Council of Higher Secondary Education Odisha

Subject: BIOLOGY

Classes XI & XII (2023-24)

The present curriculum provides the students with updated concepts along with an extended exposure to contemporary areas of the subject. The curriculum also aims at emphasizing the underlying principles that are common to animals, plants and microorganisms as well as highlighting the relationship of Biology with other areas of knowledge. The format allows a simple, clear, sequential flow of concepts. It relates the study of biology to real life through the developments in use of technology. It links the discoveries and innovations in biology to everyday life such as environment, industry, health and agriculture. The updated curriculum also focuses on understanding and application of scientific principles, while ensuring that ample opportunities and scope for learning and appreciating basic concepts continue to be available within itsframework. The prescribed syllabus is expected to:

- promote understanding of basic principles of Biology
- encourage learning of emerging knowledge and its relevance to individual and society
- promote rational/scientific attitude towards issues related to population, environment and development
- enhance awareness about environmental issues, problems and their appropriate solutions
- create awareness amongst the learners about diversity in the living organisms and developing respect for other living beings
- appreciate that the most complex biological phenomena are built on essentially simple processes

It is expected that the students would get an exposure to various branches of Biology in the curriculum in a more contextual and systematic manner as they study its various units.

BIOLOGY (THEORY)
COURSE STRUCTURE (2023 -24)
CLASS XI

Botany: Full Mark-35 **Time: 1.5 Hours**
Zoology: Full Mark-35 **Time: 1.5 Hours**

Unit wise distribution of mark

Unit	Title	Botany	Zoology
I	Diversity of Living Organisms	8	7
II	Structural Organization in Plants and Animals	6	4
III	Cell: Structure and Function	9	6
IV	Plant Physiology	12	0
V	Human Physiology	0	18
	Total	35	35

Unit-I: Diversity of Living Organisms

Chapter-1: The Living World (Botany)

Biodiversity; Need for classification; three domains of life; taxonomy and systematics; concept of species and taxonomical hierarchy; binomial nomenclature

Chapter-2: Biological Classification (Botany)

Five kingdom classification; Salient features and classification of Monera, Protista and Fungi into major groups; Lichens, Viruses and Viroids.

Chapter-3: Plant Kingdom (Botany)

Classification of plants into major groups; Salient and distinguishing features and a few examples of Algae, Bryophyta, Pteridophyta, Gymnospermae (Topics excluded – Angiosperms, Plant Life Cycle and Alternation of Generations)

Chapter-4: Animal Kingdom (Zoology)

Salient features and classification of animals, non-chordates up to phyla level and chordates up to class level (salient features and at a few examples of each category).
(No live animals or specimen should be displayed.)

Unit-II : Structural Organization in Plants and Animals

Chapter-5: Morphology of Flowering Plants (Botany)

Morphology of different parts of flowering plants: root, stem, leaf, inflorescence, flower, fruit and seed. Description of family Solanaceae

Chapter-6: Anatomy of Flowering Plants (Botany)

Anatomy and functions of tissue systems in dicots and monocots.

Chapter-7: Structural Organisation in Animals (Zoology)

Morphology, Anatomy and functions of different systems (digestive, circulatory,respiratory, nervous and reproductive) of frog.

Unit-III Cell: Structure and Function

Chapter-8: Cell-The Unit of Life (Botany)

Cell theory and cell as the basic unit of life, structure of prokaryotic and eukaryotic cells; Plant cell and animal cell; cell envelope; cell membrane, cell wall; cell organelles - structure and function; endomembrane system, endoplasmic reticulum, golgi bodies, lysosomes, vacuoles,mitochondria, ribosomes, plastids, microbodies; cytoskeleton, cilia, flagella, centrioles (ultrastructure and function); nucleus.

