases in Green Chemistry, 2000   | Cann, M.C. & Connelly, M.E.                    | American Chemical Society, Washington                  |
| 5     | Introduction to Green Chemistry, 2002       | Ryan, M.A. & Tinnensand, M.                    | American Chemical Society, Washington                  |
| 6     | Green Chemistry Experiments: A monograph    | Sharma, R.K.; Sidhwani, I.T. & Chaudhari, M.K. | I.K. International Publishing House Pvt Ltd. New Delhi |
| 7     | Green Chemistry: An introductory text       | Lancaster, M.                                  | RSC publishing, 2 <sup>nd</sup> Edition.               |



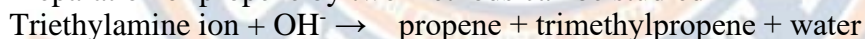
### GREEN CHEMISTRY PRACTICAL

|              |                 |
|--------------|-----------------|
| Course Code  | CHM 312         |
| Course Title | Green chemistry |

|                              |  |
|------------------------------|--|
| <b>Type of course</b>        | Discipline elective(practical)   |
| <b>L T P</b>                 | 0:0:4  |
| <b>Credits</b>               | 2  |
| <b>Course prerequisite</b>   | Bsc. Ist, Iind year with CHEMISTRY as core subject   |
| <b>Course Objective (CO)</b> | The aim of this course is to impart practical knowledge to the students green methods of synthesis.  |
| <b>Course OPutcomes (CO)</b> | i)To learn the various instrumental techniques and the technology behind them<br>ii)To understand the importance of minimized utility of agrochemicals |

1. Safer starting materials: Preparation and characterization of nanoparticles of gold using tea leaves.
2. Using renewable resources: Preparation of biodiesel from vegetable/ waste cooking oil.
3. Avoiding waste: Principle of atom economy. Use of molecular model kit to stimulate the reaction to investigate how the atom economy can illustrate Green Chemistry.

Preparation of propene by two methods can be studied



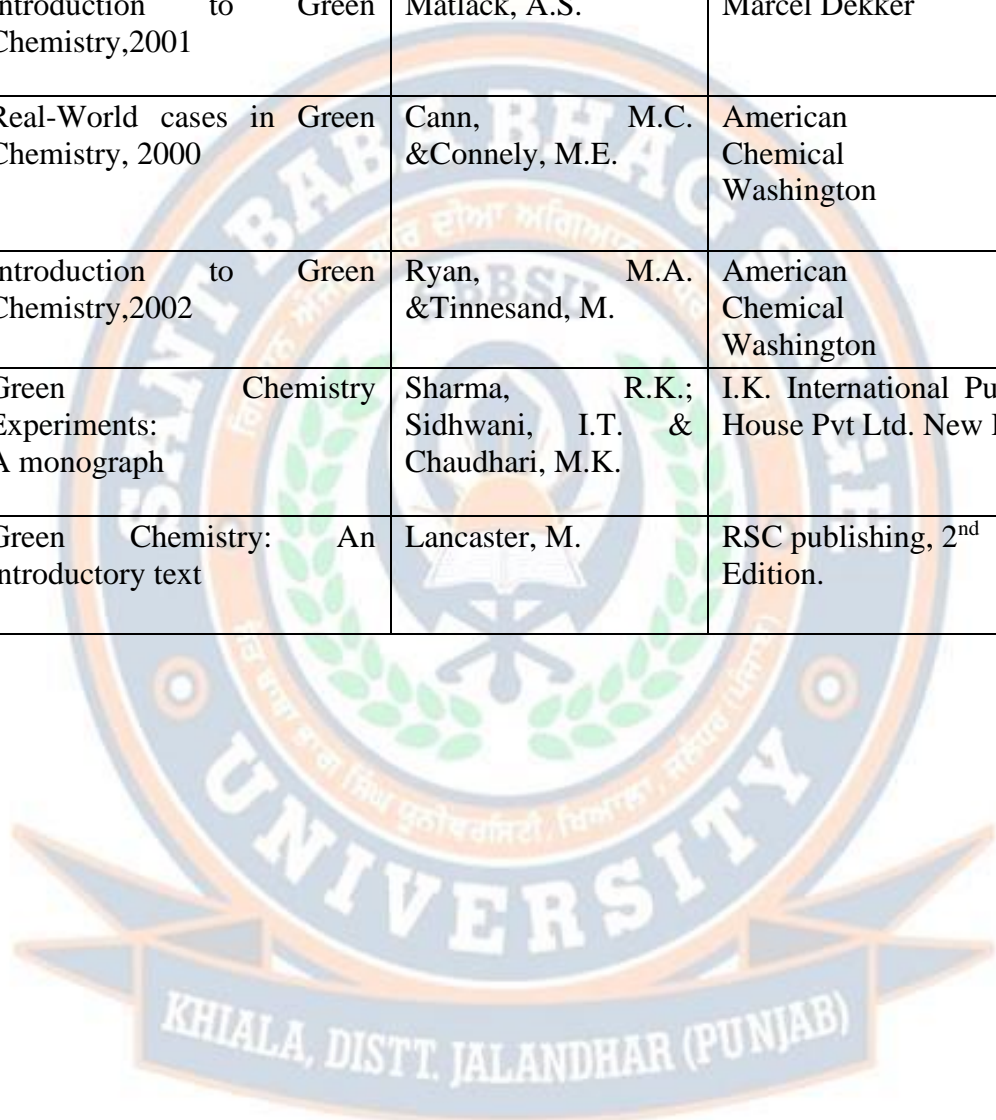
Other types of reactions, like addition, elimination, substitution and rearrangement should also be studied for the calculation of atom economy.

4. Use of enzymes as catalysts Benzoin condensation using Thiamine Hydrochloride as a catalyst instead of cyanide.
5. Alternative Green solvents Extraction of D-limonene from orange peel using liquid CO<sub>2</sub> prepared from dry ice. Mechanochemical solvent free synthesis of azomethines.
6. Alternative sources of energy: Solvent free, microwave assisted one pot synthesis of phthalocyanine complex of copper (II). Photoreduction of benzophenone to benzopinacol in the presence of sunlight.

