

**B.SC. B.ED.**  
**(4 YEARS INTEGRATED COURSE)**

**UNIVERSITY OF PUNE**

**SYLLABUS OF F.Y.B.SC.B.ED.**

## **B.Sc.B.Ed (Integrated) Programme Curriculum**

### **Objectives of the B.Sc.B.Ed (Integrated) Programme**

To enable the student teachers

1. promote capabilities for inculcating national values and goals as mentioned in the constitution of India.
2. act as agent of modernization and social change.
3. promote social cohesion, international understanding and protection of human rights and right of the child.
4. acquire competencies and skills needed for science / mathematics teacher.
5. use competencies and skills needed for becoming an effective science and mathematics teacher.
6. become competent and committed teacher.
7. be sensitive about emerging issues such as environment, population gender equality, legal literacy etc.
8. Inculcate rational thinking and scientific temper among the students.
9. develop critical awareness about the social realities among the students.
10. use managerial and organization skills.

B.Sc.B.Ed (Integrated) Course shall consist of

- i) First year B.Sc.B.Ed.
- ii) Second Year B.Sc.B.Ed.
- iii) Third Year B.Sc.B.Ed.
- iv) Final Year B.Sc.B.Ed.

The structure and the syllabus of the course will be as given below.

#### **Eligibility Norms for admission :-**

To get the admission for B.Sc.B.Ed (Integrated) course candidate should have passed the Higher Secondary School Certificate Examination of Maharashtra State Board of Higher Secondary Education or an equivalent examination from any other statutory Board or University in science stream with at least 50% marks or grade B.

**Medium of Instruction:-**

The medium of instruction will be English.

**Eligibility Norms for appearing at B.Sc.B.Ed (Integrated) Examination:-**

1) To appear for the annual examination of F.Y.B.Sc.B.Ed (Integrated) candidate has to keep two terms for the course at the College affiliated to this University up to the satisfaction of the principal and such certificate from the principal of that college should be produced along with the examination form.

2) To appear for the annual examination of S.Y.B.Sc.B.Ed (Integrated) candidate has to keep two terms for the course at the College affiliated to this University up to the satisfaction of the Principal and such certificate from the principal of the college should be produced along with the examination form. The candidate should have passed minimum 2/3rd subjects of F.Y,B.Sc.B.Ed.

3) To appear for the annual examination of T.Y.B.Sc.B.Ed (Integrated) candidate has to keep two terms for the course at the college affiliated to this University up to the satisfaction of the principal and such certificate from the principal of that college should be produced along with the examination form. The candidate should have passed all the courses of F.Y.B.Sc.B.Ed.(Integrated) and should have passed minimum 2/3rd subjects of S.Y.B.Sc.B.Ed.

4) To appear for the annual examination of Final Year B.Sc.B.Ed (Integrated) candidate has to keep two terms for the course at the College affiliated to this University up to the satisfaction of the principal and such certificate from the principal of that college should be produced along with the examination form. The candidate should have passed all the courses of S.Y.B.Sc.B.Ed (integrated) and should have passed minimum of 2/3rd subject of T.Y.B.Sc.B.Ed.

(N.B. .Keeping terms up to the satisfaction of the principal means).

a) Candidate should have attended at least 80% theory period in each term.

b) Candidate should have completed all practical and other work expected in the syllabus and should have kept their record in the form of Journals.

c) Candidate should obtain minimum 50% marks in each internal course of Part II, III and IV.

### **Norms for passing B.Sc.B.Ed Examination:-**

The class should be awarded to the student on the basis of aggregate marks obtained by the candidate in internal and external assessment at F.Y., S.Y., T.Y and Final Year of B.Sc.B.Ed examination as shown in the table given below.

| Sr.No | Class                  | % marks in External assessment                                       | Minimum Grade in Internal assessment               |
|-------|------------------------|--|--|
| 1.    | First class with Dist. | Aggregate 70% and above but minimum 50% marks in each head of Part I | Grade O in each (Part II, Part III, Part IV)       |
| 2.    | First class            | Aggregate 60% to 69% minimum 50% marks in head of Part I             | Grade A in each Part (Part II, Part III, Part IV)  |
| 3.    | Higher Second Class    | Aggregate 55% to 59% but minimum 50% marks in each head of Part I    | Grade B+ in each part (Part II, Part III, Part IV) |
| 4.    | Second Class           | Aggregate 50% to 54% but minimum 50% marks in each head of Part I    | Grade B in each Part (Part II, Part III, Part IV)  |
| 5.    | Fails                  | Below 50% in each head of Part                                       |  |

**Evaluation Procedure:** A Candidate appearing for B.Sc..B.Ed (Integrated) course will be evaluated in the manner given below.

A) External Examination :-

University will conduct this examination at the end of every year for all the theory course in Part .I as shown in the frame work of that year.

B) Internal Assessment :-

Internal Assessment will be done by the college for maximum marks as shown against each Head in the Part II, Part III, Part IV in the frame work of that year. For the assessment, college will given marks and will submit it to the university at the end of every year. University will convert these marks in to the grades and final assessment will be in the form of grades. The grades so obtained will be shown on the mark sheet of the candidate. The system of grading will be as given below.

| Grade | Range of Marks |
|-------|----------------|
| O     | 75% & above    |
| A     | 65% to 74%     |
| B+    | 55% to 64%     |
| B     | 50% to 54%     |
| C     | 40% to 49%     |
| D     | 30% to 40%     |
| E     | Below 30%      |

### **F.Y.B.Sc.B.Ed**

The structure of F.Y.B.Sc.B.Ed.(Integrated) Programme will be as given in Table No. 1

**Table No. 1****B.Sc.B.Ed. (Integrated programme) – First Year - [1200 marks]**

| General Education Component (GEC) |   |                 |  |                 | Professional Education Component (PEC) |  |             |
|-----------------------------------|---|-----------------|--|-----------------|--|--|-------------|
|                                   | Theory Course   | Marks and Hours | Practical  | Marks and Hours | Theory                                 | Practical  | Total       |
|                                   | Group A<br>(Compulsory Course)                                  |                 |  |                 | -----                                  | Personality Development<br>Praogramme.                                   |             |
| 1.                                | Chemistry I and II *  | 200 (180)       | Chemistry Practical I  | 100 (90)        | -----                                  | Content Enrichment Programme.  |             |
| 2.                                | Psychology I and II   | 200 (180)       | Psychology Practical I   | 100 (90)        | -----                                  |  |             |
|                                   | Group B<br>(Any one combination of<br>the two PCM/PCB<br>group) |                 |  |                 | -----                                  | Social Interaction Programme.<br>One practical per week                  |             |
| 3.                                | Maths I and II  | 200 (180)       | Maths Practical I  | 100 (90)        | -----                                  | Journal / Diary<br>to be maintained by the students.                     |             |
| 4.                                | Physics I and II  | 200 (180)       | Physics Practical I  | 100 (90)        | -----                                  |  |             |
|                                   | Or  |                 | Or   |                 | -----                                  | The whole work shall be assessed at<br>the beginning of the second year. |             |
| 3.                                | Zoology I and II  | 200 (180)       | Zoology Practical I  | 100 (90)        | -----                                  |  |             |
| 4.                                | Botany I and II   | 200 (180)       | Botany Practical I   | 100 (90)        | -----                                  |  | (90)        |
|                                   | Or  |                 |  |                 | -----                                  |  |             |
|                                   | Any two of the four for<br>PCMB group                           |                 | Any two of the four<br>practicals related to the<br>theory courses |                 | -----                                  |  |             |
| 5.                                | Maths, Physics, Zoology<br>and Botany I and II                  | 400             | Maths, Physics- Zoology<br>Botany-practical – I                    | 200             | -----                                  |  |             |
|                                   | <b>Total Marks</b>  | <b>800</b>      | <b>Total Marks</b>   | <b>400</b>      | -----                                  |  | <b>1200</b> |

\* The courses have been numbered as the students study them year wise.

**Internal Tests.**

It is expected that at least two internal tests in theory courses should be held during each year i.e. F.Y., S.Y., T.Y. and Final Year College will be give the marks calculated out of 20 as internal marks for the internal tests.

**S.Y.B.Sc.B.Ed.**

The structure of S.Y.B.Sc.B.Ed.(Integrated) Programme will be as given in Table No.2

**Table No.2****B.Sc. B.Ed. (Integrated) Programme Second Year – [1200 marks]**

| <b>General Education Component (GEC)</b> |   |                 |  |            | <b>Professional Education Component (PEC)</b> |                 |   |            |             |
|--|---|-----------------|--|------------|---|-----------------|---|------------|-------------|
|  | Theory                                      | Marks and Hours | Practical                                | Marks      | Theory  | Marks and Hours | Practical   | Marks      | Total       |
| Group A                                  | Compulsory Courses                          |                 |  |            | Psychology of Development and learning        | 100 (90)        | Personality development programme, Social interaction programme, Content enrichment programme. Pedagogy Practicals ** | 100 (90)   |             |
|  | Chemistry III                               | 100 (90)        | Chemistry-II                             | 100        |   |                 |   |            |             |
|  | Chemistry IV                                | 100 (90)        |  |            |   |                 |   |            |             |
| Group B                                  | PCM group                                   |                 |  |            |   |                 |   |            |             |
|  | Math's III                                  | 100 (90)        | Maths-II                                 | 100        |   |                 |   |            |             |
|  | Math's IV                                   | 100 (90)        |  |            |   |                 |   |            |             |
|  | Physics III                                 | 100 (90)        | Physics-II                               | 100        |   |                 |   |            |             |
|  | Physics IV                                  | 100 (90)        |  |            |   |                 |   |            |             |
|  | Or  |                 |  |            |   |                 |   |            |             |
|  | PCB group                                   | 100 (90)        |  |            |   |                 |   |            |             |
|  | Zoology III                                 | 100 (90)        | Zoology-II                               | 100        |   |                 |   |            |             |
|  | Zoology IV                                  | 100 (90)        |  |            |   |                 |   |            |             |
|  | Botany III                                  | 100 (90)        | Botany -II                               | 100        |   |                 |   |            |             |
|  | Botany IV                                   | 100 (90)        |  |            |   |                 |   |            |             |
|  | Or  |                 |  |            |   |                 |   |            |             |
|  | PCMB group                                  |                 |  |            |   |                 |   |            |             |
|  | Course III & IV in any two offered at FYBSC | 400             | Practical II related to the two subjects | 200        |   |                 |   |            |             |
|  | <b>Total Marks</b>                          | <b>600</b>      |  | <b>300</b> |   | <b>100</b>      |   | <b>200</b> | <b>1200</b> |

\*\* The breakup of pedagogy practical is enclosed as appendix B

## **Core training Programme**

This programme includes Micro Teaching Lessons and Integration Lessons.

a) Micro Teaching Lessons: Student teachers will give 12 micro lessons, for these lessons, they will select any six teaching skills from the list given below. They will complete the cycle of two lessons i.e. teach and re-teach for each skill. Marks calculated out of 25 are to be given for the micro lessons.

- |                                |                        |
|--------------------------------|------------------------|
| 1. Set induction               | 5. Stimulus Variation  |
| 2. Explanation                 | 6. Reinforcement       |
| 3. Open and Closed Questioning | 7. Black Board writing |
| 4. Illustrating with Examples  | 8. Closure             |

Student Teachers will complete the cycle of two lessons i.e. teach and reteach for each skill.

b) Integration Lessons: After practicing six skills in micro teaching, student will give four lessons of minimum 20 minutes, duration to integrate the skills which they practiced. Marks calculated out of 25 are to be given for the Integration lessons.

c) Simulation Lessons: Each student will conduct at least one simulation Lesson in each area given below on peer group members. Total number of simulated lessons will be four.

1. Traditional Methods
2. Models of teaching.
3. Team Teaching.
4. Technology based Lesson

Marks calculated out of 30 are to be given for simulation Lessons.

d) Lesson Observation (Eight Lessons)

## **T.Y.B.Sc.B.Ed**

The structure of T.Y.B.Sc.B.Ed.(Integrated) Programme will be as given in Table No. 3



**Table No.-3****B.Sc. B.Ed. (Integrated) Programme Third Year – [1200 marks]**

| <b>General Education Component (GEC)</b>  |                 |                                 |            | <b>Professional Education Component (PEC)</b>   |                 |                       |            |
|---|-----------------|---------------------------------|------------|---|-----------------|-----------------------|------------|
| Theory  | Marks and Hours | Practical                       | Marks      | Theory  | Marks and Hours | Practical             | Marks      |
| Compulsory Course English   | 100 (90)        |                                 |            | Content cum Methodology Math's and science      | 100 (90)        | Pedagogy Practical ** | 300        |
| Any one out of the three selected in the second year BScBEd. Preferably Chemistry |                 |                                 |            |   |                 |                       |            |
| Chemistry –V (CH331)  | 100 (90)        | Chemistry Practical III (Ch347) | 100 (90)   | Instructional system and educational evaluation | 100 (90)        |                       |            |
| Chemistry –VI (CH332)   | 100 (90)        | Chemistry Practical IV (Ch349)  | 100 (90)   |   |                 |                       |            |
| Chemistry –VII (CH333)  | 100 (90)        |                                 |            |   |                 |                       |            |
| Chemistry –VIII (CH336)   | 100 (90)        |                                 |            |   |                 |                       |            |
| <b>Total Marks</b>  | <b>500</b>      |                                 | <b>200</b> |   | <b>200</b>      |                       | <b>300</b> |

a. Practice Lessons: Each student will give 12 class-room lessons as far as possible equally distributed in the two methods but not less than 5 Lessons per method. These lessons are to be given in the secondary/ higher secondary school recognized as Practicing School by the University. College will give marks calculated out of 180 as internal marks for these Practice lessons.

b. Lessons observation: Each student will observe 12 lessons of other students in the every distributed manner throughout the year.

c. Content cum methodology workshops.

There will be two workshop of content cum methodology one for Science and the other for Mathematics of nearly 20 hours each. Each workshop will carry 30 marks.

d. Technology based training

This is ICT workshop to be conducted in computer laboratory on the line of Intel Programme for teachers or MSCIT. It will be of 30 hours duration and will carry 20 marks.

e. Health Education and NSS activities are the activities related to general education component and will be continued even for the final year. They will carry 20 marks.