Chapter-9: Biomolecules (Botany)

Chemical constituents of living cells: biomolecules, structure and function of proteins, carbohydrates, lipids, and nucleic acids; Enzyme - types, properties, enzyme action. (Topics excluded: Nature of Bond Linking Monomers in a Polymer, Dynamic State of Body Constituents – Concept of Metabolism, Metabolic Basis of Living, The Living State)

Chapter-10: Cell Cycle and Cell Division (Zoology)

Cell cycle, mitosis, meiosis and their significance

Unit-IV Plant Physiology

Chapter-11: Photosynthesis in Higher Plants (Botany)

Photosynthesis as a means of autotrophic nutrition; site of photosynthesis, pigments involved in photosynthesis (elementary idea); photochemical and biosynthetic phases of photosynthesis; cyclic and non-cyclic photophosphorylation; chemiosmotic hypothesis; photorespiration; C3 and C4 pathways; factors affecting photosynthesis.

Chapter-12: Respiration in Plants (Botany)

Exchange of gases; cellular respiration - glycolysis, fermentation (anaerobic), TCA cycle and electron transport system (aerobic); energy relations - number of ATP molecules generated; amphibolic pathways; respiratory quotient.

Chapter-13: Plant - Growth and Development (Botany)

Seed germination; phases of plant growth and plant growth rate; conditions of growth; differentiation, dedifferentiation and redifferentiation; sequence of developmental processes in a plant cell; plant growth regulators - auxin, gibberellin, cytokinin, ethylene, ABA.

Unit-V Human Physiology

Chapter-14: Breathing and Exchange of Gases (Zoology)

Respiratory organs in animals (recall only); Respiratory system in humans; mechanism of breathing and its regulation in humans - exchange of gases, transport of gases and regulation of respiration, respiratory volume; disorders related to respiration - asthma, emphysema, occupational respiratory disorders.

Chapter-15: Body Fluids and Circulation (Zoology)

Composition of blood, blood groups, coagulation of blood; composition of lymph and its function; human circulatory system - Structure of human heart and blood vessels; cardiac cycle, cardiac output, ECG; double circulation; regulation of cardiac activity; disorders of circulatory system - hypertension, coronary artery disease, angina pectoris, heart failure.

Chapter-16: Excretory Products and their Elimination (Zoology)
Modes of excretion - ammonotelism, ureotelism, uricotelism; human excretory system – structure and function; urine formation, osmoregulation; regulation of kidney function - renin - angiotensin, atrial natriuretic factor, ADH and diabetes insipidus; role of other organs in excretion; disorders - uremia, renal failure, renal calculi, nephritis; dialysis and artificial kidney, kidney transplant.

Chapter-17: Locomotion and Movement (Zoology)
Types of movement - ciliary, flagellar, muscular; skeletal muscle, contractile proteins and muscle contraction; skeletal system and its functions; joints; disorders of muscular and skeletal systems - myasthenia gravis, tetany, muscular dystrophy, arthritis, osteoporosis, gout.

Chapter-18: Neural Control and Coordination (Zoology)
Neuron and nerves; Nervous system in humans - central nervous system; peripheral nervous system and visceral nervous system; generation and conduction of nerve impulse

Chapter-19: Chemical Coordination and Integration (Zoology)
Endocrine glands and hormones; human endocrine system - hypothalamus, pituitary, pineal, thyroid, parathyroid, adrenal, pancreas, gonads; mechanism of hormone action (elementary idea); role of hormones as messengers and regulators, hypo - and hyperactivity and related disorders; dwarfism, acromegaly, cretinism, goiter, exophthalmic goitre, diabetes, Addison's disease.
Note: Diseases related to all the human physiological systems to be taught in brief.

Mark Distribution in Examination Botany / Zoology (Class XI)Theory Papers: 35 Marks

1. **MCQ 1 x 5 = 5 Marks**
2. **Fill in the blank/ one word answer 1x 5= 5 Marks**
3. **Short notes 2 x 5 =10 Marks**
4. **Differentiate between 2 ½ x 2 = 5 Marks**
5. **Long Questions 5 x 2 =10 Marks**

35 Marks

PRACTICAL

BIOLOGY-XI (Botany) Detailed syllabus

Study of:
1. Different parts of the Dissecting and Compound microscopes.
2. A typical Angiospermic plant.