#### Text and Reference Books

| S. No | Name | Author(S) | Publisher |
|-------|------|-----------|-----------|
|-------|------|-----------|-----------|

|   |   |  |  |
|---|---|--|--|
| 1 | Green Chemistry                             | V. K. Ahluwalia                                | New Age International                                  |
| 2 | Green Chemistry- Theory and Practical, 1998 | Anastas, P.T. & Warner, J.K.                   | Oxford University Press                                |
| 3 | Introduction to Green Chemistry, 2001       | Matlack, A.S.                                  | Marcel Dekker  |
| 4 | Real-World cases in Green Chemistry, 2000   | Cann, M.C. & Connely, M.E.                     | American Chemical Society, Washington                  |
| 5 | Introduction to Green Chemistry, 2002       | Ryan, M.A. & Tinnesand, M.                     | American Chemical Society, Washington                  |
| 6 | Green Chemistry Experiments: A monograph    | Sharma, R.K.; Sidhwani, I.T. & Chaudhari, M.K. | I.K. International Publishing House Pvt Ltd. New Delhi |
| 7 | Green Chemistry: An introductory text       | Lancaster, M.                                  | RSC publishing, 2 <sup>nd</sup> Edition.               |



## ANALYTICAL METHOD IN CHEMISTRY

|                            |   |
|----------------------------|---|
| <b>Course Code</b>         | <b>CHM 314</b>  |
| <b>Course Title</b>        | <b>Analytical method in chemistry</b>   |
| <b>Type of course</b>      | Discipline elective(theory)   |
| <b>L T P</b>               | 4:0:0   |
| <b>Credits</b>             | 4   |
| <b>Course prerequisite</b> | Bsc. Ist, Iind year with CHEMISTRY as core subject  |
| Course Objective (CO)      | The aim of this course is to impart theoretical knowledge to the students in analytical methods in chemistry.   |
| Course Outcomes (CO)       | <p>i) Employ a variety of analytical and instrumental methods to prepare, separate and quantify samples from various matrices.</p> <p>ii) Apply the scientific process, including statistical treatment of data, in the conduct and reporting of chemical analysis.</p> |

### UNIT I

Qualitative and quantitative aspects of analysis: Sampling, evaluation of analytical data, errors, accuracy and precision, methods of their expression, normal law of distribution if indeterminate errors, statistical test of data; F, Q and t test, rejection of data, and confidence intervals.

Optical methods of analysis: Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, validity of Beer-Lambert's law. UV-Visible Spectrometry: Basic principles of instrumentation (choice of source, monochromator and detector) for single and double beam instrument; Basic principles of quantitative analysis: estimation of metal ions from aqueous solution, geometrical isomers, keto-enol tautomers. Determination of composition of metal complexes using Job's method of continuous variation and mole ratio method.

### UNIT II

Infrared Spectrometry: Basic principles of instrumentation (choice of source, NM monochromatic & detector) for single and double beam instrument; sampling techniques. Structural illustration through interpretation of data, Effect and importance of isotope substitution. Flame Atomic Absorption and Emission Spectrometry: Basic principles of instrumentation (choice of source, monochromatic, detector, choice of flame and Burner designs. Techniques of atomization and sample introduction; Method of background correction, sources of chemical interferences and their method of removal. Techniques for the quantitative estimation of trace level of metal ions from water samples.

### UNIT III

Thermal methods of analysis: Theory of thermogravimetry (TG), basic principle of instrument Techniques for quantitative estimation of Ca and Mg from their mixture .

Electro-analytical methods: Classification of electro analytical methods, basic principle of pH metric, potentiometric and conduct metric titrations. Techniques used for the determination of equivalence points. Techniques used for the determination of pKa values.

### UNIT IV

Separation techniques: Solvent extraction: Classification, principle and efficiency of the technique. Mechanism of extraction: extraction by 129alvation and chelation. Technique of extraction: batch, continuous and counter current extractions. Qualitative and quantitative aspects of solvent extraction: extraction of metal ions from aqueous solution, extraction of organic species from the aqueous and non-aqueous media.

Chromatography: Classification, principle and efficiency of the technique. Mechanism of separation: adsorption, partition & ion exchange. Development of chromatograms: frontal, elution and displacement methods. Qualitative and quantitative aspects of chromatographic methods of analysis: IC, GLC, GPC, TLC and HPLC. Role of computers in instrumental methods of analysis.

### Text and Reference Books

| S. No | Name  | Author(S)   | Publisher                                |
|-------|---|---|--|
| 1     | Electrochemical methods, Fundamentals and Methods                 | A.J. Bard, L.R. Faulkner,                           | Wiley, 1980.                             |
| 2     | Inorganic Chemistry   | A.G. Sharpe   | ELBS                                     |
| 3     | Principles of Instrumental Methods of analysis                    | D. A. Skoog and D.M. West                           | Saunders's College Publ. Latest edition. |
| 4     | Vogel's Qualitative Inorganic Analysis (7 <sup>th</sup> Edition). | G Svehla  | Prentice Hall                            |
| 5     | Vogel's Quantitative Chemical Analysis (6 <sup>th</sup> Edition), | J. Mendham, R.C. Denney, J.D. Barnes, M.J.K. Thomas | Prentice Hall                            |
| 6     | Instrumental Analysis   | G.D. Christian and J.E.G. Reily                     | AllegnBecon, Latest edition              |
| 7     | Instrumental Methods of Chemical Analysis                         | G.W. Ewing,   | McGraw Hill Pub, 1975.                   |



**ANALYTICAL METHOD IN CHEMISTRY PRACTICAL**

|                    |                |
|--------------------|----------------|
| <b>Course Code</b> | <b>CHM 316</b> |
|--------------------|----------------|

|                              |   |
|------------------------------|---|
| <b>Course Title</b>          | Analytical method in chemistry  |
| <b>Type of course</b>        | Discipline elective(practical)  |
| <b>L T P</b>                 | 0:0:4   |
| <b>Credits</b>               | 2   |
| <b>Course prerequisite</b>   | Bsc. Ist, Iind year with CHEMISTRY as core subject  |
| <b>Course Objective (CO)</b> | The aim of this course is to impart practical knowledge to the students about analytical methods of chemical analysis .   |
| <b>Course Outcomes (CO)</b>  | 1.Describe and compare a range of analytical chemistry methods and explain the underlying theoretical principles.<br><br>2. Explain the broad role of chemists in quality control and assessment of experimental measurements and analytical tasks. |

## I. Separation Techniques

### Chromatography:

- (i) Separation of mixtures :Paper chromatographic separation of  $\text{Fe}^{3+}$ ,  $\text{Al}^{3+}$ , and  $\text{Cr}^{3+}$ .
- (ii) Separation and identification of the monosaccharides present in the given mixture (glucose & fructose) by paper chromatography. Reporting the  $R_f$  values.
- (iii) Separate a mixture of Sudan yellow and Sudan Red by TLC technique and identify them on the basis of their  $R_f$  values.
- (iv) Chromatographic separation of the active ingredients of plants, flowers and juices by TLC

### II. Solvent Extractions:

- (i) To separate a mixture of  $\text{Ni}^{2+}$  &  $\text{Fe}^{2+}$  by complexation with DMG and extracting the  $\text{Ni}^{2+}$ - DMG complex in chloroform, and determine its concentration by spectrophotometry.
- (ii) Determine the pH of the given aerated drinks fruit juices, shampoos and soaps.
- (iii) Determination of Na, Ca, Li in cola drinks and fruit juices using flame photometric techniques.