### **Final Year B.Sc.B.Ed**

The structure of F.Y.B.Sc.B.Ed.(Integrated) Programme will be as given in Table No. 4

**Table No. – 4.**

**B.Sc. B.Ed. (Integrated) Programme Final Year –[1200 marks]**

| <b>General Education Component (GEC)</b> |                 |                                    |                 | <b>Professional Education Component (PEC)</b>                                |                 |                          |       |
|--|-----------------|------------------------------------|-----------------|--|-----------------|--------------------------|-------|
| Theory                                   | Marks and Hours | Practical                          | Marks and Hours | Theory   | Marks and Hours | Practical                | Marks |
| Chemistry IX<br>(Organic Chemistry)      | 100 (90)        | Chemistry V<br>(Organic Chemistry) | 100 (90)        | Education for new times and<br>Modern Society                                | 100 (90)        | Pedagogy<br>Practical ** | 500   |
| Chemistry X<br>(Analytical Chemistry)    | 100 (90)        |                                    |                 |  |                 |                          |       |
|  |                 |                                    |                 | Educational Management,<br>Principle & Practices                             | 100 (90)        |                          |       |
|  |                 |                                    |                 |  |                 |                          |       |
|  |                 |                                    |                 | Environmental Education &<br>Disaster Management and<br>Educational research | 100 (90)        |                          |       |
|  |                 |                                    |                 | ICT & Physical Education &<br>Yoga   | 100 (90)        |                          |       |
|  | 200             |                                    | 100             |  | 400             |                          | 500   |

## Internship Programme:

Objectives: To enable the student teacher

1. Get an opportunity to observe the teaching of experienced teachers.
2. Teach under the guidance of experienced teachers.
3. Have an experience of Continuous teaching.
4. Participate in all other school activities.
5. Have a feel of total experience of teachers in the school.

### a. Block teaching (8 Lessons)

In this programme, for one method student teacher will select one unit from the subject with consultation of school teacher. He will prepare the unit plan for that unit. He will teach that unit for Three four periods under the guidance and observation of the school teacher or educator. At the end of the teaching he will prepare and conduct a unit test.

Same activity will be repeated for other method. Marks calculated out of 120 are to be given for the block teaching.

b. Technology Based Lessons: Student teacher will conduct at least two lessons using modern technology like audiovisual cassette, T.V. Program, Internet, Computerized program etc. Marks calculated out of 40 are to be given for the technology based Lessons. If because of some reasons it becomes impossible to conduct these lessons in the schools they may be conducted as simulation lessons.

c. Lessons Based on Models of Teaching Student teacher will conduct at least four lessons based on any two models of teaching suitable to his methods. Marks calculated out of 40 are to be given for lessons based on models of teaching.

d. Lessons based on value Educations/Environmental Education : Student Teacher will conduct at least four lessons based on Value Educations/Environmental Education. Marks calculate our of 60 are to be given for lessons based on concept of team teaching.

e. Team teaching Lessons : Student teacher will conduct four Lessons based on concept of team teaching. Marks calculated out of 60 are to be given for lessons based on concept of team teaching.

f. Lessons observation: Each student will observe 20 lessons of other students in the every distributed manner throughout the year.

Course 10: Other Activities:

a. Health Education: The main purpose of this course is to keep the physical fitness of the student. To serve this purpose some physical Exercises, surya namaskar, yoga or games will be practiced under the guidance of physical director regularly. Some selected students may prepare themselves as competent players for special game. College will give marks calculated out of 10 as internal marks for Health Education.

b. N.S.S.: This programme will be compulsory for all the students and will be carried out as per the guide lines received in this connection from the university time to time. College will give marks calculated out of 10 as internal marks for N.S.S.

**Course related Practical work:**

F.Y.B.Sc.B.Ed: There will be no practical related to pedagogy but practical related to Personality Development Programme(PDP),Content Enrichment Programme(CEP), Social Interaction Programme(SIP) will be organized.

S.Y.B.Sc.B.Ed: The list of practical is as follows:

1. Laboratory experiences- Microteaching (Six skills)
2. Integration lessons (Four Lessons)
3. Simulated Lessons(Four Lessons)
4. Lesson Observation (Eight Lessons)
5. Course related to practical work-Psychology of Development and Learning.

T.Y.B.Sc.B.Ed: The list of practical is as follows:

1. Practice teaching (12 Lessons)
2. Lesson Observation (12Lessons)
3. CCM Wrkshops-2
4. Practical related to Instructional System and Educational Evaluation
5. Technology based Training
6. Health Education
7. N.S.S.

Final Year B.Sc.B.Ed:

- 1 .Block Teaching (8 Lessons)

2. Technology based lessons (2 Lessons)
3. Lessons on Models of Teaching (2 Lessons)
4. Value Education based lessons (4 Lessons)
5. Team Teaching (4 Lessons)
6. Observation and Participation in school activities:
  - a. Lesson observation (20Lessons)
7. Theory Courses Related Practical:
  - a. Education for New Times
  - b. Educational Management
  - c. Environmental Education and Educational Research
  - d. Physical Health Education and Yoga
8. Technology Based Teaching
9. Working With Community and co curricular activities
10. Health Education
11. N.S.S.

An outline of pedagogical practical work of B.Sc.B.Ed.(Integrated) programme is given in appendix – A. The illustrative lists of the other practical is given appendix B

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It should be noted that the syllabus of the course from the B.Ed. components of B.Sc. B.Ed. will be as per the B.A.B.Ed. Programme. The syllabus of Content-cum Methodology- Science and Content-cum Methodology-Mathematics is enclosed as appendix – C and appendix –D.

The syllabuses of the science courses will be strictly as per the revised syllabus of B.Sc. Programme. However there will be Annual pattern of examination instead of semester pattern.

## Physics Paper-I

### Section-I

#### 1: Kinematics [8 Lectures]

- 1.1 Displacement, Time and Average Velocity (x-t graph illustrations to be included)
  - 1.2 Instantaneous Velocity (Finding of velocity on an x-t graph)
  - 1.3 Average and Instantaneous Acceleration (Illustration with  $v - t$  and  $a - t$  graph)
  - 1.4 Motion with Constant Acceleration (Illustration with  $a - t$  and  $v - t$  graph)
  - 1.5 Freely Falling Bodies (Up and Down motion in fall with  $y-t$  and  $v_y-t$  graph)
  - 1.6 Velocity and Position by Integration.
  - 1.7 Position and Velocity Vectors
  - 1.8 Acceleration Vector
  - 1.9 Problems
- Ref. 1: Ch2  
Ref. 2: Ch3  
Ref. 3: § 1.1 & 1.3

#### 2. Newton's laws of motion [6 Lectures]

- 2.1 Newton's First and Second Law and their explanation
  - 2.2 Working with Newton's First and Second Law.
  - 2.3 Newton's Third Law of motion and its explanation with problems.  
Various types of forces in nature (explanation)
  - 2.4 Pseudo Forces (e.g. Centrifugal Force)
  - 2.5 Problems
- Ref.1: Ch. 4 & 5  
Ref.2: Ch. 5, Ch. 4  
Ref.3: § 1.3

#### 3: Work and Energy [8 Lectures]

- 3.1 Kinetic Energy
  - 3.2 Work and Work-Energy Theorem
  - 3.3 Calculation of Workdone with
    - i) Constant Force
    - ii) Spring ForceIllustration
  - 3.4 Works-Energy Theorem
  - 3.5 Potential Energy
  - 3.6 Conservative and Non-conservative Forces.
  - 3.7 Definition of potential energy and conservation of Mechanical energy.
  - 3.8 Change in the potential energy in a rigid body motion.
- Mass-energy equivalence  
Problems  
Ref.1: Ch.6  
Ref.2: Ch.8  
Ref.3: § 1.7

#### 4: Surface Tension [5 Lectures]

- 4.1 Surface Tension (Definition), Angle of Contact, Revision of Capillary Rise Method.
- 4.2 Rise of liquid in capillary tube of insufficient length
- 4.3 Rise of liquid in a conical capillary tube.

- 4.4 Energy required to raise a liquid in capillary tube.
- 4.5 Rise of liquid between two parallel plates.
- 4.6 Factors affecting surface tension.
- 4.7 Jeager's Method for Determination of surface tension
- 4.8 Applications of Surface Tension
- Ref.: 5

### **5. Viscosity and Fluid Mechanics [9 Lectures]**

- 5.1 Fluids, Friction in Solid surfaces in contact verses Friction in Fluid
- 5.2 Pressure in a fluid
- 5.2(a) Definition of buoyancy
- 5.3 Pascal's law
- 5.4 Atmospheric Pressure and Barometer
- 5.5 Archimedes' Principle
- 5.6 Pressure difference and Buoyant Force in accelerating fluids
- 5.7 Steady and Turbulent Flow.
- 5.8 Equation of continuity
- 5.9 Bernoulli's Principle
- 5.10 Application of Bernoulli's equation
  - i) Speed of Efflux
  - ii) Ventury meter
  - iii) Aspirator Pump
  - iv) Change of plane of motion of a spinning ball.
  - v) Atomiser or spray
- 5.11 Aerodynamics, Concept of Aerofoil, Forces acting on aerofoil.

Ref.1: Ch.14

Ref.2: Ch.13

Ref.3: § 1.13

Ref.4: Ch.2 & 6

### **Reference Books:**

1. University Physics, Sears and Zeemansky XIth edition, Pearson education.
2. Concepts of Physics H.C. Varma Bharati Bhavan Publishers
3. Problems in Physics P.K. Srivastava Wiley Eastern Ltd.
4. Applied Fluid Mechanics, Mott Robert Pearson Benjamin Cummir, VI Edition, Pearson Education/Prentice Hall International, New Delhi
5. Properties of Matter, D. S. Mathur, Shamlal Chritable Trust New Delhi

## **Section-II: Heat and Thermodynamics**

### **6. Basic Concepts of Thermodynamics [6 lectures]**

- 6.1 Thermodynamic state of a system
- 6.2 Thermal Equilibrium
- 6.3 Zeroth law of Thermodynamics
- 6.4 Internal Energy of System-Concept of heat
- 6.5 Equation of State : The Ideal Gas Equation
- 6.6 Indicator Diagram
- 6.7 First law of Thermodynamics
- 6.8 Thermodynamic Process-Isothermal, Adiabatic, Isobaric, Isochoric.
- 6.9 Adiabatic relations of system for perfect gas.
- 6.10 Work done during Isothermal and Adiabatic changes.
- 6.11 Reversible and Irreversible changes.
- 6.12 Problems

### **7. Second Law of Thermodynamics: Entropy [9 lectures]**

- 7.1 Conversion of Heat into Work and its converse
- 7.2 Reversible and Irreversible Processes.
- 7.3 Examples of Irreversible Processes.



7.4 Carnot's Cycle and Carnot's Heat Engine and its efficiency

7.5 Second law of Thermodynamics: Statements

7.6 Carnot Theorem

7.7 Entropy

7.8 Principle of Increase in Entropy

7.9 Generalised form of the First and Second laws:

1) Entropy changes for an Ideal Gas.

2) Entropy of van der Waals' gas.

7.10 Problems

### **8. Heat engines & Refrigerators [9 lectures]**

8.1 Heat Engines

8.1.1 Otto cycle and its efficiency

8.1.2 Diesel cycle and its efficiency

8.1.3 Comparison between Otto and Diesel cycle

8.2 Refrigerators:

8.2.1 General Principle and Coefficient of performance of refrigerator

8.2.2 The Carnot Refrigerator

8.2.3 Simple structure of vapour compression refrigerator

8.3 Air conditioning: principle and its applications

8.4 Problems

### **9. Equation of state and Thermodynamic relations [8 lectures]**

9.1 Various equations of state,

9.2 Andrew's experiment,

9.3 Amagat's experiment,

9.4 van der Waals' equation of state, Critical constants,

9.5 Reduced equation of state,

9.6 Thermodynamic functions: Internal energy, Helmholtz' function, Enthalpy, Gibb's function.

9.7 Problems

### **10. Thermometry [4 lectures]**

10.1 Principle and Types of Thermometry

10.2 Gas filled and Liquid Filled Thermometers

10.3 Problems

### **Reference Books:**

1. Physics, 4<sup>th</sup> Edition, Volume I, Resnick/Halliday/Krane JOHN WILEY & SONS (SEA) PTE LTD.

2. Heat and Thermodynamics Mark. W. Zemansky, Richard H. Dittman Seventh Edition, McGraw-Hill International Editions.

3. Thermal Physics (Heat & Thermodynamics) A.B. Gupta, H.P. Roy Books and Allied (P) Ltd, Calcutta.

4. Heat and Thermodynamics Brijlal, N. Subrahmanyam S. Chand & Company Ltd, New Delhi

5. Thermodynamics and Statistical Physics J.K. Sharma, K.K. Sarkar, Himalaya Publishing House

6. Concept of Physics H.C. Verma Bharati Bhavan Publishers.

## **Paper – II,**

### **Section – I**

#### **EMERGING PHYSICS**

#### **1 : History and Philosophy of Physics (8 Lectures)**

1.1. Introduction to the specific meaning of the world modern as in 'Modern Physics'

1.2. Early Modern Physics 16<sup>th</sup> century – scientific revolution, Work of Nicolus Copernicus

1.3. Physics of 17<sup>th</sup> century – work of Galileo Galilei, Huygens, Robert Hooke, Torricelli, Vernier, Tycho Brache, Pascal, Kepler and Newton.

1.4. Physics of 18<sup>th</sup> Century – Newton, Boyle and Young, Thompson, Coulomb, Amperes, Gauss, Biot – Savarts, Cavendish, Galvani, Franklin, Lagrange and Bernoulli

1.5. Physics of 19<sup>th</sup> century – Volta, Dalton, Michael Faraday, Ohm, Oersted, Hamilton, Maxwell, J. J. Thomson, Clausius, Hall, Boltzmann, Joule, Michelson Morley expt, Miller, Tesla, Roentgen, Pierre and Marie Curie, Becquerel

1.6. Physics of 20<sup>th</sup> century – Rutherford, Larmour, Lorentz, Einstein, Planck, Bohr, William, Bragg, Chadwick, Heisenberg, Fermi, Edwin Hubble, Karl Jansky, George Gamow, Pauli, Dirac, Max Born, Felix, Bloch, Ernest Lawrence, Shockley, Brattain,

and Bardin, Fred Hoyle, Richard Feynman, Robert Mills, Murray Gell-Mann, Glashow, Abdus Salam, Steven Weinberg, K Onnes, A. Fert and Grunberg, Stephan Hawking.