Major experiment

3. Study and describe at least one common flowering plant from each of the following families (Malvacae, Solanaceae, Fabaceae and Liliacease) including dissection and display of floral whorls, anther and ovary to show number of chambers.
4. Preparation and study of T.S. of dicot and monocot roots, and stem and leaf (Primary).
5. Study of mitosis in onion root tips.

Minor experiment:

6. Study of cells (Onion scale leaf, *Rhoeo* leaves)
7. Test for presence of starch, proteins and fats.
8. Study of starch grains and raphides.
9. Qualitative test for catalase activity by leaf disc method/potato disc method.
10. Modification of root, stem and leaf.
11. Study of flower and its parts.
12. Types of inflorescence.

Spotting:

a. Study of the specimens and identification with reasons - bacteria, *Oscillatoria*, *Spirogyra*, *Rhizopus*, Mushroom, Yeast, Liverwort, Moss, Fern, Cycas, one monocotyledonous plant, one dicotyledonous plant and one lichen.
b. Study of tissues and diversity in shapes and sizes in plants (simple tissue, complex tissue) through temporary/permanent slides.

BIOLOGY-XI (Botany) for Visually Impaired Students

Note: The 'Evaluation schemes' and 'General Guidelines' for visually impaired students as given for Class XII may be followed.

A. Items for Identification/Familiarity with the apparatus /equipment /animal and plant material / chemicals. for assessment in practicals (All experiments)

B. Equipment - compound microscope, test tube, petridish, chromatography paper, chromatography chamber, beaker, scalpel

Chemical – alcohol

Specimen/Fresh Material – mushroom, succulents such as *Aloe vera*/ kalanchoe, raisins, potatoes, seeds of monocot and dicot- maize and gram or any other plant, plants of Solanaceae - Brinjal, Petunia,any other

C. List of Practicals

1. Study locally available common flowering plants of the family – Solanaceae and identify type of stem (Herbaceous or Woody), type of leaves (Compound or Simple).
2. Study the parts of a compound microscope- eye piece and objective lens, mirror, stage, coarse and fine adjustment knobs.
3. Differentiate between monocot and dicot plants on the basis of venation patterns.
4. Identify the given specimen of a fungus – mushroom, gymnosperm-pine cone

5. Identify and relate the experimental set up with the aim of experiment:
   For Potato Osmometer/endosmosis in raisins.

Note: The above practicals may be carried out in an experiential manner rather than only recording observations.

BIOLOGY - XI (Zoology) Detailed Practical Syllabus

A. Experiments/ Observations:

1. To test the presence of carbohydrate, protein and fat in suitable animal materials (qualitative only).

B. Spotiing/ Identification:

a. Study of specimens and identification with reasons- Amoeba, Hydra, Sycon, Liver fluke, Earthworm, Leech, Cockroach, Prawn, Snail and Starfish
b. Study of squamous epithelium, muscle fibres and mammalian blood film (temporary/ permanent slides).
c. Study and comment on the morphological adaptations of two animals (Tree frog, Bat) found in terrestrial conditions and two animals (Flying fish,) found in aquatic conditions.

BIOLOGY-XI (Zoology) for Visually Impaired Students

Note: The 'Evaluation schemes' and 'General Guidelines' for visually impaired students as given for Class XII may be followed.

A. Items for Identification/Familiarity with the apparatus /equipment /animal and plant material / chemicals. for assessment in practicals (All experiments)

B. Equipment - compound microscope, test tube, petri dish, chromatography paper, chromatography chamber, beaker, scalpel

Chemical – alcohol

Models – Model of Human skeleton to show – Ball and socket joints of girdles and limbs, Rib cage, Honey comb, Mollusc shell, Pigeon and Star fish, cockroach

C. List of Practicals

a. Study the following parts of human skeleton (Model): Ball and socket joints of thigh and shoulder
b. Rib cage
c. Study honeybee/butterfly, snail/sheik snail through shell, Starfish, Pigeon (through models).

Note: The above practical may be carried out in an experiential manner rather than only recording observations.