### Analysis of soil:

- (i) Determination of pH of soil.
- (ii) Total soluble salt
  - (iii) Estimation of calcium, magnesium, phosphate, nitrate

**Ion exchange:**

- (i) Determination of exchange capacity of cation exchange resins and anion exchange resins.
- (ii) Separation of metal ions from their binary mixture.
- (iii) Separation of amino acids from organic acids by ion exchange chromatography.

**III Spectro-photometry**

- (i) Determination of pKa values of indicator using spectrophotometry.
- (ii) Structural characterization of compounds by infrared spectroscopy.
- (iii) Determination of dissolved oxygen in water.
- (iv) Determination of chemical oxygen demand (COD).
- (v) Determination of Biological oxygen demand (BOD).

**Text and Reference Books**

| S. No | Name  | Author(S)   | Publisher                              |
|-------|---|---|--|
| 1     | Electrochemical methods, Fundamentals and Methods                 | A.J. Bard, L.R. Faulkner,                           | Wiley, 1980.                           |
| 2     | Inorganic Chemistry   | A.G. Sharpe   | ELBS                                   |
| 3     | Principles of Instrumental Methods of analysis                    | D. A. Skoog and D.M. West                           | Saunders College Publ. Latest edition. |
| 4     | Vogel's Qualitative Inorganic Analysis (7 <sup>th</sup> Edition). | G Svehla  | Prentice Hall                          |
| 5     | Vogel's Quantitative Chemical Analysis (6 <sup>th</sup> Edition), | J. Mendham, R.C. Denney, J.D. Barnes, M.J.K. Thomas | Prentice Hall                          |
| 6     | Instrumental Analysis   | G.D. Christian and J.E.G. Reily                     | AllegnBecon, Latest edition            |
| 7     | Instrumental Methods of Chemical Analysis                         | G.W. Ewing,   | McGraw Hill Pub, 1975.                 |

**CHEMISTRY OF MAIN GROUP ELEMENT, THEORIES OF ACIDS AND BASES**

|                    |                |
|--------------------|----------------|
| <b>Course Code</b> | <b>CHM 306</b> |
|--------------------|----------------|

|                              |   |
|------------------------------|---|
| <b>Course Title</b>          | <b>Chemistry of main group element, theories of acids and bases</b>   |
| <b>Type of course</b>        | Discipline elective(theory)   |
| <b>L T P</b>                 | 4:0:0   |
| <b>Credits</b>               | 4   |
| <b>Course prerequisite</b>   | Bsc. Ist, IInd year with CHEMISTRY as core subject  |
| <b>Course Objective (CO)</b> | The aim of this course is to impart theoretical knowledge to the students in Main group elements.   |
| <b>Course Outcomes (CO)</b>  | <p>1. Basic concepts about acids and bases, HSAB concept and its application, Relative strength of acid and bases and effects of solvents and substituent on them.</p> <p>2. Students become able to distinguish or classify the acidic and basic strength of different acids and bases respectively they come to know about anomalous behavior of hydrogen and its position and anomaly.</p> |

### UNIT I

Acids and Bases Brönsted–Lowry concept, conjugate acids and bases, relative strengths of acids and bases, effects of substituent and solvent, differentiating and levelling solvents. Lewis acid-base concept, classification of Lewis acids and bases, Lux-Flood concept and solvent system concept. Hard and soft acids and bases ( HSAB concept), applications of HSAB process  
 General Principles of Metallurgy: Chief modes of occurrence of metals based on standard electrode potentials, Ellingham diagrams for reduction of metal oxides using carbon and carbon monoxide as reducing agents. Hydrometallurgy with reference to cyanide process for gold and silver. Methods of purification of metals (Al, Pb, Ti, Fe, Cu, Ni, Zn, Au): electrolytic refining, zone refining, van Arkel-de Boer process, Parting Process, Mond’s process and Kroll Process.

### UNIT II

*s*- and *p*-Block Elements Periodicity in *s*- and *p*-block elements with respect to electronic configuration, atomic and ionic size, ionization enthalpy, electron gain enthalpy, electronegativity (Pauling scale). General characteristics of *s*-block metals like density, melting and boiling points, flame colour and reducing nature. Oxidation states of *s*- and *p*-block elements, inert-pair effect, diagonal relationships and anomalous behaviour of first member of each group. Allotropy in C, P and S. Complex forming tendency of *s* block elements and a preliminary idea of crown ethers and cryptates, structures of basic beryllium acetate, salicylaldehyde/ acetylacetonato complexes of Group 1 metals. Solutions of alkali metals in liquid ammonia and

their properties. Common features, such as ease of formation, solubility and stability of oxides, peroxides, superoxides, sulphates and carbonates of *s*-block metals.

### UNIT III

Structure, bonding and properties (acidic/ basic nature, oxidizing/ reducing nature and hydrolysis of the following compounds and their applications in industrial and environmental chemistry wherever applicable: Diborane and concept of multicentre bonding, hydrides of Groups 13 (EH<sub>3</sub>), 14, 15, 16 and 17. Oxides

### UNIT IV

Noble gases: Rationalization of inertness of noble gases, catharses, preparation and properties of XeF<sub>2</sub>, XeF<sub>4</sub> and XeF<sub>6</sub>, bonding in these compounds using VBT and shapes of noble gas compounds using VSEPR Theory. Inorganic Polymers Types of inorganic polymers and comparison with organic polymers, structural features, classification and important applications of silicates. Synthesis, structural features and applications of silicones. Borazines and cyclophosphazenes – preparation, properties and reactions. Bonding in (N<sub>2</sub>PCl<sub>2</sub>)<sub>3</sub>. of N and P, Ox acids of P, S and Cl. Halides and ox halides of P and S (PCl<sub>3</sub>, PCl<sub>5</sub>, SOCl<sub>2</sub> and SO<sub>2</sub>Cl<sub>2</sub>). Interhalogen compounds. A brief idea of pseudo halides.

### Text and Reference Books

| S. No | Name   | Author(S)   | Publisher                                 |
|-------|--|---|---|
| 1     | Concise Inorganic Chemistry                                      | I.D. Lee  | ELBS                                      |
| 2     | Inorganic Chemistry  | A.G. Sharpe   | ELBS                                      |
| 3     | Inorganic Chemistry Principles of Structure and Reactivity       | J.E. Huheey   | Harper Inter science                      |
| 4     | Principles of Inorganic Chemistry                                | Puri, Sharma and Kalia  | Vishal publishers                         |
| 5     | Synthesis and Technique in Inorganic chemistry                   | G. S. Grolomi; R.J. Angleci   | Latest edition, University Science Books. |
| 6     | Physical Chemistry   | R.A. Alberty  | Wiley Eastern Ltd                         |
| 7     | Shriver & Atkin's Inorganic Chemistry (5 <sup>th</sup> Edition), | P Atkins, T. Overton, J. Rourke, M. Weller, F. Armstrong, M. Hagerman | Oxford University Press,                  |