1.7. Indian Scientists : Bose, Raman, Saha and Chandrasekhar

**Reference :**

1. [http://en.wikipedia.org/wiki/History\\_of\\_Physics](http://en.wikipedia.org/wiki/History_of_Physics)
2. [http://en.wikipedia.org/wiki/Nobel\\_Prizes\\_in\\_Physics](http://en.wikipedia.org/wiki/Nobel_Prizes_in_Physics)

**2 : Lasers and Laser applications (8 Lectures)**

- 2.1. A brief history of lasers
- 2.2. Einstein prediction : The Three Processes
- 2.3. Einstein's relations (qualitative discussion only)
- 2.4. Pumping schemes (Ref.1, 1.1 – 1.12, 1.15, 1.16, 1.18-1.20)
- 2.5. Characteristics of lasers (Ref.. 2, 11.7.1 – 11.7.4)
- 2.6. Types of lasers : 1. Ruby laser, 2. He-Ne laser (Ref.1 , 2.2.1, 2.3.1)
- 2.7. Applications of lasers (Ref. 2, 11.9, 11.10, 11.11, 11.12)

**References :**

1. An introduction to Lasers – Theory and Applications M. N. Avadhanalu, S. Chand and Co, Ltd.
2. Solid State Physics P. K. Palanisamy, Scitech Publications (India) Pvt. Ltd

**3 : Sensors and Transducers (6 Lectures)**

- 3.1. Overview – need, definition and qualities of transducers
- 3.2. Temperature – thermocouples, thermistors, platinum resistance thermometer, IC temperature sensors, quartz thermometer, pyrometers, cryogenic temperature measurements
- 3.3. Light Sensors-Photodiodes, Phototransistors, and Photomultipliers, References :

1. Instrument measurement and Analysis by B. C. Narka and K. K. Chaudhary, Tata McGraw Hill Publishing Company 16<sup>th</sup> reprint Chapter 1.

**4 : Bioelectricity (6 Lectures)**

- 4.1. Electricity observed in living systems
- 4.2. Origin of bioelectricity
- 4.3. Sodium and potassium transport
- 4.4. Resting potential and action potential
- 4.5. Nernst's equation
- 4.6. Conduction velocity
- 4.7. Origin of compound action potential
- 4.8. Neuron structure and function
- 4.9. An axon as cable
- 4.10. Membrane resistance and capacitance

**Reference :**

From Neuron to Brain, Kuffler and Nicholas, Sinauer Associates, Inc Pub. Sunderland, Massschuetts

**5 : Nanomaterials**

- 5.1. Introduction
- 5.2. Reduction of dimensions 3D, 2D, 1D, 0D materials.
- 5.3. Surface and Interface effect
- 5.4. Modelling of quantum size effect
- 5.5. Synthesis of nano particles – Bottom Up and Top Down approach, Wet Chemical Method
- 5.6. Idea of Biomimicking, naturally occurring nanocrystals

**References :**

1. Nanomaterial-Synthesis, Properties and Applications - Edelstein, Camarata, Institute of Physics Publishing, Bristol and Philadelphia
2. Introduction to Nanotechnology Charles P. Poole Jr, Frank J. Owens John Wiley and Sons publications
3. Physics Education Vol. 14, No. 4, Jan – March 1998
4. Nanotechnology : Principles and Practices S. K. Kulkarni, Capital Publishing Company.

**Paper II**  
**Section II**  
**ELECTRICITY AND MAGNETISM**

**6: ELECTROSTATICS (8 Lectures)**

6.1 Coulomb's law

6.1.1 Statement

6.1.2 Vector form of Coulomb's law for like and unlike charges.

6.1.3 Variation force with distance (F.vs.r graph) (Ref. 2, 21.3)

6.2 Superposition principle

6.2.1 Statement and explanation with illustration

6.2.2 Illustrations with specific configuration of three charges (triangular form) and four charges (square form)

6.2.3 Problems on superposition principle

6.3 Energy of the system of charges

6.3.1 Illustration with three charges

6.3.2 Electric potential energy

(Ref. 1, 1.5 and Ref. 2, 23.1)

6.4 Concept of electric field

6.4.1 Electric field due to point charge

6.4.2 Electric field due to group of charges

6.4.3 Lines of force

6.4.4 Relation between electric intensity and electric potential

(Ref. 2, 21.4, 21.6, 22.1, 22.3, 23.5)

6.5 Concept of electric flux

6.5.1 Gauss's theorem in electrostatics ( statement only and explanation )

6.5.2 Illustrations of Gauss law with examples.

(Ref. 2, 22.1, 22.3)

**7 : DIELECTRICS (8 Lectures)**

7.1 Electric Dipole

7.1.1 Electric dipole and dipole moment

7.1.2 Electric potential due to dipole

7.1.3 Electric intensity due to dipole

7.1.4 Torque on electric dipole in external electric field

7.1.5 Polar and non – polar molecules with examples.

7.1.6 Effect of external electric field on polar and non – polar molecules.

7.2 Dielectric materials

7.2.1 Electric polarization of dielectric material

7.2.2 Electric polarization vector

7.2.3 Strength of dielectric material and Dielectric breakdown

7.2.4 Electric displacement and Gauss law in dielectric.

7.2.5. Relation between three electric vectors (E, D and P)

(Without derivation, qualitative discussion only)

7.2.6 Effect of dielectric on capacitance of problems (parallel plate capacitor only).

7.2.7 Problems

(Ref. 2, 21.7, 24.4, 24. 6)

**8 : MAGNETOSTATICS (8 lectures)**

8.1 Concept of magnetic field

Definition and properties of magnetic field

8.2 Revision of Biot – Savart's law

Examples :

1. Long straight conductor.

2. Current carrying circular loop on the axis

8.3. Ampere's circuital law.

Field of solenoid.

Field of toroidal solenoid

8.4 Magnetic Field lines and Magnetic flux

Gauss's law for magnetism

8.5 Problems

(Ref. 2, 27.2, 27.3, 28.2, 28.3, 28.4, 28.6) (Ref. 1, 6.2)

### **9 : MAGNETIC PROPERTIES OF MATERIAL (7 lectures)**

9.1. Magnetic Materials Bohr magneton.

9.2. Magnetisation (M), Magnetic Intensity (H) and magnetic induction (B)

9.3. Magnetisation and Susceptibility and magnetic permeability

9.4. Relation between B, M and H (without derivation, qualitative discussion only)

9.5. Diamagnetic, paramagnetic and ferromagnetic. Explanation with the help of susceptibility and permeability .  
Problems.

9.6. Hysteresis

(Ref. 2, 28.8)

### **10 : TRANSIENT CURRENTS (5 lectures)**

10. 1 Transient currents

10.2 Growth of current in an inductive (LR) circuit

10.3 Decay of current in an inductive circuit Physical meaning of time constant

10.4 Charging of condenser through resistance

10.5 Discharging of condenser through resistance Time constant

(Ref. 2, 26.4, 30.4)

#### **Reference books:**

1 Berkeley Physics Course – Vol – II Electricity and Magnetism. Edward M Purcell.

2 University Physics – H.D. Young R. A. Freedman Pearson – Freedman

3 Resnick and Halliday, Physics Vol – II

4. Electromagnetics by B.B.Laud

## **Physics paper III Practical**

### **1. Mechanics**

(1) Range and Least Count of Instruments, Measurements using various instruments and error analysis (Vernier caliper, screw gauge, traveling microscope, spectrometer etc.)

(2) Interpretation of kinematics graphs – part I

From data plotting of x vs. t graph, From this graph plotting of v vs. t and a vs. t graph

(3) Interpretation of kinematics graphs – part II

From data plotting of a vs. t graph, From this graph plotting of v vs. t and x vs. t graph.

(4) Determination MI of disc using ring

(5) MI of Flywheel

(5) Determination of coefficient of viscosity by Poiseulli's method

(6) Determination of Y and n by flat spiral spring

(7) Determination of Y by bending

(8) Surface Tension by Jeager's method.

### **2. Heat and Thermodynamics**

(1) Interpretation of isothermal and adiabatic curves on PV diagram (Theoretical).

Theoretical study of Carnot's cycle by drawing graphs of isothermal and adiabatic curves.

(2) Temperature coefficient of resistance

(3) Study of thermocouple and determination of inversion temperature

(4) Thermal conductivity by Lee's method

(5) Specific heat of graphite

### **3. Light**

(1) Study of spectrometer and determination of angle of prism

(2) Spectrometer calibration. Determination of refractive indices of different colours and plotting the graph of refractive index vs . wavelength.

- (3) Study of total internal reflection using LASER
- (4) Study of polarization of light by reflection
- (5) Determination of wavelength of LASER light by plane diffraction grating or cylindrical obstacle

#### **4. Electricity and magnetism**

- (1) Charging and discharging of a capacitor
- (2) Study of LR circuit
- (3) Study of LCR series circuit
- (4) Study of Krichhoff's laws
- (5) Diode characteristics
- (6) Study of multimeters (all AC, DC ranges, Least Count )
- (7) Determination of frequency of AC mains Students have to perform minimum three experiments from each section and total sixteen experiments.

#### **Additional Activities**

##### **1. Demonstrations**

(Any four demonstrations equivalent to two experiments)

- (1) Electromagnetic induction by using two coils
- (2) Magnet –magnet interaction
- (3) Collision by using balls
- (4) Study of Signal generator using CRO (Sine, square wave signal, measurement of AC voltage, frequency)
- (5) Demonstration of action potential
- (6) Measurement of sound pressure level

##### **2. Computer aided demonstrations (Using computer simulations or animations)**

**(Any two demonstrations equivalent to two experiments)**

- (1) Coulomb's law
- (2) Vectors : visualization of vectors
- (3) Bohr's model
- (4) Carnot engine, diesel engine
- (5) Graphs and their slopes, and Kinematics graphs (using computer simulations)

##### **3. Mini projects/Hand on activities**

(Any one equivalent to two experiments )

- (1) Students should carry out miniprojects
- (2) Study of any two Laboratory equipments (e.g. Luxmeter, Sound Pressure level meter, Sphygmomanometer (Blood Pressure meter), Pulsoximeter)

##### **4. Study tour (Equivalent to two experiments)**

Students participated in study tour must submit a study tour report. Students have to perform at least two additional activities out of four activities in addition to sixteen experiments mentioned above. Total Laboratory work with additional activities should be equivalent to twenty experiments.

## **Chemistry Syllabus**

### **Paper I Physical and Inorganic Chemistry**

#### **Section – I**

#### **Physical Chemistry**

##### **1. Chemical Mathematics:- (10 Lectures)**

- a. Logarithm:- Rules of logarithm, Characteristic and mantissa, Change of sign and base, Problems based on pH and pOH.
- b.. Graphical representation of equations: Rules for drawing graph co-ordinates etc., Equation of straight line, slope and intercept, plotting the graph from the data of chemical properties and problems.
- c.. Derivative:- Rules of differentiation and partial differentiation, Algebraic, logarithmic and exponential functions and problems.
- d. Integration:- Rules of integration, Algebraic and exponential functions and problems.

## **2. Gaseous and Liquids State: - (08 Lectures)**

Ideal and non-ideal gases, deviation of gases from ideal behavior, compressibility factor ( $Z$ ), van der Waal's equation of state and its application to explain deviation of gases.

Critical constant of gas in terms of van der Waal's constant, Experimental determination of  $P_c$ ,  $T_c$  and  $V_c$ , Reduced equation of state, Law of corresponding state. Measurable physical properties of liquid such as vapour pressure, Surface tension and viscosity and their experimental determination (One method of each).

## **3. Chemical Thermodynamics: - (06 Lectures)**

Second law of thermodynamics, Carnot cycle, mechanical efficiency, Entropy changes for system and surroundings for reversible and irreversible processes, Entropy changes for an ideal gas in isothermal, isobaric and isochoric changes, Entropy Changes in chemical reactions. Entropy changes accompanying fusion.

### **Reference Books :-First term.**

1. Mathematical preparation for physical Chemistry By F. Daniel, Mc. Graw Hill publication.
2. University General Chemistry. By C.N. R. Rao Mc. Millan Publication.
3. Principles of Physical Chemistry. By Maron and Pruton 4<sup>th</sup> Ed. Oxford and IBH publication.
4. Physical Chemistry. By G.M. Barrow.

**PHYSICAL & INORGANIC CHEMISTRY**  
**PAPER – I**  
**SECTION II**  
**INORGANIC CHEMISTRY.**

**1. Chemistry of hydrogen (04)**

**1. Chemistry of hydrogen**

Position of hydrogen in periodic table, isotopes of Hydrogen, properties of Isotopes, heavy water, its preparation and application (Ref 1 & 2)

**Hydrogen bonding**

Types of hydrogen, bonding, effect of hydrogen bonding on physical properties of substances like.

a) Physical State b) MP & BP c) Solubility d) Viscosity (Ref. 3)

**Text Books (for Chapter 1 & 2)**

- 1) Concise Inorganic Chemistry By J.D. Lee, Chapman & Hall 5<sup>th</sup> Ed. (1996)  
( Page No. 240 – 247)
- 2) Advanced Inorganic Chemistry by Satya Prakash Tuli, Basu & Madan 6<sup>th</sup> edn.  
(page 301 – 303, 311-318, 319-322)
- 3) A new guide to Modern Valency Theory by G.I. Brown ( Pages 142 – 149, 154 – 160)

**3. Stoichiometry (06)**

i) Mole concept, Determination of mole wt. By gram molecular volume relationship, problems based on mole concept (Ref. 1 & 2)

ii) Methods of expressing concentrations, strength, Normality, Molarity & Molality, ppm.

iii) Standardization of solutions, primary and secondary standard substances.

iv) Preparation of standard solution of acids and bases, problems related to acid base titrations only (Ref. 2 & 3)

References:

- 1) College Chemistry by Linus Pauling (Page 165 to 171)
- 2) Calculation of Analytical Chemistry by Hamilton, Simpson & Ellis 7<sup>th</sup> Edn. (Pages 154 – 199)
- 3) Quantitative Inorganic Analysis by A.I Vogel. (Page 257-262)
- 4) Analytical Chemistry by G.D. Christian relevant pages.