Prescribed Books:

1. Biology Class-XI, Published by NCERT
2. Bureau's Higher Secondary Biology, Vol-I : Published by Text Book Bureau, Odisha
3. Other related books and manuals brought out by NCERT (including multimedia).

Question Pattern for Practical

1. Major Experiment 6 ½ Marks
   (Theory & Procedure = 2 ½ Marks, Experiment & Result = 4 Marks)
2. Spotting 1 ½ x 3 = 4.5 Marks
3. Record = 2 Marks
4. Viva = 2 Marks

   15 Marks

BIOLOGY (THEORY)

COURSE STRUCTURE (2023 -24)

CLASS XII

Botany: Full Mark-35 **Time: 1.5 Hours**
Zoology: Full Mark-35 **Time: 1.5**
Hours Unit wise distribution of mark

Unit	Title	Botany	Zoology
VI	Reproduction	5	11
VII	Genetics and Evolution	11	9
VIII	Biology and Human Welfare	6	6
IX	Biotechnology and its Applications	6	6
X	Ecology and Environment	7	3
	Total	35	35

Unit-VI Reproduction

Chapter-1: Sexual Reproduction in Flowering Plants (Botany)
Flower structure; development of male and female gametophytes; pollination - types, agencies and examples; out breeding devices; pollen-pistil interaction; double fertilization; post fertilization events - development of endosperm and embryo, development of seed and formation of fruit; special modes- apomixis, parthenocarpy, polyembryony; Significance of seed dispersal and fruit formation.

Chapter-2: Human Reproduction (Zoology)
Male and female reproductive systems; microscopic anatomy of testis and ovary; gametogenesis
-spermatogenesis and oogenesis; menstrual cycle; fertilisation, embryo development upto blastocyst formation, implantation; pregnancy and placenta formation (elementary idea); parturition (elementary idea); lactation (elementary idea).

Chapter-3: Reproductive Health (Zoology)
Need for reproductive health and prevention of Sexually Transmitted Diseases (STDs); birth control - need and methods, contraception and medical termination of pregnancy (MTP); amniocentesis; infertility and assisted reproductive technologies - IVF, ZIFT, GIFT (elementary idea for general awareness).

Unit-VII Genetics and Evolution

Chapter-4a: Principles of Inheritance and Variation (Botany)
Heredity and variation: Mendelian inheritance; deviations from Mendelism – incomplete dominance, co-dominance, multiple alleles and inheritance of blood groups, pleiotropy; elementary idea of polygenic inheritance; chromosome theory of inheritance; chromosomes and genes;

Chapter-4b: (Zoology)

Sex determination - in humans, birds and honey bee; linkage and crossing over; sex linked inheritance - haemophilia, colour blindness; Mendelian disorders in humans - thalassemia; chromosomal disorders in humans; Down's syndrome, Turner's and Klinefelter's syndromes.

Chapter-5: Molecular Basis of Inheritance (Botany)

Search for genetic material and DNA as genetic material; Structure of DNA and RNA; DNA packaging; DNA replication; Central Dogma; transcription, genetic code, translation; gene expression and regulation - *lac* operon; Genome, Human and rice genome projects; DNA fingerprinting.

Chapter-6: Evolution (Zoology)

Origin of life; biological evolution and evidences for biological evolution (paleontology, comparative anatomy, embryology and molecular evidences); Darwin's contribution, modern synthetic theory of evolution; mechanism of evolution - variation (mutation and recombination) and natural selection with examples, types of natural selection; Gene flow and genetic drift; Hardy
- Weinberg's principle; adaptive radiation; human evolution.

Unit-VIII: Biology and Human Welfare

Chapter-7: Human Health and Diseases (Zoology)

Pathogens; parasites causing human diseases (malaria, dengue, chikungunya, filariasis, ascariasis, typhoid, pneumonia, common cold, amoebiasis, ring worm) and their control; Basicconcepts of immunology - vaccines; cancer, HIV and AIDS; Adolescence - drug and alcoholabuse.