### CHEMISTRY OF MAIN GROUP ELEMENT, THEORIES OF ACIDS AND BASES PRACTICAL

|                              |   |
|------------------------------|---|
| <b>Course Code</b>           | <b>CHM 308</b>  |
| <b>Course Title</b>          | <b>Chemistry of main group element, theories of acids and bases</b>   |
| <b>Type of course</b>        | Discipline elective(practical)  |
| <b>L T P</b>                 | 0:0:4   |
| <b>Credits</b>               | 2   |
| <b>Course prerequisite</b>   | Bsc. Ist, IInd year with CHEMISTRY as core subject  |
| <b>Course Objective (CO)</b> | The aim of this course is to impart practical knowledge to the students in qualitative and quantitative inorganic analysis..  |
| <b>Course Outcomes (CO)</b>  | 1.General Trends and characteristics of s and p block elements including detailed description of various properties.<br><br>2. Preparation properties and structure of important compound of noble gases. |

1. Iodometric estimation of potassium dichromate and copper sulphate
2. Iodimetric estimation of antimony in tartaremetic
3. Estimation of amount of available chlorine in bleaching powder and household bleaches
4. Estimation of iodine in iodized salts.
5. Iodimetric estimation of ascorbic acid in fruit juices.
6. Estimation of dissolved oxygen in water samples.
7. Gravimetric estimation of sulphate as barium sulphate.
8. Gravimetric estimation of aluminium as oximato complex
9. Preparation of the following :potash alum, chrome alum, tetraamminecopper(II) sulphate monohydrate, potassium trioxalatoferrate(III) (any two, including one double salt and one complex).

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

| <b>S. No</b> | <b>Name</b>                   | <b>Author(S)</b> | <b>Publisher</b> |
|--------------|-------------------------------|------------------|------------------|
| 1            | Vogel's Qualitative Inorganic | G Svehla         | Prentice Hall    |

|   |   |   |                   |
|---|---|---|-------------------|
|   | Analysis (7 <sup>th</sup> Edition). ISBN-13:978-0582218666,                               |   |                   |
| 2 | Vogel's Quantitative Chemical Analysis (6 <sup>th</sup> Edition), ISBN-13:978-0582226289, | J. Mendham, R.C. Denney, J.D. Barnes, M.J.K. Thomas | Prentice Hall     |
| 3 | Advanced Practical Inorganic Chemistry  | Ayodha Singh  | Campus Books 2002 |



### ECONOMIC BOTANY AND BIOTECHNOLOGY

|             |        |
|-------------|--------|
| Course Code | BOT302 |
|-------------|--------|

|                             |   |
|-----------------------------|---|
| <b>Course Title</b>         | <b>Economic Botany and Biotechnology</b>  |
| <b>Type of course</b>       | Theory  |
| <b>L T P</b>                | 4 0 0   |
| <b>Credits</b>              | 4   |
| <b>Course prerequisite</b>  | B.Sc Medical II year  |
| <b>Course Objective</b>     | To study economically important plants and recombinant DNA techniques.  |
| <b>Course Outcomes (CO)</b> | 1.Understand core concepts of Economic Botany and relate with environment, populations, communities, and ecosystems<br>2.Develop a basic knowledge of taxonomic diversity and important families of useful plants |

#### UNIT-I

**Origin of Cultivated Plants:** Concept of centres of origin, their importance with reference to Vavilov's work

**Cereals :**Wheat, Rice, Maize –Origin, morphology, uses

**Legumes:** General account with special reference to Gram, Pea, Soybean,

#### UNIT-I

**Spices:** General account with special reference to clove and black pepper (Botanical name, family, part used morphology and uses)

**Beverages:** Tea, Coffee (morphology, processing, uses)

#### UNIT-III

**Oils and Fats:** General description with special reference to groundnut

**Fibre Yielding Plants:** General description with special reference to Cotton (Botanical name, family, part used, morphology and uses)

**Plant tissue culture:** Micropropagation ; haploid production through androgenesis and gynogenesis; brief account of embryo & endosperm culture with their applications

#### UNIT-IV

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

#### Text and reference books:

| <b>S. no.</b> | <b>Title</b>  | <b>Author</b>                  | <b>Publisher</b>           |
|---------------|---|--------------------------------|----------------------------|
| 1             | Economic Botany in the Tropics  | Kochhar, S.L.                  | MacMillan Publishers India |
| 2             | Plant Tissue Culture: Theory and Practice                               | Bhojwani, S.S. and Razdan, M.K | Elsevier Science           |
| 3             | Molecular Biotechnology- Principles and Applications of recombinant DNA | Glick, B.R., Pasternak, J.J.   | ASM Press                  |

## ECONOMIC BOTANY AND BIOTECHNOLOGY PRACTICAL

|                             |   |
|-----------------------------|---|
| <b>Course Code</b>          | <b>BOT304</b>   |
| <b>Course Title</b>         | <b>Economic Botany and Biotechnology Practical</b>  |
| <b>Type of course</b>       | Practical   |
| <b>L T P</b>                | 0 0 4   |
| <b>Credits</b>              | 2   |
| <b>Course prerequisite</b>  | B.Sc Medical II year  |
| <b>Course Objective</b>     | To impart practical knowledge about economically important plants and recombinant DNA techniques.   |
| <b>Course Outcomes (CO)</b> | 1.Increase the awareness and appreciation of plants & plant products encountered in everyday life<br>2.Appreciate the diversity of plants and the plant products in human use |

### LIST OF EXPERIMENTS

4. Study of economically important plants: Wheat, Gram, Soybean, Black pepper, Clove  
Tea, Cotton, Groundnut through specimens, sections and microchemical tests
2. Familiarization with basic equipments in tissue culture.
3. Study through photographs: Anther culture, somatic embryogenesis, endosperm and embryo culture; micropropagation.
5. Study of molecular techniques: PCR, Blotting techniques, AGE and PAGE.

#### **Text and reference books:**

| <b>S. no.</b> | <b>Title</b>  | <b>Author</b>                  | <b>Publisher</b>           |
|---------------|---|--------------------------------|----------------------------|
| 1             | Economic Botany in the Tropics  | Kochhar, S.L.                  | MacMillan Publishers India |
| 2             | Plant Tissue Culture: Theory and Practice                               | Bhojwani, S.S. and Razdan, M.K | Elsevier Science           |
| 3             | Molecular Biotechnology- Principles and Applications of recombinant DNA | Glick, B.R., Pasternak, J.J.   | ASM Press                  |

## BIOINFORMATICS

|                     |                       |
|---------------------|-----------------------|
| <b>Course Code</b>  | <b>BOT306</b>         |
| <b>Course Title</b> | <b>Bioinformatics</b> |

|                             |   |
|-----------------------------|---|
| <b>Type of course</b>       | Theory  |
| <b>L T P</b>                | 4 0 0   |
| <b>Credits</b>              | 4   |
| <b>Course prerequisite</b>  | B.Sc Medical II year  |
| <b>Course Objective</b>     | To give knowledge about creation and usefulness of plant databases and softwares related to it.   |
| <b>Course outcomes (CO)</b> | 1.To get introduced to the basic concepts of Bioinformatics and its significance in Biological data analysis.<br>2.Describe the history, scope and importance of Bioinformatics and role of internet in Bioinformatics. |

### UNIT-I

**Introduction to Bioinformatics:** Introduction, Branches of Bioinformatics, Aim, Scope and Research areas of Bioinformatics.