**PAPER – I**  
**PHYSICAL & INORGANIC CHEMISTRY**  
**SECTION I**  
**PHYSICAL CHEMISTRY.**

**Atomic structure:**

Historical Development, Daltons atomic theory, Limitation of Daltons atomic theory, Electron, its discovery and properties.  $e/m$  ratio of electron by Thomson's method Charge on electron by Millikens oil drop method, Proton- its discovery and properties, 'Thomson's Atomic model and its drawbacks. Rutherford's alpha particles scattering experiments, Rutherford's atomic model and its drawbacks. Prouty's hypothesis, Moseley experiment and its importance. The Neutron – its discovery and properties, atomic spectra. Ritz – combination principle, Bohr's model of hydrogen atom, postulates, derivation for its radius and energy. Application of Bohr's theory, spectra and ionization potential of hydrogen, Limitations of Bohr's theory, spectra and ionization potential of hydrogen, Limitations of Bohr's theory, Quantum number, Pauling's Exclusion principle, Hund's principles of maximum multiplicity and Aufbau's principle.

**Colloids:**

Preparation, purification, Optical properties, Tyndall effect, shape and size, stability, solvation, interaction between, colloids, solution, emulsions and gels.

## **Catalysis:**

Catalyst and catalysis, positive and negative catalysis, Type of catalysis, Characteristics of catalytic reactions, promoters, Catalytic poisoning\*, Theories of catalysis, Active centre on catalyst surface, Adsorption theory and catalytic activity, Acid – Base catalysis, Enzyme catalysis, Mechanism of enzyme catalysis, characteristics of enzyme catalysis, application of catalysis in industries. \*Autocatalysis, negative catalysis, Activation energy and catalysis.

## **Reference Books For second term.**

1. University General Chemistry. By C.N. R. Rao. Mc Millan Publication.
2. Principles of Physical Chemistry. By Maron and Pruton 4<sup>th</sup> Ed. Oxford and IBH publication.
3. Physical Chemistry. By G.M. Barrow.

## **PAPER – I: PHYSICAL & INORGANIC CHEMISTRY**

### **SECTION II INORGANIC CHEMISTRY.**

#### **I) Chemical bonding and structure. (6)**

- i) Attainment of stable configuration.
- ii) types of bonds a) ionic, b) covalent c) Coordinate d) metallic (Ref.1)
- iii) Types of overlap, formulation of  $\sigma$  and  $\pi$  bonds S – S overlap, P-P overlap, p-d overlap with suitable examples (Ref.1)
- iv) Theories of bonding, Valence bond theory a) Hitler London theory and b) Pauling Slater theory (Ref. 1)

#### **References:**

- i) Concise Inorganic Chemistry by J.D. Lee 5<sup>th</sup> Edn. ( page No. 30 to 36, 90 – 96)
- ii) A new guide to modern valency theory by G.I. Brown ( Pages 106, 114, 165 – 168)

#### **II) Concept of hybridization (06)**

- i) Definition, need of hybridization, steps involved in Hybridization, Explanation of covalency of atoms in the molecules on the basis of hybridization, types of hybridization involving S, P orbitals and S, P, d, orbitals (Ref. 1, 2 & 3) Applications of hybridization concept, geometries of molecules like BeF<sub>2</sub> CH<sub>4</sub>, BF<sub>3</sub>, SiCl<sub>4</sub>, PCI<sub>5</sub>, IF<sub>7</sub>, SF<sub>6</sub>, [Ni (CN)<sub>4</sub> ]<sub>2</sub>- (Ref. 1,2 & 3)
- ii) VSEPR theory Assumptions, need of theory, application of the theory to explain geometry of irregular molecules like H<sub>2</sub>O, NH<sub>3</sub>, TiCl<sub>4</sub>, ClF<sub>3</sub>, ICl<sub>2</sub>, BrF<sub>3</sub>, BrF<sub>5</sub>, OF<sub>2</sub>

#### **References:**

- 1) Consise Inorganic Chemistry by J.D. Lee 5<sup>th</sup> edn. (Page 30-36, 72-96)
- 2) Basic Inorganic Chemistry by Cotton & Wilkison.
- 3) Inorganic Chemistry – Principles of structure and reactivity by J.E. Huheey, E.A. Keiter, R.L. Keiter, U.k. Medhi, 1<sup>st</sup> impression (2006) person Education Publishers (Pages 117 – 170) and (171-190)
- 4) New guide to modern valence Theory By G.I. Brown (Pages 106-114, 165-168).

## **Paper II ( Organic & Inorganic Chemistry)**

### **Section I – Organic Chemistry**

#### **Chapter (I) Introduction to Organic Chemistry. (02)**

Development of organic chemistry, unique Properties of organic compounds, Sources of organic compounds, applications of organic compounds. Ref 1 : 1 to 12

#### **Chapter ( II) Structure & Bonding in organic Molecules (08)**

2.1 Covalent bond, Hybridization in organic molecules ( sp<sup>3</sup>, sp<sup>2</sup>, sp), bond length, bond angles, bond energies, localized & delocalized chemical bond, vander Waal's interactions, Inter & Intra molecular forces & their effects on physical properties.



2.2 Structural effects like inductive, Resonance, Hyper conjugation, steric effect, Hydrogen bonding.  
Ref : - 2, Sec. 1.8 to 1.22, pages – 45 to 72. Ref : 3 : Sec. 1.2 to 1.6 , Pages – 4 to 26

### **Chapter ( III) Isomerism in organic compounds ( Part I) (10)**

3.1 Concept of isomerism, type, (Structural chain, position, functional group)

3.2 Representation of organic, Molecules – zig- zag structures, projection formulae – (Saw horse ( Andiron), Newman, Fisher & Dotted – wedge)

3.3 Conformational isomerism in alkanes, free rotation about carbon- carbon single bond, conformation of ethane, propane n, butane , relative stability of different conformations.

3.4 Optical isomers – Isomer number & tetrahedral carbon atom chirality, optical isomerism with one asymmetric carbon atom, Polarimeter, Specific rotation, Enantiomerism R & S Nomenclature.

3.5 Geometrical isomerism – Definition, conditions for geometrical isomerism, cis-trans & E-Z nomenclature, physical & chemical properties of geometrical isomerism.

Ref. 2 Sec. 4.1 to 4.11, 4.13 to 4.16, Pages – 161 to 179, sec. 8.7 , pages 315 to 318.

### **Chapter ( IV) Chemistry of Alkanes:- (04)**

Classification, higher alkanes Homologous Series, Nomenclature, Physical properties, laboratory methods, of preparation, Industrial methods of preparations, Reactions of alkanes, Combustion, pyrolysis, cracking, Analysis of alkanes. Ref. 2. Sec, 3.1, 3.6 to 3.15, 3.18, 3.34, Pages. – 113, 114, 122 to 135, 138, 139, 158.

## **Paper – II – Organic & Inorganic Chemistry.**

### **Section – II : - Inorganic Chemistry**

#### **1) Modern Periodic table and electronic configurations of elements (8)**

i) Electronic Configuration of Elements, Aufbau principle, Hund's rule of Maximum multiplicity, (n+1) rules, shapes of s, p, and d orbital, Pauli exclusion Principle, Heisenberg's uncertainty principle and problems based on uncertainty in velocity and position (Ref. – 1)

ii) Periodic table Types of elements: inert gases, representative elements, transition and inner transition elements, Blocks in periodic table S, p, d & f blocks.

Nomenclature of super heavy elements periodic law periodicity in properties throughout the periodic table (Only general trends in each block.)

a) Size and atoms of ions.

b) Ionisation energy

c) Electron affinity

d) Electro negativity.

iii) Shielding effect and shielding constant, Slater's rule to calculate shielding constant, numerical Problems bases on shielding constant.

#### **References:**

1) Concise Inorganic Chemistry by J.D. Lee, Chaman and Hall, 5<sup>th</sup> edn. ( 1996) (Pages 17 to 24).

2) Theoretical Inorganic Chemistry by Day & Selbin.

3) Chemistry by Raymond Chang ( pages 292 – 314)

4) Concepts, Models of inorganic chemistry by B. Douglas & D. Mc. Daniels, J. Alexander, Mohan wiley & sons 3<sup>rd</sup> Edn (2007) Relevant Pages.

#### **2. Oxidation & Reduction (04)**

i) Introduction, definition of related terms like oxidation, reduction, oxidizing agent and reducing agent ( ref. 1)

ii) Balancing of redox reaction using ion electron method and oxidation number method (ref. 1)

iii) Rules to find oxidation number,

iv) Problems based on equivalent weight of oxidant and reductants ( ref. 2)

Ref : 1 College Chemistry by Linus Pauling ( Pages 338 – 349)

2. Calculations of Analytical Chemistry by Hamilton, Simpson & Ellis 7<sup>th</sup> Edn. Relevant Pages.

## Section I

### Organic Chemistry

#### Chapter ( I) Alkenes, Dienes & Alkynes:- (06)

1.1 Alkenes:- Introduction, higher alkenes, Nomenclature, physical properties, preparations, Reactions of alkenes, Analysis of Alkenes.

Ref. 2 Sec. 8.7 to 8.9, 8.11 to 8.13, Sec. 9.1, 9.2, 9.27.

Pages 309, 318 to 321, 323 to 329, 353 to 359, 396 to 398.

1.2 Dienes : Structure & Properties, Conjugated dienes, Reactions of dienes, analysis of dienes.

Ref. 2. Sec – 11.17, 11.19, 11.21, 11.22, 11.26

Pages: - 445, 446 to 448, 450 to 452, 457, 458.

1.3 Alkynes:- Introduction , Nomenclature, Physical properties, preparation, Reactions & analysis of alkynes.

Ref. 2 . Sec - 12-1, 12-3 to 12.7 , 12-14, Pages–461,464 to 469, 476.

#### Chapter 2 : Halogen derivatives of Alkanes. (04)

Introduction & Classification of Halogen derivatives, Structure of alkyl halides, classification, Nomenclature, physical properties, preparation, reactions, analysis of alkyl halides.

Ref. 2 Sec. 5-4 to 5-6, 6-24, Pages:- 204 to 208, 247.

#### Chapter 3 :- Alcohols & Ethers (06)

3.1 Alcohols :- Introduction, physical properties, Reactions of alcohols, industrial sources of ethyl alcohol, proof, spirit, denatured spirit, absolute alcohol, analysis of alcohols.

Ref : 2, Sec 6-2 to 6-9 to 6-11 , 6-22, Pages: 250 to 255, 257 to 263, 279, 280

3.2 Ethers :- Introduction, Nomenclature, Physical Properties, industrial sources, Laboratory Preparations, Williamson's Synthesis, Diazomethane Method Reactions of ethers.

Ref. 2. Sec. – 6.16 to 6.21, Pages – 273 to 279.

#### Chapter 4 : Benzene & its Reactions (05)

Structure of benzene, Kekule structure, stability of benzene, Reactions of benzene, aromatic character, Huckel rule, Nomenclature of benzene derivatives, sulphonation, halogenation, Friedal – Crafts reactions of benzene.

Ref. 2 Sec.- 14.1 to 14.4, 14.10, 14.11,Pages – 529 to 534, 540 to 545.

#### Chapter 5: Phenols:- (03)

Structure, classification, Physical properties, Nomenclature, Preparation of phenols, industrial source, Laboratory methods, Reactions of Phenols Nitration, Sulphonation, Halogenation, nitrosation, carbonation (Kolbe synthesis,) Reimer – Tiemann reaction & analysis. of phenols.

Ref. 2 Sec – 24.1 to 24.4, 14.10, 24.7, 24.8, 24.10 to 24.16.

Pages – 925 to 930, 934 to 938, 941 to 948.

#### List of Reference Books

Ref. 1 Organic Chemistry by Clayden, Oxford uni.press.

Ref. 2 Organic Chemistry by Morrison & Boyd, 6<sup>th</sup> Edition.

Ref. 3 A guide book to Mechanism in Organic Chemistry by Peter Sykes, 6<sup>th</sup> Edition.

## Paper – II- Organic And Inorganic Chemistry.

### Section – II : Inorganic Chemistry

#### 1) Chemistry S. Blocks Elements. (8)

Position of elements in periodic Table, Electronic configuration, Periodic trends in Properties viz. size of atom, ion, oxidation state, ionization potential, & reactivity. Anomalous behavior of Li, Be Diagonal relationship between Li & Mg. Industrial biological and Agricultural applications of these elements & their Compounds, Crown ethers, Separation of these elements using Crown ethers. Solution of these metals in liquor NH<sub>3</sub>

**Text Book:-**

Concise inorganic Chemistry by J.D. Lee, Chapman & Hall 5<sup>th</sup> Edn. (1996) ( Page No. 273, 281, 302, 308, 325, 326, 329, 335 and 353)

**2 Chemistry of Noble Gases. (4)**

- 1) Position of these elements in periodic table, Electronic configuration.
- 2) Chemical Properties of Noble Gases.
- 3) Chemistry of xenon structure and bonding in xenon compounds.

XeF<sub>2</sub>, XeF<sub>4</sub>, XeO<sub>6</sub>, XeO<sub>4</sub>, XeO<sub>2</sub>F<sub>2</sub>, [XeO<sub>6</sub>]<sup>-4</sup>, XeOF<sub>4</sub>

**Ref Books:-**

- 1) Concise Inorganic Chemistry by J.D. Lee Chapman and hall 5<sup>th</sup> edn. (1996) pages (635 – 647)
- 2) Concepts and Models of Inorganic Chemistry by B. Douglas & D. Mc. Daniels Alexander Mohan Wiley & sons 3<sup>rd</sup> Edn. ( 2007) Relevant pages.
- 3) Inorganic Chemistry Principles of structure & reactivity By James Huheey, Keiter, Medhi (Pearson Education) Pages 342-348.