**Databases in Bioinformatics:** Introduction, Biological Databases, Classification format of Biological Databases, Biological Database Retrieval System.

### UNIT-II

**Biological Sequence Databases:** National Center for Biotechnology Information (NCBI): Tools and Databases of NCBI, Database Retrieval Tool, Sequence Submission to NCBI, Basic local alignment search tool (BLAST), Nucleotide Database, Protein Database, Gene Expression Database.

EMBL Nucleotide Sequence Database (EMBL-Bank): Introduction, Sequence Retrieval, Sequence Submission to EMBL, Sequence analysis tools.

### UNIT-III

DNA Data Bank of Japan (DDBJ): Introduction, Resources at DDBJ, Data Submission at DDBJ. Protein Information Resource (PIR): About PIR, Resources of PIR, Databases of PIR, Data Retrieval in PIR.

Swiss-Prot: Introduction and Salient Features **Sequence Alignments:** Introduction, Concept of Alignment, Multiple Sequence Alignment (MSA), MSA by CLUSTALW, Scoring Matrices, Percent Accepted Mutation (PAM), Blocks of Amino Acid Substitution Matrix (BLOSUM).

### UNIT-IV

**Molecular Phylogeny:** Methods of Phylogeny, Software for Phylogenetic Analyses, Consistency of Molecular Phylogenetic Prediction.

**Applications of Bioinformatics:** Structural Bioinformatics in Drug Discovery, Quantitative structure-activity relationship (QSAR) techniques in Drug Design, Microbial genome applications, Crop improvement.

### Text and reference books:

| S. no. | Title | Author | Publisher |
|--------|-------|--------|-----------|
|--------|-------|--------|-----------|

|   |   |                            |                         |
|---|---|----------------------------|-------------------------|
| 1 | Bioinformatics: Principles and Applications         | Ghosh Z. and Bibekanand M  | Oxford University Press |
| 2 | Bioinformatics and Functional Genomics              | Pevsner J                  | Wiley-Blackwell         |
| 3 | Discovering Genomics, Proteomics and Bioinformatics | Campbell A. M., Heyer L. J | Benjamin Cummings       |

### BIOINFORMATICS PRACTICAL

|                             |   |
|-----------------------------|---|
| <b>Course Code</b>          | <b>BOT308</b>   |
| <b>Course Title</b>         | <b>Bioinformatics Practical</b>   |
| <b>Type of course</b>       | Practical   |
| <b>L T P</b>                | 0 0 4   |
| <b>Credits</b>              | 2   |
| <b>Course prerequisite</b>  | B.Sc Medical II year  |
| <b>Course Objective</b>     | To give practical knowledge about creation and usefulness of plant databases and softwares related to it.   |
| <b>Course Outcomes (CO)</b> | 1.Explain about the methods to characterise and manage the different types of Biological data.<br>2.Classify different types of Biological Databases. |

### LIST OF EXPERIMENTS

1. Nucleic acid and protein databases.
2. Sequence retrieval from databases.
3. Sequence alignment.
4. Sequence homology and Gene annotation.
5. Construction of phylogenetic tree.

#### Text and reference books:

| S. no. | Title   | Author                     | Publisher               |
|--------|---|----------------------------|-------------------------|
| 1      | Bioinformatics: Principles and Applications         | Ghosh Z. and Bibekanand M  | Oxford University Press |
| 2      | Bioinformatics and Functional Genomics              | Pevsner J                  | Wiley-Blackwell         |
| 3      | Discovering Genomics, Proteomics and Bioinformatics | Campbell A. M., Heyer L. J | Benjamin Cummings       |

### IMMUNOLOGY

|                              |   |
|------------------------------|---|
| <b>Course Code</b>           | <b>ZOO302</b>   |
| <b>Course Title</b>          | <b>Immunology</b>   |
| <b>Type of course</b>        | Theory  |
| <b>L T P</b>                 | 4 0 0   |
| <b>Credits</b>               | 4   |
| <b>Course prerequisite</b>   | B.Sc Medical II year  |
| <b>Course Objective</b>      | To make students aware about the immunological reaction taking place in your body.<br>To aware students about statistical methods used in biology.                                  |
| <b>Copurse Outcomes (CO)</b> | 1.Imparts in depth knowledge of tissues, cells and molecules involved in host defense mechanisms<br>2.Interactions of antigens, antibodies, complements and other immune components |

### UNIT I

**Overview of the Immune System:** Introduction to basic concepts in immunology, components of immune system, principles of innate and adaptive immune system, Cells and Organs of the Immune System Haematopoiesis, Cells of immune system and organs (primary and secondary lymphoid organs) of the immune system

### UNIT-II

**Antigens:** Basic properties of antigens, B and T cell epitopes, haptens and adjuvants. **Antibodies:** Structure, classes and function of antibodies, monoclonal antibodies, antigen antibody interactions as tools for research and diagnosis

### UNIT-III

**Working of the immune system:** Structure and functions of MHC, exogenous and endogenous pathways of antigen presentation and processing, basic properties and functions of cytokines, Classical pathway of Complement system.

### UNIT-IV

**Immune system in health and Vaccines:** General introduction to vaccines, various types of vaccines, various types of hypersensitivities, Introduction to concepts of autoimmunity and immunodeficiency,

### Text and Reference Books:

| S.No | Title                   | Author   | Publisher                   |
|------|-------------------------|--|-----------------------------|
| 1.   | Immunology, VI Edition  | Kindt, T. J., Goldsby, R.A., Osborne, B. A. and Kuby, J (2006) | W.H. Freeman and Company    |
| 2.   | Immunology, VII Edition | David, M., Jonathan, B., David, R. B. and Ivan R. (2006)       | Mosby, Elsevier Publication |
| 3.   | Text book of Immunology | Dr. P. MadhaveeLatha   | S. Chand publications       |

|    |  |   |                       |
|----|--|---|-----------------------|
| 4. | <i>Cellular and Molecular Immunology</i> . V Edition | Abbas, K. Abul and Lechtman H. Andrew (2003.) | Saunders Publication. |
| 5. | Biostatistics  | P. Ramakrishnan                               | Saras Publications    |

### IMMUNOLOGY PRACTICAL

|                             |  |
|-----------------------------|--|
| <b>Course Code</b>          | <b>ZOO304</b>  |
| <b>Course Title</b>         | <b>Immunology</b>  |
| <b>Type of course</b>       | Practical  |
| <b>L T P</b>                | 0 0 4  |
| <b>Credits</b>              | 2  |
| <b>Course prerequisite</b>  | B.Sc Medical II year   |
| <b>Course Objective</b>     | To study histology of immune system and physiology of immunological reactions; graphical representation of data  |
| <b>Course Outcomes (CO)</b> | 1.Provides basics knowledge about immune system and allows the student to create insight as how to improve their immune system and good health.<br>2. Use of Math in science for study of different data |

### LIST OF EXPERIMENTS

1. Demonstration of lymphoid organs
2. Histological study of spleen, thymus and lymph nodes through slides/ photographs
3. Preparation of stained blood film to study various types of blood cells.
4. ABO blood group determination.
5. Demonstration of Immunoelectrophoresis
6. Demonstration of ELISA
7. Chromatography (Paper and TLC).