**CHEMISTRY PRACTICAL SYLLABUS****A: PHYSICAL CHEMISTRY PRACTICALS ( ANY FIVE)**

1. Determination of molecular weight of given volatile organic liquid by using ideal gas equation.
2. Determination of Viscosity of liquid by Oswald's viscometer.
3. Determination of viscosity of two pure liquids A and B hence find the composition of the two liquids.
4. To determine the surface tension of a given liquid by capillary rises method.
5. Heat of solution of KNO<sub>3</sub>/ NH<sub>4</sub>Cl.
6. To determine the gas constant R an expression of it in different units by Eudiometric method.
7. Kinetics of hydrolysis of ester in presence of HCl.

**Reference Books:-**

1. Experiments in general chemistry by C.N.R. Rao and Agrawal East West Press.
2. Experiments in Physical Chemistry by R.C. Das and Behere Tata Mc Graw Hill.
3. Experimental physical Chemistry by F. Daniel and others ( International Student Edition)
4. Systematic Experimental Physical Chemistry by S.W. Rajbhoj and Dr. T.K. Chodhekar, Anjali Publication Aurangabad.

**B) INORGANIC CHEMISTRY PRACTICALS****1. Volumetric analysis ( Only two)**

- i) Acid-base titration using two burettes of ( on micro scale)
- ii) Standardization of KMnO<sub>4</sub> and estimation of Fe (II) Volumetrically.
- iii) Determination of Hardness of water from given sample by E.D.T.A. method.

**2. Gravimetric analysis – ( any one)**

- i) Determination of water of crystallization of given salt. BaCl<sub>2</sub> 2H<sub>2</sub>O, Mg.SO<sub>4</sub>, 7H<sub>2</sub>O.
- ii) Determination of Percentage Purity of given Salt. (Na<sub>2</sub>CO<sub>3</sub>, NaHCO<sub>3</sub>)

**3. Inorganic Qualitative analysis . ( Four Mixtures to be analyzed, without phosphate and Borate)**

Reference Book :- Inorganic Qualitative Analysis by Vogel.

**C) ORGANIC CHEMISTRY PRACTICALS.****1) Purification of Organic Compounds**

- 1) Crystallization 2) Sublimation 3) Distillation.

**2) Recording of M.P. & B.P. – (Confirmation by Mixed M.P.)****3) Characteristic Reactions of following functional groups.**

A) Alcohols – 1) Sodium metal test 2) Lucas Reagent test 3) Iodoform test 4) Esterification 5) Action of K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>

B) Alkenes – 1) KMnO<sub>4</sub>(Alkaline) 2) Bromine in CCl<sub>4</sub>

C) Aldehydes and Ketones.

1) 2, 4-DNP test 2) Semi carobazone 3) Iodoform 4) Tollen's Reagent 5) Fehling's solution 6) Schiff's Reagent

D) Acids 1) NaHCO<sub>3</sub> 2) Esterfication 3) AgNO<sub>3</sub> test.

E) Phenols 1) NaOH 2) FeCl<sub>3</sub> 3) Bromine.

F) Amines. i) HCl test ii) Diazotization test iii) Carbylamine test iv) Hinsberg test.

G) Amides i) NaOH test ( Evolution of NH<sub>3</sub>)

H) Esters i) Hydrolysis (Depolarization of Phenolphthalein

I) Aromatic system

i) Sooty flame test ii) Br<sub>2</sub> in CCl<sub>4</sub> iii) KmnO<sub>4</sub> test.

#### 4) Analysis of given Organic Compounds

i) Type Determination.

ii) Recording of physical constants.

iii) Determination of functional groups.

5) Estimations:- i) Phenol / Aniline / Acetone.

List of compounds for analysis is attached.

**Acid:** Benzoic, Salicylic, Oxalic, Acetic, Succinic, Cinnamic, phthalic, Pnitrobenzoic.

Phenols:  $\alpha$  - naphthol ,  $\beta$  - naphthol, Resorcinol, Phenol, O - nitrophenol, P- nitrophenol , m-nitrophenol, p - cresol. Bases - Aniline isopropyl amine, n - butyllamine, p - Toludine, o- nitroaniline, m-nitroaniline, p-nitroaniline, methylamine, **Dimethyl amine, diphylamine.** Neutrals:- Acetamide, Urea, Thiourea, Acetanilide, Ethyl acetate, Methyl acetate, Ethyl benzote, methyl salicylate, Nitrobenzene, m - dinitorbenzene, Anisole, Methyl alcohol, n- propylalcohol, Isopropyl alcohol, n-butyl alcohol, Benzyl alcohol, isoamyl alcohol, Naphthalene, Anthracene, Bi-phenyl, Cyclohexene, chlorobenzene, Bromobenzene, chloroform, Glucose, Benzaldehyde, Acetone, ehtylmethyl ketone, benzophenone, Acetophenone.

Reference Book:- Organic Chemistry by Vogel.

### Pattern for F.Y.B.Sc. Practical Examination

1. At the time of Practical examination in a batch 50 % Students must be given Physical Experiments.
  2. For detections of Functional Groups two different compounds must be given.
  3. For Organic Qualitative Analysis 20 marks & for purifications/ functional group 15 marks.
  4. For Volumetric Analysis Students must prepare standard solutions.
  5. No external printed material or practical book/ text book is allowed during the practical examination.
1. Physical Experiment Or } 35 marks.  
Inorganic Volumetric / Organic Volumetric.
  2. Inorganic Qualitative Analysis Or  
a. Organic Qualitative Analysis } 35 Marks  
b. Purification of Organic Compounds/ Detection of Functional group.
  3. Oral 10 marks
  4. Internal marks for Journal & Oral. 20 marks.

## Botany Syllabus

### Botany Paper – I : Plant Diversity Section – I

(36 Lectures )

#### 1. Introduction to plant diversity: (4L)

**Plant diversity** – concept, Plant kingdom- Cryptogams and Phanerogams, diversity in plant kingdom – habit, habitat, duration of life, Position of plants in five kingdom system.

#### 2. Algal diversity: (10L)

Occurrence, habitat, thallus, cell structure, pigment and food reserve material, reproduction

Life cycle patterns in *Ulothrix* and *Ulva*

**3. Fungal diversity: (10L)**

Occurrence, cell structure (Myxomycetes – *Stemonites* and Eumycetes – *Aspergillus*), thallus, nutrition and reproduction Life cycle patterns in *Cystopus* and *Agaricus*

**4. Lichen diversity: (3L)**

Thallus, reproduction and association

**5. Bryophyte diversity: (9L)**

Occurrence, thallus, reproduction and sporophyte diversity Life cycle pattern in Bryophytes

**Plant Diversity Section – II ( 36 Lectures )**

**1. Pteridophyte diversity: (8L)**

Sporophyte, gametophyte and reproduction Life cycle pattern in Pteridophytes Diversity in stelar type

**2. Gymnosperm diversity : (8L)**

Sporophyte, gametophyte, reproduction and wood Life cycle pattern in Gymnosperms Affinities with pteridophytes and angiosperms

**3. Angiosperm diversity: (14L)**

Sporophyte diversity in habit, habitat, organization of body and nutrition Mode of reproduction and dispersal Gametophyte Morphology and anatomy of root, stem and leaf with reference to primary structure of dicot and monocot Diversity of angiosperms as a basis for evolutionary success and Dominance

**4. Conservation of plant diversity: (6L)**

Concept, types and Need

Methods –*In-situ* and *Ex-situ* enlisting

Detail study of National Parks, Biosphere Reserve Programmes; Tissue culture and Botanical gardens Importance

**Paper –II**

**Plant Resources - Management and Utilization  
Section – I**

**( 36 Lectures )**

**1. Introduction : (6L)**

- a) Concept, natural resources, biological resources, plants as natural resources
- b) Management practices - need and methods
- c) Utilization - Bioenergy, food, fodder, fibre, medicine and essences.
- d) Plant Resources

Processed – Jam, jelly, squash, ketchup, raisin, pickle and rubber

Unprocessed – Honey, timber, wood, tannins and latex

**2. Nursery management : (6L)**

Introduction, types of nurseries and cultural practices Seed (propagule) collection, selection of propagule materials, storage and treatment Manures, fertilizers and pesticides Methods of irrigation – Drip, sprinkler and flood

**3. Horticultural practices : (6L)**

Introduction, branches and importance Methods of propagation: Vegetative –i) Natural - Rhizome, bulb, corm and sucker

ii) Artificial –Cuttings, layering, grafting and budding Landscaping as a means of plant resources conservation

**4) Greenhouse technology : (6L)**

Introduction, advantages and limitations Types of greenhouses Greenhouse structure, principle – i) Site selection and orientation, ii) Structure materials, iii) Covering materials, iv) Temperature and humidity control Greenhouse technology as applied to ornamentals, vegetables, fruit plants and medicinal plants

**5. Harvest Technology (8L)**

Harvest technology management for fruits, flowers and medicinal plants Artificial ripening, maturity indices, methods of picking Post-harvest technology and management for fruits, flowers and medicinal plants – Grading, processing, storage and packing

**6. Weed management : (4L)**

Introduction and need Invasive weeds - concept and causes of their dominance

Weed control – Physical, chemical and biological methods Sustainable use of weeds

## **Plant Resources – Section II : Management and Utilization ( 36 Lectures )**

### **7. Flower arrangement : (5L)**

Introduction, principles, types – social, formal and non-formal, materials used, vase life improvement. Flower arrangement as a business

### **8. Biocontrol : (6L)**

Introduction, sources and advantages Important commercial products – Source, preparation and uses of Pyrethrins, Azadiractin, *Trichoderma*, *Indiara*, *Trichogramma* Biocontrol as a agrobusiness

### **9. Phytoremediation : (6L)**

Introduction, concept and principles Plant population for phytoremediation processes Phytoremediation strategies Applications

### **10. Bioprospecting : (6L)**

Introduction, concept and scope Biochemical resources from plants and fungi Untapped plant resources as potential resources Sea weeds as a potential resource – Food, fodder and fertilizer

Applications

### **11. Forest as potential resource : (6L)**

Introduction and scope

Major forest produce and their uses - Timber, fuel, paper (two examples of each)

Minor forest produce and their uses – Gum, resin, tannin, dyes and pigments (two examples of each)

### **12. Plant resources used in cosmetics, aromatics and pharmaceuticals (7L)**

Introduction and scope

Herbal preparations

Methods of extraction – Maceration, digestion, decoction, aromatic waste, extracts and tinctures

i) Aloe, ii) Henna, iii) Lemon grass, iv) Rose, v) Jasmine vi) Turmeric, vii) Ginger, viii) Neem, ix) Holy basil, x) Kuda, xi) Amala with reference to part used, products and uses

## **Practical Course based on Paper I & Paper II**

(1) Study of prokaryotic organisms. (*Nostoc*, *Oscillatoria*, *Croococcus*, *Microcystis* and *Scytonema*). 1 P

(2) Study of thallus diversity in Algae : *Chlorella*, *Volvox*, *Hydrodictyon*, *Batrchospermum*, *Caulerpa*, *Ulva*, *Padina* and Diatoms 1 P

(3) a) Study of thallus diversity in fungi : *Stemonites*, *Synchytrium*, *Plasmopara* / *Phytophthora* and *Mucor* 1P

b) Study of thallus diversity in fungi : *Phyllachora*, *Yeast*, *Puccinia*, *Ustilago*, *Agaricus*, *Polyporus* / *Ganoderma*, *Aspergillus* / *Penicillium* and *Fusarium*. 1 P

(4) Study of Lichen diversity : Crustose, Foliose, Fruticose. 1 P

(5) Study of Bryophyte diversity : *Riccia*, *Anthoceros*, *Funaria* with comparative account. 1 P

(6) Study of methods of propagation with the help of suitable materials – tubers, bulbs, rhizomes, corms, suckers and runners. 1 P

(7) Propagation of horticultural plants by stem cuttings and air layering. 1 P

(8) Propagation of horticultural plants by grafting (Approach and stone) and ‘T’ budding. 1 P

(9) Visit to nursery and polyhouse/greenhouse. 1 P

(10) a) Preparation of jam and jelly 1 P

b) Preparation of squash and pickle 1 P

(11) Extraction of essential oil from lemon grass / rose petals and collection and preparation of Henna powder / Aloe gel. 1 P

(12) Study of Pteridophyte diversity (Sporophytes) : *Psilotum*, *Selaginella*, *Equisetum*, *Nephrolepis* with comparative account. 1 P

(13) Stelar diversity in Pteridophytes. 1 P

(14) Study of Gymnosperm diversity (Sporophyte) : *Cycas*, *Pinus*, *Gnetum*. (comparative account of vegetative and reproductive diversity) 1 P

(15) Study of Angiosperm diversity with reference to habit – herbs, shrubs, trees, climbers, epiphytes and parasites. (with one example of each) 1 P

(16) Study of Angiosperm diversity with reference to external adaptations : hydrophytes, mesophytes, xerophytes and halophytes.(one example of each with comparative account) 1 P

- (17) a) Study of internal structure of dicot: stem, root and leaf. 1 P  
 b) Study of internal structure of monocot : stem, root and leaf 1 P
- (18) Study of *In-situ* conservation : Visit to Botanical Garden/Reserve forest/National park/Herbal Garden (Visit report expected). 1 P
- (19) Flower arrangements : Formal, non-formal and social. 1 P
- (20) Commercial products and their applications in biocontrol : Pyrethrin, Azadiractin and *richoderma* 1 P
- (21) Observation of plants used in phytoremediation : *Echhornia*, *Azolla*, *Pistia*, *Lemna*, Algal blooms 1 P
- (22) Study of plant resources and products : Yeast – Yeast tablets, *Penicillium*– Penicillin, *Spirulina* – *Spirulina* tablets, Algal products – agar, liquid biofertilizer, Bamboo – paper, Teak – timber, *Acacia arabica* - gum, Asafoetida - resin, *Acacia catechu* – kath. 1 P
- (23) Study of any two resources of fodder (Alfalfa, *Sesbania*), fibre (Cotton, Coconut), medicinal (Amla, *Aloe*), biofertilizers (BGA, *Azolla*), honey, timber (Teak, Sisso) and tannins (*Acacia* pod/bark, Tea). 1 P
- (24) Observation of weeds with reference to Botanical Name, Family, Morphological and Ecological peculiarities: Native – *Cynadon*, *Euphorbia*, *Amaranthus*. Exotic/Invasive – *Parthenium*, *Xanthium*, *Alternanthera*, *Argemone* 1 P
- \*Students of F. Y. B. Sc. must submit a visit report at the time of practical examination with reference to Sacred Groves / National Park / Reserve Forest / Botanical Garden and Nursery / Greenhouse.
- \* Study tour for observation of plant diversity in nature is compulsory. Report on excursion is to be submitted at the time of examination. Submission of herbarium is not expected but photographs may be submitted along with report.