### Text and reference books:

| S. no. | Title                             | Author  | Publisher                |
|--------|-----------------------------------|---|--------------------------|
| 1      | Immunology                        | Kindt, T. J., Goldsby, R.A., Osborne, B. A. and Kuby, J | W.H. Freeman and Company |
| 2      | Immunology                        | David, M., Jonathan, B., David, R. B. and Ivan R        | Elsevier Publication     |
| 3      | Cellular and Molecular Immunology | Abbas, K. Abul and Lechtman H. Andrew                   | Saunders Publication     |

### REPRODUCTIVE BIOLOGY

|                             |  |
|-----------------------------|--|
| <b>Course Code</b>          | <b>ZOO306</b>  |
| <b>Course Title</b>         | <b>Reproductive Biology</b>  |
| <b>Type of course</b>       | Theory   |
| <b>L T P</b>                | 4 0 0  |
| <b>Credits</b>              | 4  |
| <b>Course prerequisite</b>  | B.Sc Medical II year   |
| <b>Course Objective</b>     | To aware students about the organs of reproduction and their hormonal secretions and the role played by each hormone for the development of reproductive organs in humans.                                       |
| <b>Course Outcomes (CO)</b> | B Upon successful completion of this subject, students should be able to:<br>ii) describe the structure of the organs of the reproductive system in males and females and indicate how this relates to function; |

### UNIT-I

**Reproductive Endocrinology:** Gonadal hormones and mechanism of hormone action, steroids, glycoprotein hormones, and prostaglandins, hypothalamo – hypophyseal – gonadal axis, regulation of gonadotrophin secretion in male and female; Reproductive System: Development and differentiation of gonads, genital ducts, external genitalia, mechanism of sex differentiation.

### UNIT-II

#### **Functional anatomy of male reproduction**

Outline and histological of male reproductive system in rat and human; Testis: Cellular functions, germ cell, stem cell renewal; Spermatogenesis: kinetics and hormonal regulation; Androgen synthesis and metabolism; Epididymal function and sperm maturation; Accessory glands functions; Sperm transportation in male tract

### UNIT-III

**Functional anatomy of female reproduction:** Outline and histological of female reproductive system in rat and human; Ovary: folliculogenesis, ovulation, corpus luteum formation and regression; Steroidogenesis and secretion of ovarian hormones; Reproductive cycles (rat and human) and their regulation, changes in the female tract; Ovum transport in the fallopian tubes; Sperm transport in the female tract, fertilization; Hormonal control of implantation; Hormonal regulation of gestation, pregnancy diagnosis, foeto – maternal relationship; Mechanism of parturition and its hormonal regulation; Lactation and its regulation

### UNIT-IV

**Reproductive Health** Infertility in male and female: causes, diagnosis and management; Assisted Reproductive Technology: sex selection, sperm banks, frozen embryos, in vitro fertilization, ET, EFT, IUT, ZIFT, GIFT, ICSI, PROST; Modern contraceptive technologies; Demographic terminology used in family planning.

#### **Text and reference books:**

| <b>S. no.</b> | <b>Title</b>                   | <b>Author</b>                   | <b>Publisher</b>           |
|---------------|--------------------------------|---------------------------------|----------------------------|
| 1             | Reproduction in Mammals        | Austin, C.R. and Short, R.V     | Cambridge University Press |
| 2             | Endocrinology                  | Degroot, L.J. and Jameson, J.L. | W.B. Saunders and Company  |
| 3             | The Physiology of Reproduction | Knobil, E                       | Raven Press Ltd            |



### REPRODUCTIVE BIOLOGY PRACTICAL

|                    |               |
|--------------------|---------------|
| <b>Course Code</b> | <b>ZOO308</b> |
|--------------------|---------------|

|                             |   |
|-----------------------------|---|
| <b>Course Title</b>         | <b>Reproductive Biology Practical</b>   |
| <b>Type of course</b>       | Practical   |
| <b>L T P</b>                | 0 0 4   |
| <b>Credits</b>              | 2   |
| <b>Course prerequisite</b>  | B.Sc Medical II year  |
| <b>Course Objective</b>     | To aware students about the different techniques used in studying various types of cells involved in formation of reproductive organs.  |
| <b>Course outcomes (CO)</b> | i) describe the hormonal, tissue and behavioural changes that occur across the menstrual cycle and explain how these are regulated;<br>ii) demonstrate an understanding of the hormonal control of reproduction in males and how this is regulated; |

#### **LIST OF EXPERIMENTS**

8. Study of animal house: set up and maintenance of animal house, breeding techniques, care of normal and experimental animals.
2. Examination of vaginal smear rats from live animals.
3. Surgical techniques: principles of surgery in endocrinology. Ovariectomy, hysterectomy, castration and vasectomy in rats.
4. Examination of histological sections from photomicrographs/ permanent slides of rat/human: testis, epididymis and accessory glands of male reproductive systems; Sections of ovary, fallopian tube, uterus (proliferative and secretory stages), cervix and vagina.
5. Human vaginal exfoliate cytology.
6. Sperm count and sperm motility in rat
7. Study of modern contraceptive devices

#### **Text and reference books:**

| <b>S. no.</b> | <b>Title</b>                   | <b>Author</b>                   | <b>Publisher</b>           |
|---------------|--------------------------------|---------------------------------|----------------------------|
| 1             | Reproduction in Mammals        | Austin, C.R. and Short, R.V     | Cambridge University Press |
| 2             | Endocrinology                  | Degroot, L.J. and Jameson, J.L. | W.B. Saunders and Company  |
| 3             | The Physiology of Reproduction | Knobil, E                       | Raven Press Ltd            |

## INSECT, VECTOR AND DISEASES

|                             |   |
|-----------------------------|---|
| <b>Course Code</b>          | <b>ZOO310</b>   |
| <b>Course Title</b>         | <b>Insect, Vector And Diseases</b>  |
| <b>Type of course</b>       | Theory  |
| <b>L T P</b>                | 4      0      0   |
| <b>Credits</b>              | 4   |
| <b>Course prerequisite</b>  | B.Sc Medical II year  |
| <b>Course Objective</b>     | To aware students about the role different insects in spreading the various diseases so that they can aware a general human being to take precautionary measure from insects                      |
| <b>Course Outcomes (CO)</b> | 1.Develop awareness about the causative agents and control measures of many commonly occurring diseases.<br><br>2.Develop understanding about the favourable breeding conditions for the vectors. |

### UNIT-I

**Introduction to Insects:** General Features of Insects, Morphological features, Head – Eyes, Types of antennae, Mouth parts w.r.t. feeding habits

**Concept of Vectors:** Brief introduction of Carrier and Vectors (mechanical and biological vector), Reservoirs, Host-vector relationship, Vectorial capacity, Adaptations as vectors, Host Specificity

### Unit II

**Insects as Vectors:** Classification of insects up to orders, detailed features of orders with insects as vectors – Diptera, Siphonaptera, Siphunculata, Hemiptera

**Dipteran as Disease Vectors:** Dipterans as important insect vectors – Mosquitoes, Sand fly, Houseflies; Study of mosquito-borne diseases – Malaria, Dengue, Chikungunya, Viral encephalitis, Filariasis; Control of mosquitoes Study of sand fly-borne diseases – Visceral Leishmaniasis, Cutaneous Leishmaniasis, Phlebotomus fever; Control of Sand fly Study of house fly as important mechanical vector, Myiasis, Control of house fly

### UNIT-III

**Siphonaptera as Disease Vectors:** Fleas as important insect vectors; Host-specificity, Study of Flea-borne diseases– Plague, Typhus fever; Control of fleas

**Siphunculata as Disease Vectors:** Human louse (Head, Body and Pubic louse) as important insect vectors; Study of louse-borne diseases – Typhus fever, Relapsing fever, Trench fever, Vagabond's disease, Phthiriasis; Control of human louse

### UNIT-IV

**Hemiptera as Disease Vectors:** Bugs as insect vectors; Blood-sucking bugs; Chagas disease, Bed bugs as mechanical vectors, Control and prevention measures.

**Text and reference books:**

| <b>S. no.</b> | <b>Title</b>                        | <b>Author</b> | <b>Publisher</b>           |
|---------------|-------------------------------------|---------------|----------------------------|
| 1             | A General Text Book of Entomology   | Imms, A.D     | Chapman & Hall             |
| 2             | The Insects: Structure and Function | Chapman, R.F  | Cambridge University Press |
| 3             | Entomology and Pest Management      | Pedigo L.P    | Prentice Hall Publication  |
| 4             | Integrated Vector Management        | Mathews, G.   | Wiley-Blackwell            |

**INSECT VECTORS AND DISEASES PRACTICAL**

|                     |  |
|---------------------|--|
| <b>Course Code</b>  | <b>ZOO312</b>                                |
| <b>Course Title</b> | <b>Insect, Vector And Diseases Practical</b> |

|                             |  |
|-----------------------------|--|
| <b>Type of course</b>       | Practical  |
| <b>L T P</b>                | 0 0 4  |
| <b>Credits</b>              | 2  |
| <b>Course prerequisite</b>  | B.Sc Medical II year   |
| <b>Course Objective</b>     | To give hands on training to the students about the different types of insects and their body parts which are involved in spreading disease, so that they will remain away from them.  |
| <b>Course Outcomes (CO)</b> | i.Devise strategies to manage the vectors population below threshold levels, public health importance.<br><br>ii.Undertake measures or start awareness programmes for maintenance of hygienic conditions, avoidance of contact from vector, destruction of breeding spots in the vicinity of houses and cattle shed by public health education campaign. |

### LIST OF EXPERIMENTS

1. Study of different kinds of mouth parts of insects
2. Study of following insect vectors through permanent slides/ photographs:  
*Aedes, Culex, Anopheles, Pediculus humanus capitis, Pediculus humanus corporis, Phithirus pubis, Xenopsyllacheopis, Cimexlectularius, Phlebotomusargentipes, Musca domestica*, through permanent slides/ photographs
3. Study of different diseases transmitted by above insect vectors

**Submission of a project report on any one of the insect vectors and disease transmitted**

#### Text and reference books:

| S. no. | Title                               | Author       | Publisher                  |
|--------|-------------------------------------|--------------|----------------------------|
| 1      | A General Text Book of Entomology   | Imms, A.D    | Chapman & Hall             |
| 2      | The Insects: Structure and Function | Chapman, R.F | Cambridge University Press |
| 3      | Entomology and Pest Management      | PedigoL.P    | Prentice Hall Publication  |
| 4      | Integrated Vector Management        | Mathews, G.  | Wiley-Blackwell            |

### INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS

|                    |               |
|--------------------|---------------|
| <b>Course Code</b> | <b>CHM326</b> |
|--------------------|---------------|

|                             |   |
|-----------------------------|---|
| <b>Course Title</b>         | <b>Instrumental Methods Chemical of Analysis</b>  |
| <b>Type of course</b>       | Theory  |
| <b>L T P</b>                | 4 0 0   |
| <b>Credits</b>              | 4   |
| <b>Course prerequisite</b>  | B.Sc Medical II year  |
| <b>Course Objective</b>     | The aim of this course is to impart theoretical knowledge to the students about various spectroscopic methods, chromatographic methods for analysis.    |
| <b>Course Outcomes (CO)</b> | i) Proficiency in professional sampling and sample treatment prior to analysis<br>ii) Capability of treatment and evaluation of the results of analysis |

### UNIT-I

**Introduction to spectroscopic methods of analysis:** Recap of the spectroscopic methods covered in detail in the core chemistry syllabus: Treatment of analytical data, including error analysis. Classification of analytical methods and the types of instrumental methods. Consideration of electromagnetic radiation.

*Infrared spectroscopy:* Interactions with molecules: absorption and scattering. Means of excitation (light sources), separation of spectrum (wavelength dispersion, time resolution), detection of the signal (heat, differential detection), interpretation of spectrum (qualitative, mixtures, resolution), advantages of Fourier Transform (FTIR). Samples and results expected. Applications: Issues of quality assurance and quality control, Special problems for portable instrumentation and rapid detection.

### UNIT-II

*UV-Visible/ Near IR* – emission, absorption, fluorescence and photoacoustic. Excitation sources (lasers, time resolution), wavelength dispersion (gratings, prisms, interference filters, laser, placement of sample relative to dispersion, resolution), Detection of signal (photocells, photomultipliers, diode arrays, sensitivity and S/N), Single and Double Beam instruments, Interpretation (quantification, mixtures, absorption vs. fluorescence and the use of time, photoacoustic, fluorescent tags).

### UNIT-III

**Separation techniques Chromatography:** Gas chromatography, liquid chromatography, supercritical fluids, Importance of column technology (packing, capillaries), Separation based on increasing number of factors (volatility, solubility, interactions with stationary phase, size, electrical field), Detection: simple vs. Specific (gas and liquid), Detection as a means of further analysis (use of tags and coupling to IR and MS), Electrophoresis (plates and capillary) and use with DNA analysis.