## Zoology

### Paper I - ZY-101: NONCHORDATES

#### Section – I

1. **Scope of Zoology, Introduction to various branches of Zoology:** Physiology, Cell Biology, Biochemistry, Biostatistics, Molecular Biology, Biotechnology, Biophysics, Entomology, Immunology, Aquaculture. **4**
2. **Introduction to classification of living organisms. 3**
  - 2.1 Systematics- Linnaean Hierarchy (Phylum, class, order, family , genus, species)
  - 2.2 Binominal Nomenclature
  - 2.3 Five Kingdom Classification
3. **Protista. 5**
  - 3.1 General organization, habits and habitat.
  - 3.2 Classification with major characters of the following Subphyla (one example each): Opalinata, Ciliophora, Sarcodina, Dinophyta and Euglenophyta
  - 3.3 Study of *Paramoecium* with respect to: habits, habitat, Structure, nutrition, excretion and reproduction (binary fission and conjugation) **5**
4. **Porifera 4**
  - 4.1 General Organization
  - 4.2 Diversity in sponges: skeletal elements and canal system.
  - 4.3 Classification with one example of each: Class Calcarea, Hexactinellida, Sclerospongiae and Demospongiae.
5. **Cnidaria- 4**
  - 5.1. General organization (including symmetry, alternation of generation and polymorphism)
  - 5.2. Classification- Hydrozoa, Scyphozoa, Anthozoa .
  - 5.3. Concept of Coral Reef and its importance.
6. **Platyhelminthes- 3**
  - 6.1. General organization, Habit and Habitat.
  - 6.2. Classification with one example each- Class Turbellaria, Trematoda and Cestoda.
  - 6.3 Economic importance of Helminthes, regeneration in Planaria.
7. **Annelida- 4**
  - 7.1. Diversity in habits and habitat; Classification- Class Polychaeta, Aeolosomata and Clitellata.
  - 7.2. Vermiculture and its importance, useful species for vermiculture, methods of vermiculture.
8. **General introduction to other invertebrates** like: Arthropoda, Mollusca and Echinodermata **2**
9. **Shell and pearl formation in Mollusca, 2**

10. Bioluminescence in invertebrates 1
11. Regeneration and autotomy in Echinodermata 2
12. Mimicry in butterflies 2

**ZY-101 Paper I-**  
**Section Two**  
**CHORDATES**

13. Distinctive features and broad classification of Phylum 4 Hemichordata and Phylum Chordata (subphyla-Urochordata, Cephalochordata, Vertebrata)
14. General organization of Cyclostomata: 4 habits and habitat of Petromyzon and Myxine along with their importance.
15. Fishes (Pisces): general organization, economic importance, 4 migration.
16. Evolution and adaptive radiation of reptiles during Mesozoic era; 4 Extinction of Dinosaurs
17. General adaptations for aerial mode of life in birds 2
18. Egg laying and Marsupial mammals 2
19. Diversity and adaptive radiation of placental mammals 4
20. **Study of Frog:** systematic position, habits, habitat, external characters; sexual dimorphism, digestive, circulatory (lymphatic system not expected), respiratory, central nervous system and reproductive systems of male & female. 20

**ZY 102 Paper II**  
**GENETICS**  
**Section One**

**1. Introduction to genetics 3**

1.1 Recapitulation of Mendelian Genetics and its practical applications, Mendelian laws, Back cross

**2. Multiple Alleles 4**

2.1 Concept of multiple alleles, coat color in Rabbit, ABO & Rh Blood group system

2.2 Concept of multiple genes (polygenic inheritance) with reference to skin color in man

2.3 Concept of pleiotropy

**3. Gene Interaction 8**

3.1 Concept of gene interaction, co-dominance and incomplete dominance

3.2 Complementary factors (9:7)

3.3 Supplementary Factors (9: 3:4)

3.4 Inhibitory factors (13:3)

3.5 Duplicate dominant factors (15:1)

3.6 Lethal genes (dominant and recessive)

**4. Chromosomes 5**

4.1 Introduction to morphology, composition and classification based on the centromeric position, types of chromosome ( autosomes, sex chromosome, polytene and lampbrush chromosomes)

4.2 Chromosomal aberrations: numerical and structural

**5. Sex- determination 4**

5.1 Chromosomal: XX-XY, ZZ-ZW, XX-XO methods, Haploid-Diploid Parthenogenesis, Gynandromorphy

5.2 Environmental – Sex determination in *Bonellia*

**6. Human genetics 5**

6.1 Preparation and analysis of human karyotype

6.2 Syndromes- **autosomal**- Down's (Mongolism), Patau's, Edward and Cri du chat

**sex chromosomal** abnormalities in man: Klinefelter and Turner syndrome

6.3 Inborn errors of metabolism: albinism, phenylketonuria, alkaptonuria

**7. Sex linked inheritance in human 3**

7.1 Colorblindness, Haemophilia and hypertrichosis

7.2 Sex-influenced genes- Pattern baldness in human

**8. Cytoplasmic inheritance 2**

8.1 Kappa particles in *Paramecium*



## 9. Application of genetics 6

9.1 Genetic counseling.

9.2 Eugenics.

9.3 Concept of cloning and transgenic animals

9.4 DNA Fingerprinting and gene therapy

## ZY 102 Paper II PARASITOLOGY

### Section Two

10. Introduction, scope and branches of parasitology 2

Definition : host, parasite, vector, commensalisms, mutualism and parasitism.

11. Types of parasites: ectoparasites, endoparasites and their subtypes. 3

12. Types of hosts : intermediate and definitive, paratenic, reservoir. 3

13. Host – parasite relationship : Host specificity – definition, structural specificity, physiological specificity and ecological specificity. 3

14. Parasitic adaptations : In ectoparasites and endoparasites 3

15. Life cycle, pathogenicity and control measures: *Plasmodium vivax*, *Entamoeba histolytica*, *Fasciola hepatica*, *Taenia solium*, *Wuchereria bancrofti* *Ascaris lumbricoides*. 16

16. Study of the following parasites with reference to morphology, life cycle, pathogenicity and control measures: Head louse, Mite (*Sarcoptes scabiei*). Parasitological significance of domestic, wildlife and zoonosis: Bird flu, Anthrax, Rabies and Toxoplasmosis 10

17. Human defense mechanism: Immunity (natural, acquired) 2

### ZY-103: Practical Course

**Minimum of 25 practicals are to be performed by students**

1. Study of : *Amoeba*, *Paramoecium*, *Trypanosoma*, *Balantidium*/ *Opalina* (D) with the help of slides and live specimens.

2. Study of fresh water sponges and gemmules and spicules (D)

3. Study of hydra, jellyfish, sea anemone and one coral

4. Classification of phylum Annelida (one example from each class)

5. Study of of live *Balantidium* , *Vorticella*, *Carchesium* and *Stentor* from fresh water (E)

6. Culturing of *Paramoecium*/ *Daphnia*/Rotifers and study of binary fission and conjugation and cyclosis in *Paramoecium* (E)

6

7. Study of cockroach: External characters and sexual dimorphism and Dissection of digestive system of cockroach (E)

8. Cockroach: Dissection of female reproductive system( E)

9. Cockroach: Dissection of male reproductive system ( E)

10. Mounting from cockroach: cornea, thoracic spiracles, gizzard(E)

11. Study of monohybrid and dihybrid ratio providing hypothetical data and deducing applicability of Mendelian laws and problems based on theory topics 1,2,3.

12. Culturing *Drosophila* using standard methods (E)

13. Study of external characters and sexual dimorphism in *Drosophila* ( E)

14. Study of mutants of *Drosophila* (eye and wing mutants)

15. Study of normal human karyotype from metaphasic chromosomal spread picture (normal male and female) (E)

16. Study characters and karyotypes of syndromes like: Down, Klinefelter and Turner (D).

17. Study of genetic traits in human beings (tongue rolling, widow's peak, ear lobes, colour blindness, PTC taster / non taster

18. Study of Cyclostomata: *Petromyzon* and *Myxine*

19. Study of frog : External characters and sexual dimorphism (D)

20. Study of Frog: Digestive system (D) and dorsal and ventral view of brain of Frog (D)

21. Study of Frog: Urinogenital systems male/female (D)

22. Study of Frog : Axial skeleton

23. Study of Frog : Appendicular skeleton

24. Study of Frog : Development (egg, blastula, gastrula sections) and metamorphosis (D)

25. Study of *Fasciola hepatica* and *Ascaris lumbricoides* : External characters and life cycle

26. Study of Parasites/Diseases/causative organism of medical importance : *Plasmodium*, *Wuchereria*, *Ascaris*, head louse , Mite (D)
27. Study of insects vectors : house fly , rat flea, mosquito (D)
28. Study of blood groups in human ( ABO and Rh) (E)
29. Study of live cercaria and redia from fresh water snail (E)
30. Study of rectal parasites of cockroach / frog.

7

### **Reference Books for Zoology**

1. The Frog – its reproduction and development. By Robert Rugh, Tata McGraw Hill Edition, New Delhi
2. Invertebrate Structure and Function. by EJW Barrington, ELBS, III Edition
3. Biology of Animals. By Ganguly, BB., Sinha, A.K., Adhikari, S., New Central Book Agency, Kolkata
4. Arthropod Phylogeny. By Gupta, A.P., van Nostrand Co., New York
5. Introduction to Amphibia. By Bhamrah, MS and Juneja, K., Amol Publications, Delhi
6. Life of Vertebrates. Young, JZ., III Edition, Clarendon Press, London
7. General Zoology. By Goodnight and others, IBH Publishing Co.,
8. Life of Invertebrates. By Prasad, ASN. Vikas Publishing House, New Delhi
9. Textbook of Vertebrate Zoology. By Prasad, SN and Kashyap, V., New Age India Publishers, New Delhi
10. Modern Text-Book of zoology, Vertebrates. By Kotpal, RL., Rastogi and Co., Meerut
11. Phylum Protozoa to Echinodermata (series) by Kotpal, RL. Rastogi and Co., Meerut
12. Fish and Fisheries of India. By Jhingran, JG. Hindustan Publishing corporation, New Delhi
13. Animal Diversity. By Kershaw, DR. Redwood Burn Ltd, Trowbridge.
14. Text-Book of Zoology. By Parker J. and Haswell, W., ELBS Edition
15. Text-Book of Zoology. By Vidyarthi, Agrasia Publishers, Agra.
16. Chordate Zoology. By Jordan EL and Verma PS. S. Chand and Co., New Delhi
17. Functional Organization of Chordate (parts I and II) Nigam, HC and Sobti, R, S. Chand and Co., New Delhi
18. Invertebrate Zoology. By Barnes, Saunders College Publishing Co., Philadelphia, USA, 1987
19. Genetics. By Verma, PS and Agarwal, VK., S. Chand and Co., New Delhi
20. Principles of Genetics. By Sinnott, Dunn and Dobzhansky, Tata McGraw Hill, New Delhi India.
21. Genetics. By Gupta, PK., Rastogi Publications, Meerut
22. Genetics. By Sarin, C., Tata McGraw Hill, New Delhi.8
23. Principles of Genetics. By Gardner, EJ, Simmons, MJ and Snustad, DP. John Wiley and Sons
24. Introduction to Parasitology. By Chandler and Reid..
25. Parasitology. By Chatterjee, KD...
26. Essentials of Parasitology, Gerald D. Schmidt, 4<sup>th</sup> Edition. Universal Book Stall, New Delhi 1990 reprint
27. An Introduction to Parasitology By Bernard E Mathews, Cambridge University Press, 1998
28. Parasitology. By Noble ER and Noble GA, Lea and Febiger, Philadelphia, USA, 1976
29. Textbook of Parasitology. By Kochhar SK, Dominant Publishers and Distributors, New Delhi 2004
30. The Invertebrates: A New synthesis. By Barnes, RSK, Calow, P. and Olive, PJW, Blackwell Scientific Publishers, 1988
31. Cytology and genetics. By Dyanasagar, VR. Tata McGraw Hill Pub. Co. Ltd., New Delhi 1992 reprint
32. Essential Genetics. By Lynn Burnet, Cambridge University Press, 1989
33. Genetics. By Ursula Goodenough, 3<sup>rd</sup> Edition, Saunders College Publishing, 1984
34. The Invertebrates: Function and Form. By Sherman W and Sherman VG, 1976, Pearson Education Low Priced Edition, Indian reprint 2007

## **Skeleton paper & guidelines for examiners for F.Y.B.Sc. Practical**

### **Examination in Zoology**

**Max. Marks (80)**

**Time- more than 4 hour**

**Q.1** Dissect cockroach so as to expose its digestive/male/female reproductive system.(20)

**Q.2.** Make a temporary preparation of cornea/gizzard/spiracle from cockroach. (08)

**Q.3. Identify the following specimens/slides as per the instructions (10)**

i) Identify & describe (Amoeba/Paramecium/Irypanosoma/Balantidium/ opalina

ii) Identify & give its peculiarities (fresh water sponge/Gemmule/Spicules).

iii) Identify & describe (from colenterata)

iv) Identify & classify (from annelida).

v) Identify & describe (Binary fission/conjugation slide from paramecium)

**Q.4 Identify the following specimen/slides as per instructions (10)**

i. Identify & describe (Cyclostomata)

ii. Identify the sex with reason (frog/sexual dimorphism)

iii. Identify & describe the pointed organ from dissected specimen(Any one visceral organ from frog).

iv. Identify & describe (Any one bone from frog)

v. Identify & describe (Any one developmental stage from Embryology/Metamorphosis).

**Q.5. Identify the following specimen/slides as per instructions. (12)**

i) Identify & describe (*Fasciolahepatatica/Ascaris lumbricoides*).

ii) Identify & describe the pathogenecity (Plasmodium/wuchereria/ Headlouse/Tick

iii) Identify & describe its role in health of human being (House fly/Rat flea/Mosquito

iv) Identify & describe (Any one Larval stage from life cycle of faciola/Ascaris).

**Q.6.A) Identify the following specimen/slides as per instructions (15)**

a) Identify the blood group with reason & state the blood group to whom it can donate the blood & from which blood group it can accept the blood (Any one blood group card)

b) Identify the mutant & describe it (from Drosophillia).

c) Identify the sex by giving reasons. (Mate/female Drosophilla.)

d) Identify & comment upon the human genetic trait (Any one from roller/Non roller,attached/free earlobe,Taster/Non -taster).

e) Identify & describe (Metacentric,submetacentric,Acrocentric,Telocentric).

**B) Any one genetical problem based on monohybrid & Dihybrid ratio.(05)**

## MATHEMATICS

### PAPER – 1

### ALGEBRA AND GEOMETRY

#### Section I

#### 1) Sets (4 Lectures)

1.1 Power set of a set, Product of two sets.

1.2 Equivalence relations, partitions of sets, Equivalence classes.

#### 2) Functions (4 Lectures)

2.1 Definition of a function. Domain, co-domain and the range of a function.

Review of injective, surjective and bijective functions, Composition of functions. Invertible functions and the inverse of a function.

2.2 Binary operations.

#### 3) Integers (14 Lectures)

3.1 Well Ordering Property (W.O.P) for  $\mathbb{N}$ .

3.2 Divisibility in  $\mathbb{Z}$ : Definition and elementary properties. Division Algorithm, G.C.D.and L.C.M of two integers.

Basic properties of G.C.D. including G.C.D. for any two integers a and b if it exists, is unique, and can be expressed as  $ua+vb$ . Euclidean Algorithm.

3.3 Primes. Euclid's Lemma, Unique Factorization Theorem.

3.4 Congruences: Definition and elementary properties. The set  $\mathbb{Z}_n$ . Fermat's Theorem. Euler phi-function.

Addition modulo n , multiplication modulo n and its properties.

#### 4) Complex Numbers (10 Lectures)

4.1 Addition and multiplication of complex numbers, Modulus and amplitude of a complex number. Real and imaginary parts and the conjugate of a complex number. Geometric representation of the sum, difference, product and quotient of two complex numbers as well as of the modulus, amplitude and the conjugate of a complex number.

4.2 De-Moivre's Theorem. Roots of unity. Solutions of the equation  $w_n = z$ .

#### 5) Polynomials ( 4 Lectures)

- 5.1) i) The set  $Q[x]$  of polynomials in one variable with rational coefficients.  
 Division Algorithm (without proof). G.C.D of two polynomials(without proof).  
 ii) Remainder Theorem, Factor Theorem(with proof).  
 iii) Relation between the roots and the coefficients of a polynomial. Examples.

### **Section –II**

#### **6) Analytical Geometry of Two Dimensions (8 Lectures)**

- 6.1) Change of axes: translation and rotation.  
 6.2 ) Conic Sections: General equation of second degree in two variables. Reduction to standard form. Centre of conic. Nature of conic.

#### **7) Analytical Geometry of Three Dimensions ( 12 Lectures)**

- 7.1) Review of Co-ordinates in 3-space. Direction cosines and direction ratios.  
 7.2) Every linear equation in x,y,and z represents a plane.  
 7.3) Equations of coordinate planes. Normal form of equation of a plane.Plane passing through three non-collinear points. Intercept form of equation of a plane. Distance of a point from a plane. Distance between parallel planes.  
 7.4) Systems of planes. Bisector planes.  
 7.5) Equations of a line in various forms. Symmetric and unsymmetric forms of the equations of a line. Line passing through two points.  
 7.6) Angle between a line and a plane. Perpendicular distance of a point from a plane. Condition for two lines to be coplanar.  
 7.3) Skew lines and shortest distance between skew lines.

#### **8) Sphere: (6 Lectures)**

- 8.1) Equation of a sphere in different forms, plane section of a sphere, Equation of a circle. Sphere through a given circle. Intersection of a sphere and a line. Equation of tangent plane to standard sphere and general sphere.

#### **9) System of Linear Equations : (10 lectures)**

- 9.1) System of m linear equations in n unknowns; Homogeneous systems, Non homogeneous system, Matrix form of System of Equations  
 9.2) Echelon form; row reduced echelon form of a matrix  
 9.3) Definition of rank of a matrix. Examples.  
 9.4) Gauss Elimination Method.  
 9.5) Consistency of a system of non homogeneous equations; Condition of consistency i.e. for  $AX = B$ ,  $\rho[A,B] = \rho[A]$  (without proof).

### **TEXT BOOKS :**

- 1) Complex Variables and Applications : Ruel. V.Churchill; McGraw Hill Co.
- 2) Elementary Number Theory : David Burton ; Tata McGraw Hill (Walter Rudin Series), Indian Edition.
- 3) Matrices : Shanti Narayan; S.Chand & Co. N.Delhi
- 4) Analytical Geometry of Two and Three Dimensions : Qazi Zameeruddin; Narosa Publ..

## **MATHEMATICS**

### **PAPER II CALCULUS**

#### **1. The Real Numbers : [8 lectures**

- i. Algebraic and order properties of  $R$
- ii. Absolute Value and the Real Line
- iii. The Completeness Property of  $R$
- iv. Applications of the Supremum Property

#### **2. Sequences of Real Numbers : [20 lectures**

- i. Sequences and their Limits
- ii. Limit Theorems
- iii. Monotone Sequences
- iv. Subsequences and Bolzano - Weierstrass Theorem
- v. The Cauchy criterion

- vi. Properly divergent sequences
- vii. Introduction to infinite series

### **3. Limits** [8 lectures

- i. Limits of Functions
- ii. Limit Theorem
- iii. Some Extensions of Limit Concepts Section – II

### **4 Continuous Functions** [16 lectures

- i. Continuous Functions
- ii. Combinations of Continuous Functions
- iii. Continuous functions on intervals

### **5 Differentiation** [20

- i. The Derivative
- ii. The Mean Value Theorem
- iii. L'Hospital's Rules
- iv. Successive Differentiation
- v. Taylor's Theorem

#### **Text Books :**

1. Introduction to Real Analysis by Robert G. Bartle and Donald R. Sherbert, Third Edition, John Wiley and Sons, 2002

Sections : First Term : 2.1, 2.2, 2.3, 2.4, 3.1 to 3.7 , 4.1, 4.2, 4.3

Second Term : 5.1, 5.2, 5.3, 6.1, 6.2, 6.3, 6.4

2. Differential Calculus, Shantinayakan, 7<sup>th</sup> Edition, S. Chand and Co. Publication Chapter 5

#### **Reference Books :**

- 1. A Course in Calculus and Analysis by Sudhir Ghorpade and Balmohan Limaye, Springer 2006.
- 2. Principles of Mathematical Analysis, W. Rudin, Third Edition, McGraw Hill, 1976

## **PRACTICAL PAPER**

### **Modalities For Conducting The Practical and The Practical Examination**

- 1) There will be four Practical slots (each of 45 minutes) per week, two slots for Paper I and two for Paper II. (24 Practical slots for Paper I and 24 practical slots for Paper II per term in any one term) **OR** one 3 hour Practical session for each batch of 20 students per week
- 2) A question bank consisting of 100 problems in all for the whole year, distributed in four Sections: 50 questions for each term (25 questions on Paper I and 25 on Paper II) will be the course work for this paper. Question Bank will be prepared by a Sub-Committee to be appointed by the Board of Studies in Mathematics. Question Bank shall be ready by first week of June, 2008.
- 3) The College will conduct the written Practical Examination of 80 marks at least 15 days before the commencement of the Main Theory Examination. There will be no external examiner. The written practical exam will be of the duration of 3 hours and the question paper will be as follows:

Q1. (a) Any 1 out of 2 worth 10 marks on Paper I(first term).

(b) Any 1 out of 2 worth 10 marks on Paper II.(first term).

Q2. Any 4 out of 5 each of 5 marks on Paper I.

Q3. Any 4 out of 5 each of 5 marks on Paper II.

Q4. (a) Any 1 out of 2 of 10 marks on Paper I(second term).

(b) Any 1 out of 2 worth 10 marks on Paper II(second term).

In Q2 and Q3, there will be either 2 questions from first term and 3 questions from the second term or vice versa.

4) Each student will maintain a journal to be provided by the College at cost.

The student will submit certified journal at the time of the Practical Examination. There will be 20 marks for internal assessment, which will include marks for journal and attendance.

5) 60 percent of the questions for the written practical examination will be exclusively set from the Question Bank provided. **Questions from the**

**Question Bank (meant for practical course) should NOT be asked in the University Theory Examinations.**

6) The Question Bank shall be changed once every three years.

7) A Guideline as to the number of slots per week to be allotted for each topic per paper is as under:-

**N.B. :-** In each term 12 practicals will be held including 2 revision practicals. Each practical can either be conducted in one session of 3 hours or it can be spread out over 4 slots of 45 mins each per week. Hence the total number of slots per term for the practicals is 48.

### **Paper-I: Algebra and Geometry**

| <b>Sr.No.</b> | <b>Topic</b>           |           |
|---------------|------------------------|-----------|
| <b>1</b>      | <b>Sets</b>            | <b>02</b> |
| <b>2</b>      | <b>Functions</b>       | <b>02</b> |
| <b>3</b>      | <b>Integers</b>        | <b>06</b> |
| <b>4</b>      | <b>Complex Numbers</b> | <b>06</b> |
| <b>5</b>      | <b>Polynomials</b>     | <b>04</b> |
| <b>6</b>      | <b>Revision</b>        | <b>04</b> |
| <b>Total</b>  |                        | <b>24</b> |

### **Paper-II: Calculus.**

| <b>Sr.No</b> | <b>Topic</b>                     |           |
|--------------|----------------------------------|-----------|
| <b>1</b>     | <b>The Real Numbers</b>          | <b>04</b> |
| <b>2</b>     | <b>Sequences of Real Numbers</b> | <b>06</b> |
| <b>3</b>     | <b>Limits</b>                    | <b>04</b> |
| <b>4</b>     | <b>Continuous Functions</b>      | <b>06</b> |
| <b>5</b>     | <b>Revision</b>                  | <b>04</b> |
| <b>Total</b> |                                  | <b>24</b> |

### **Paper-I: Algebra and Geometry**

| <b>Sr.No</b> | <b>Topic</b>                        |           |
|--------------|-------------------------------------|-----------|
| <b>1</b>     | <b>Geometry of Two Dimensions</b>   | <b>06</b> |
| <b>2</b>     | <b>Geometry of three dimensions</b> | <b>06</b> |
| <b>3</b>     | <b>Sphere</b>                       | <b>02</b> |
| <b>4</b>     | <b>System of linear equations</b>   | <b>06</b> |
| <b>5</b>     | <b>Revision</b>                     | <b>04</b> |
| <b>Total</b> |                                     | <b>24</b> |

### **Paper-II: Calculus.**

| <b>Sr.No</b> | <b>Topic</b>                             |           |
|--------------|--|-----------|
| <b>1</b>     | <b>Continuous Functions on intervals</b> | <b>08</b> |
| <b>2</b>     | <b>Differentiation</b>                   | <b>12</b> |
| <b>3</b>     | <b>Revision</b>                          | <b>04</b> |
| <b>Total</b> |  | <b>24</b> |

## **Psychology**

### **Paper I: General Psychology**

#### **1: The Science of Psychology (Total 11 periods)**

1.1 What is Psychology? – Definition, goals, types of psychological professionals

1.2 Historical Perspectives in Psychology

a. Structuralism

b. Functionalism

c. Gestalt

d. Psychoanalysis

1.3 Modern Perspectives in Psychology

a. Behavioural

b. Humanistic

c. Biopsychosocial

d. Cognitive

1.4 Scientific Methods

a. Steps in scientific methods

b. Descriptive methods: Naturalistic, observation, case studies, surveys, correlations

c. Experimental method: Laboratory experiment and field experiment

1.5 Application: How to enhance your academic performance?

## **2: Biological Foundation of Behaviour (Total 11 periods)**

2.1 Neuron: Structure and function, synapse, neurotransmitters

2.2 Central Nervous System

[A] Brain

a. Structure and function of the brain

b. Cerebral hemispheres

[B] Spinal Cord: Structure and function

2.3 Peripheral Nervous System: Structure and function

a. Autonomous Nervous System

b. Somatic Nervous System

2.4 Glandular System: Pituitary, Thyroid, Parathyroid, Adrenal, Pancreas, Gonads.

2.5 Application: Peeking inside the brain – Clinical studies; EEG, CT, MRI, and PET Scan

2

## **3: Sensation and Perception (Total 10 periods)**

3.1 Sensation: Definition, sensory receptors, sensory threshold, subliminal perception, habituation & sensory adaptation

3.2 Definition of perception and perceptual constancies (size, shape and brightness)

3.3 Gestalt principles of perception

3.4 Perceptual illusion: Geometrical, movement

3.5 Application: Thinking about extra-sensory perception

## **4: Motivation and Emotion (Total 10 periods)**

4.1 Definition of motivation, concept of homeostasis, Maslow's hierarchy of needs

4.2 Types of motives

a. Physiological- Hunger, thirst, sleep and sex

b. Social- Achievement, affiliation, power, and aggression & hostility

4.3 Frustration and conflict

4.4 Emotion

4.4.1 Definition

4.4.2 Elements of emotion

a. Physiology of emotion

b. Behavioural expression of emotion

c. Subjective experience

4.5 Application: Being happy

## **5: Personality (Total 11 periods)**

5.1 Personality: Definitions

5.2 Theories of personality

a. Freud's Psychoanalytic Theory

b. Allport's Theory

c. Cattell's Theory

d. The Big Five Model

5.3 Assessment of personality (I)

Personality inventories

a. 16 PF

b. MMPI

c. NEO-PI

5.4 Assessment of personality (II)

5.4.1 Behavioural assessment

a. Observation

b. Rating

5.4.2 Projective techniques

a. TAT

b. Rorschach's Ink Blot Test

c. Sentence Completion Test

5.5 Application: Increasing self efficacy through goal setting

## **6: Learning (Total 11 periods)**

6.1 Learning: Definition

6.2 Classical conditioning- Pavlov's experiment, extinction, spontaneous recovery, generalization, discrimination, higher-order conditioning.