*Immunoassays and DNA techniques*

*Mass spectroscopy:* Making the gaseous molecule into an ion (electron impact, chemical ionization), Making liquids and solids into ions (electrospray, electrical discharge, laser desorption, fast atom bombardment), Separation of ions on basis of mass to charge ratio, Magnetic, Time of flight, Electric quadrupole. Resolution, time and multiple separations, Detection and interpretation (how this is linked to excitation).

#### UNIT-IV

**Elemental analysis:** Mass spectrometry (electrical discharges).

Atomic spectroscopy: Atomic absorption, Atomic emission, and Atomic fluorescence.

Excitation and getting sample into gas phase (flames, electrical discharges, plasmas),

Wavelength separation and resolution (dependence on technique), Detection of radiation

(simultaneous/scanning, signal noise), Interpretation (errors due to molecular and ionic species, matrix effects, other interferences).

**NMR spectroscopy:** Principle, Instrumentation, Factors affecting chemical shift, Spin coupling, Applications.

**Electroanalytical Methods:** Potentiometry & Voltammetry

**Radiochemical Methods**

**X-ray analysis and electron spectroscopy (surface analysis)**

**Text and reference books:**

| S. no. | Title  | Author   | Publisher                         |
|--------|--|--|-----------------------------------|
| 1      | Principles of Instrumental Analysis                      | Skoog, D.A. Holler F.J. & Nieman, T.A                | Cengage Learning India Ed         |
| 2      | Instrumental Methods of Analysis, 7 <sup>th</sup> Ed     | Willard, H.H., Merritt, L.L., Dean, J. & Settoe, F.A | Wadsworth Publishing Company Ltd. |
| 3      | Physical Chemistry                                       | P.W. Atkins  |                                   |
| 4      | Fundamentals of Molecular Spectroscopy                   | C.N. Banwell   |                                   |
| 5      | Infrared Spectral Interpretations: A Systematic Approach | Brian Smith  |                                   |

#### INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS PRACTICAL

|             |        |
|-------------|--------|
| Course Code | CHM328 |
|-------------|--------|

|                             |  |
|-----------------------------|--|
| <b>Course Title</b>         | <b>Instrumental Methods of Chemical Analysis Practical</b>   |
| <b>Type of course</b>       | Practical  |
| <b>L T P</b>                | 0 0 4  |
| <b>Credits</b>              | 2  |
| <b>Course prerequisite</b>  | B.Sc Medical II year   |
| <b>Course Objective</b>     | The aim of this course is to impart practical knowledge to the students about various spectroscopic methods, chromatographic methods for analysis.   |
| <b>Course outcomes (CO)</b> | i) Understanding and capability of performing basic chemical processes in an analytical laboratory<br><br>ii) Capability of performing measurements on basic analytical instruments (photometers, spectrometers, chromatographs, ion-selective electrodes) |

### LIST OF EXPERIMENTS

1. Safety Practices in the Chemistry Laboratory
2. Determination of the isoelectric pH of a protein.
3. Titration curve of an amino acid.
4. Determination of the void volume of a gel filtration column.
5. Determination of a Mixture of Cobalt and Nickel (UV/Vis spec.)
6. Study of Electronic Transitions in Organic Molecules (i.e., acetone in water)
7. IR Absorption Spectra (Study of Aldehydes and Ketones)
8. Determination of Calcium, Iron, and Copper in Food by Atomic Absorption
9. Quantitative Analysis of Mixtures by Gas Chromatography (i.e., chloroform and carbon tetrachloride)
10. Separation of Carbohydrates by HPLC
11. Determination of Caffeine in Beverages by HPLC
12. Potentiometric Titration of a Chloride-Iodide Mixture
13. Cyclic Voltammetry of the Ferrocyanide/Ferricyanide Couple
14. Nuclear Magnetic Resonance
15. Use of fluorescence to do “presumptive tests” to identify blood or other body fluids.
16. Use of “presumptive tests” for anthrax or cocaine
17. Collection, preservation, and control of blood evidence being used for DNA testing
18. Use of capillary electrophoresis with laser fluorescence detection for nuclear DNA (Y chromosome only or multiple chromosome)
19. Use of sequencing for the analysis of mitochondrial DNA
20. Laboratory analysis to confirm anthrax or cocaine
21. Detection in the field and confirmation in the laboratory of flammable accelerants or explosives
22. Detection of illegal drugs or steroids in athletes
23. Detection of pollutants or illegal dumping
24. Fibre analysis

*At least 10 experiments to be performed.*

**Text and reference books:**

| <b>S. no.</b> | <b>Title</b>   | <b>Author</b>  | <b>Publisher</b>                  |
|---------------|--|--|-----------------------------------|
| 1             | Principles of Instrumental Analysis                  | Skoog, D.A. Holler F.J. & Nieman, T.A                | Cengage Learning India Ed         |
| 2             | Instrumental Methods of Analysis, 7 <sup>th</sup> Ed | Willard, H.H., Merritt, L.L., Dean, J. & Settoe, F.A | Wadsworth Publishing Company Ltd. |
| 3             | Physical Chemistry                                   | P.W. Atkins  |                                   |
| 4             | Electrochemical methods, Fundamentals and Methods    | A.J. Bard, L.R. Faulkner,                            | Wiley, 1980.                      |



**GENDER EQUITY**

|                     |                      |
|---------------------|----------------------|
| <b>Course Code</b>  | <b>SSC001</b>        |
| <b>Course Title</b> | <b>Gender Equity</b> |

|                               |  |
|-------------------------------|--|
| <b>Type of course</b>         | <b>ID</b>  |
| <b>L T P</b>                  | <b>3:0:0</b>   |
| <b>Credits</b>                | <b>3</b>   |
| <b>Course prerequisite</b>    | <b>NA</b>  |
| <b>Course Objectives (CO)</b> | <ol style="list-style-type: none"> <li>1. The students will be able to acquire knowledge and understanding of theory and concepts related to gender and gender relations</li> <li>2. The students will be able to critically reflect how gender is a development issue.</li> </ol> |
| <b>Course Outcomes (CO)</b>   | The students will analyse the evolution of thinking and approaches around gender and development.  |

#### **UNIT I**

Concept of sex and gender  
Gender attributes and questions of identity.

#### **UNIT II**

Empowerment- concept and meaning.  
Definition of feminism, feminist and women movements in U.S.A, U.K., France and India

#### **UNIT III**

Women development and development organizations.  
Impact of development on gender.

#### **UNIT IV**

Policies and current debates on women rights.  
Role of UN in establishing gender equality.  
Violence against women and need for reforms.

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

| S.No. | Author(S)           | Year | Title  | Publisher   |
|-------|---------------------|------|--|---|
| 1     | Jayachandran, Seema | 2014 | The Roots of Gender Inequality in Developing Countries | NBER Working Paper No.20380. Issued in August 2014      |
| 2     | Duflo, Esther       | 2012 | Women's Empowerment and Economic Development           | <i>Journal of Economic Literature</i> , 50(4): 1051-79. |