6.3 Operant conditioning- Thorndike's Laws of learning, Skinner's experiment,

positive reinforcer, negative reinforcer, schedules of reinforcement, shaping

6.4 Cognitive learning theories (Tolman, Kohler); Observational learning theory (Bandura).

6.5 Applications of classical and operant conditioning

**7: Memory (Total 10 periods)**

7.1 Memory: Definition and process

7.2 Types of memory

a. Sensory memory

b. Short term memory

c. Long term memory

7.3 Types of long term memory- Procedural, Declarative (episodic, semantic), Explicit and implicit

7.4 Forgetting: Course of forgetting (Ebbinghaus' forgetting curve); and causes of forgetting (encoding failure, decay of memory traces, interference, motivated forgetting).

7.5 Application: Improving memory - Keyword technique, method of loci, encoding specificity, organization of test material, organization of lecture notes, practice and rehearsal.

**8: Intelligence (Total 10 periods)**

8.1 Intelligence: Definition

8.2 Measurement of intelligence

8.2.1 Concepts in measurement of intelligence (C.A., M.A., IQ)

8.2.2 Tests of intelligence – Binet, Stanford Binet, Wechsler

8.3 Individual differences in intelligence

8.3.1 Mental retardation: Meaning, causes and classification

8.3.2 Giftedness

8.4 Theories of intelligence – Spearman, Gardner, Sternberg

8.5 Application: Early childhood intervention- a means for boosting intelligence

**Books for reading:**

1. Feldman, R. S. (8th ed.) (2008). *Understanding psychology*. TMH.

2. Ciccarelli, S. & Meyer, G. E. (2006). *Psychology*. New Delhi: Pearson Education.

3. Passer, M. W. & Smith, R. E. (2007). *Psychology: The science of mind and behaviour*. New Delhi: Tata McGraw-Hill.

4. Coon, D. & Mitterer, J. O. (2007). *Introduction to psychology: Gateways to mind and behavior*. Singapore: Thomson Wadsworth.

5. Lahey, B.B. (2003). *Psychology: An introduction*. New Delhi: Tata McGraw-Hill.

6. Smith, E.E. and others (2003). *Atkinson Hilgard's introduction to psychology*. Thomson & Wadsworth.

7. Smith, D.B. (1908). *Psychology: Science and understanding*. Boston: McGraw-Hill.

8. Zimbardo, P. G. and Weber, A. L. (1997). *Psychology*. N.Y.: Longman.

9. Baron, R. A. (2001). *Psychology*. New Delhi: Pearson Education Pvt. Ltd.

10. Morgan & others *Introduction to Psychology*

11. Atkinson, and Hilgard (2003). *Introduction to psychology*. Thomson Wadsworth.

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**Paper II**

**Experimental Psychology & Psychological Testing**

**1: Nature and Scope of Experimental Psychology (Total 11 periods)**

1.1- Concept of experimentation, the experimental method.

1.2- Psychological experiment: Experimental and Control group.

1.3- Concept of Variable: Independent and Dependent, Relevant and Irrelevant, Qualitative and Quantitative, Continuous and Discrete.

1.4- Control techniques in experimentation – Randomization, Matching and Counterbalancing .

**2: Psychophysical Methods (Total 11 periods)**

2.1- Basic concepts of Psychophysics.

2.2- Basic problems in Psychophysics and errors in Psychological methods.

2.3- Weber's law and Fechner's law.

2.4- Methods of Psychophysics: Method of limits, Method of constant stimuli, Method of average error.

2.5- Applications of Psychophysics.

**3: Reaction Time: (Total 10 periods)**

3.1- Introduction and definition of reaction time.

3.2- Types of reaction time.

3.3- Determinants of reaction time: The characteristics of the stimulus , Set and attitudes of the reactor, Individual differences among subjects.



3.4- Applications of reaction time.

**4: Problem Solving (Total 10 periods)**

4.1- Learning to solve problems: What is problem? How do we solve problems? Trial and error in problem-solving

4.2- Insight behaviour in problem solving, stages in problem solving

4.3- Maladjustment and problem solving

4.4- Creative problem solving

**5: Nature and Uses of Psychological Tests (Total 10 periods)**

5.1- What is Psychological Test? Controlling the use of Psychological tests.

5.2- Characteristics of Psychological tests.

5.3- Types and uses of Psychological tests.

5.4- Social and ethical implications of testing.

**6: Reliability and Validity of Psychological Tests (Total 10 periods)**

6.1- Definition and types of Reliability.

6.2- Factors affecting reliability coefficient.

6.3- Meaning and types of Validity.

6.4- Uses and limitations of criterion related validation.

**7: Measurements of Intelligence and Aptitudes (Total 11 periods)**

7.1- Nature of Intelligence. What is measured by intelligence test?

7.2- Intelligence tests

a) Individual tests - Stanford-Binet Scale, Wechsler's Intelligence Scale for Children (WISC)

b) Group tests – SPM, Cattell's Culture Fair Test

7.3- Concept of Aptitude, basic assumptions about aptitudes.

7.4- Aptitude tests – DAT, GATB

7.5- Applications of intelligence and aptitude tests.

**8: Measurement of Personality and Interest (Total 11 periods)**

8.1- Nature and definition of personality and interest

8.2- Personality tests:

a) Self report inventories – HSPQ, 16 PF

b) Projective tests – TAT, sentence completion test

8.3- Interest tests - The Strong Cambell Interest Inventories, Kuder Preference Record.

8.4- Applications of personality and interest tests.

6

**Books for Reading-**

1) Anne Anastasi and Susana Urbina (2005) "Psychological Testing" (7<sup>th</sup> Edn ) Prentice-Hall , New Delhi.

2) Dandekar W.N. and Rajguru (2001) "An introduction to Psychological Testing and Statistics" Seth Publications Pvt. Ltd.

3) Dandekar W.N. (1994) "Fundamentals of Experimental Psychology" Anmol Prakashan, Pune.

4) D'Amato (2004) "Experimental Psychology: Methodology, Psychophysics and Learning "

5) Kaplan, R.M. & Saccuzzo, D.P. (2007). Psychological Testing: Principles, Applications, and Issues. Australia : Thomson Wadsworth.

6) Rajamanickam, M. (2005). Experimental Psychology: with Advanced Experiments, Volume 1 & 2. New Delhi: Concept Publishing Company.

7) Myers A and Hansen (2002) "Experimental Psychology " Wadsworth

8) Postman L and Eagan J.P. (1949) "Experimental Psychology – An Introduction" Kalyani Pub.

9) Sharma Ramnath & Sharma (2000) "Experimental Psychology" Atlantic Publication.

10) Snodgrass J. G., Levy-Berger, Hyden (1985) "Human Experimental Psychology" Oxford University Press – New York

**PRACTICAL  
EXPERIMENTAL PSYCHOLOGY AND  
PSYCHOLOGICAL TESTING: PRACTICAL  
Experiments**

(Any six practicals should be performed in the first term)

1. Method of limits – RL / DL

2. Method of constant stimuli – RL / DL

3. Method of average error

4. Measurement of illusion

5. Measurement of RT

6. Recall and Recognition

7. Retroactive inhibition

8. Manual dexterity or finger dexterity

9. STM

10. KOR

### 1) General Ability / Special Ability Testing-

Any two standardized tests

### 2) Interest Inventories-

Any two standardized tests

### 3) Personality and Adjustment testing-

- Any one standardized personality test and
- Any one standardized adjustment test

## STATISTICS

- Measurement of central tendency – Mean, Median, Mode
- Standard Deviation, Rank Order Correlation Coefficient

Note :

1. Practical Examination will be conducted by respective Colleges at the end of the Academic Year.

2. Distribution of marks – 80 marks for assigned to practical 20 marks for internal examination. (10 marks journal 10 marks for oral)

3. Simple Statistical problems are set for annual practical examinations

1) Anastasi, A. and Susana Urbina (2005) “ Psychological Testing” (7<sup>th</sup> Edn ) Prentice- Hall, New Delhi.

2) Choube S. P. (1985) “Some Psychological Experiments” L.N.A.Education Publication,Agra.

3) D’Amato (2004) “Experimental Psychology: Methodology, Psychophysics and Learning ”

4) Das, G. “Experimental Psychology” King Books New Delhi.8

5) Garrett H E (1979) “Statistic in Psychology & Education”

6) Jalota (1985) “Experiments in Psychology”

7) Kothurkar and Vanarase (1985) “Experiments in Psychology a systematic introduction”

8) Mohanty, G. 1997 “Experiments in Psychology” Kalyani Publication New Delhi

9) Mohsin, S. M. “Experiments in Psychology”

10) Parmeshwaran, E. G. (1998) “Manual of Experimental Psychology” Lavani Publication House New Delhi.

11) Postman, L. and Eagan, J.P. (1960) “Experimental Psychology – An Introduction” Kalyani Pub.

12) Snodgrass, J. G., Levy-Berger, Hyden (1985) “Human Experimental Psychology” Oxford University Press – New York

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## Appendix –A

B.Sc. B.Ed. (Integrated) Programme

### **Break-up of the Pedagogical Practicum and the other Practicals**

| Year                 | Pedagogical Practicum   | Marks and hours  | The other Practicals  | Marks and hours |
|----------------------|---|--|---|-----------------|
| 1 <sup>st</sup> Year | There will be no practical related to pedagogy  |  | Personality Development Programme (PDP), Content Enrichment Programme (CEP), Social Interaction Programme (SIP)   | (90)            |
| 2 <sup>nd</sup> Year | -Laboratory Experiences - Microteaching – (Six skills)<br>-Integration Lessons – (Four Lessons)<br>-Simulated Lessons – (Four Lessons)<br>-Lessons Observation (Eight Lessons)<br>-Course Related Practical - Course Psychology of Development and Learning   | 25(50)<br>25(40)<br>30(40)<br>---<br>20(30)<br><b>100</b>  | Personality Development Programme (PDP) *<br>Social Interaction Programme (SIP)<br>Content Enrichment Programme (CEP)<br>(*100 marks for 1 <sup>st</sup> and 2 <sup>nd</sup> Year's work together). | 100*<br>(90)    |
| 3 <sup>rd</sup> Year | -Practice Teaching (12 lessons)-<br>-Lesson Observation – (12 lessons )<br>-CCM Workshops - 2<br>-Practical Related to Instructional system and Educational Evaluation -<br>-Technology Based Training –<br>-Health Education -<br>- NSS / Social-work -  | 180(120)<br>-----<br>60(40)<br><br>20(20)<br>20(30)<br>10(60)<br>10(60)<br><b>300</b>  |   |                 |
| 4 <sup>th</sup> Year | Internship Programme<br>a. Block Teaching (8 lessons) -<br>b. Technology Based Lessons 2 -<br>c. Lessons on Models of Teaching- 2<br>d. Value Education Based Lessons-4<br>e. Team Teaching -<br>f. Observation and Participation in School Activities<br>-Lesson Observation (20 lessons)<br>-Theory Courses Related Practical<br>a. Education for New Times -<br>b. Educational Management -<br>c. Environmental Education and Educational Research -<br>d. Physical and Health Education and yoga-<br>-Technology Based Teaching-<br>-Working with the Community and Co-curricular Activities<br>-Health Education | 120(80)<br>40(30)<br>40(40)<br>60(30)<br>60(30)<br>30(100)<br>----<br><br>20(30)<br>20(30)<br><br>20(30)<br>10(30)<br>10(40)<br>50(30)<br>10(60) |   |                 |

|  |                   |        |  |  |
|--|-------------------|--------|--|--|
|  | -NSS /Social work | 10(60) |  |  |
|  |                   | 500    |  |  |

## Appendix- B

### Personality Development Programme(PDP)

The activities in PDP are to be selected and organized in such way that they enhance personality development as a prospective teacher.

#### Illustrated list of Activities

- Yoga, sports
- soft skill development
- SWOT analysis,
- co-curricular activities,
- creative writing,
- general reading, elocution,
- Craft and drawing, photography, music- instrumental and vocal, activities for the development of hobbies, scientific temper.
- Value development activities
- activities based on multiple intelligence

#### Content Enrichment Programme (CEP)

- General Knowledge enrichment
- Events related to mathematics and science
- Activities for removal of superstitions
- Celebration of anniversaries of scientists and great inventions
- Science and mathematics in day today life.
- Contemporary events related to science and Mathematics
- Science talent search scheme
- Olympiads, competitive examinations
- General Knowledge related to science and on science fiction reading
- Studying biographies of scientists.
- Science Projects.

#### Social Interactive Programme (SIP)

- Self introduction
- Feedback giving and receiving activities
- Co-operative learning
- Interviews of the parents/ teachers
- Dialogue with school children
- Case study of child
- Social work

- Social service
- Literacy Programme

## Appendix 'F'

### **QUALIFICATIONS OF ACADEMIC STAFF**

For B.A.B.Ed. And B.Sc.B.Ed. (Integrated) Programme

1. Good academic record with at least 55% marks (or an equivalent grade in a point scale wherever grading system is followed) at the Master's Degree level in the relevant subject from an Indian University, or an equivalent degree from an accredited foreign university.
2. M.Ed. with at least 55% marks or equivalent grade.
3. Besides fulfilling the above qualifications, the candidate must have cleared the National Eligibility Test (NET) conducted by the UGC, CSIR or similar test accredited by the UGC like SLET/SET either in Education or in the relevant subject at master level.
4. Notwithstanding anything contained in sub-clauses (i) and (ii) to this Clause 4.4.1, candidates, who are, or have been awarded a Ph. D. Degree in Education or relevant subject, accordance with the University Grants Commission (Minimum Standards and Procedure for Award of Ph.D. Degree) Regulations, 2009, shall be exempted from the requirement of the minimum eligibility condition of NET/SLET/SET for recruitment and appointment of Assistant Professor or equivalent positions in Universities/Colleges/Institutions.
5. A relaxation of 5% may be provided from 55% to 50% of the mark to the Ph.D. degree holders who have obtained their Master's Degree prior to 19<sup>th</sup> September 1991.