Chapter-8 : Microbes in Human Welfare (Botany)

Microbes in food processing, industrial production, sewage treatment, energy generationand microbes as bio-control agents and bio-fertilizers. Antibiotics; production and judicioususe.

Unit-IX: Biotechnology and its Applications

Chapter-9: Biotechnology - Principles and Processes (Zoology)

Genetic Engineering (Recombinant DNA Technology).

Chapter-10: Biotechnology and its Applications (Botany)

Application of biotechnology in health and agriculture: Human insulin and vaccine production, stem cell technology, gene therapy; genetically modified organisms - Bt crops; transgenic animals;biosafety issues, biopiracy and patents.

Unit-X Ecology and Environment

Chapter-11: Organisms and Populations (Botany)

Population interactions - mutualism, competition, predation, parasitism; population attributes - growth, birth rate and death rate, age distribution. (Topics excluded: Organism and its Environment, Major Aboitic Factors, Responses to Abioitic Factors, Adaptations)

Chapter-12: Ecosystem (Botany)

Ecosystems: Patterns, components; productivity and decomposition; energy flow; pyramids of number, biomass, energy (Topics excluded: Ecological Succession and Nutrient Cycles).

Chapter-13: Biodiversity and its Conservation (Zoology)

Biodiversity-Concept, patterns, importance; loss of biodiversity; biodiversity conservation; hotspots, endangered organisms, extinction, Red Data Book, Sacred Groves, biosphere reserves, national parks, wildlife, sanctuaries and Ramsar sites. (with special emphasis on Odisha/ wildlife of Odisha)

Mark Distribution in Examination Botany / Zoology (Class XII) Theory Papers: 35 Marks

1. **MCQ 1 x 5 = 5 Marks**
2. **Fill in the blank/ one word answer 1x 5= 5 Marks**
3. **Short notes 2 x 5 =10 Marks**
4. **Differentiate between 2 ½ x 2 = 5 Marks**
5. **Long Questions 5 x 2 =10 Marks**

35 Marks

PRACTICALS
BIOLOGY - XII (Botany) Detailed syllabus

Major Experiments:

1. Study of the effect of temperature and chemicals (ethanol, acetone, formaldehyde) on leaching of pigments in beet root.
2. Study of plants pigments by paper chromatography.
3. Study of transpiration by Ganong's or Farmer's potometer.
4. Study of relation between transpiration and absorption by T/A apparatus.
5. Effect of different wave length of light on photosynthesis by Wilmott's bubbler.
6. Study of effect of dissolved carbondioxide on photosynthesis by Wilmott's bubbler.
7. Comparative study of rate of transpiration from upper and lower surface of dicot leaf.
8. Collect and study soil from at least two different sites and study them for texture, moisture content, pH and water holding capacity of soil. Correlate with the kinds of plants found in them.
9. Collect water from two different water bodies around you and study them for pH, clarity and presence of any living organisms.
10. Study the presence of suspended particulate matter in air at the two widely different sites.
11. Study of plant population density by quadrate method.
12. Study of plant population frequency by quadrate method.

Minor Experiments:

13. Study of pollen germination on a slide.
14. Study of distribution of stomata on upper and lower surface of a dicot and a monocot leaf.
15. Study of osmosis by potato osmometer.
16. Analysis of samples for verification of Mendelian ratio using Pea seeds or colour beads.
17. Study of plasmolysis.

Spotting:

18. Conditions necessary for seed germination.
19. Types of germination.
20. Phototropism
21. Morphological adaptation of hydrophyte and Xerophyte.

Question Pattern for Practical (Botany)

1. Major Experiment 6 ½ Marks
   (Theory & Procedure = 2 ½ Marks, Experiment & Result = 4 Marks)
2. Spotting 1 ½ x 3 = 4.5 Marks
3. Record = 2 Marks
4. Viva = 2 Marks

15 Marks

BIOLOGY -XII (Botany) for Visually impaired students

A. Items for Identification/ familiarity with the apparatus for assessment in practicals (Allexperiments) Petriplates, soil from different sites - sandy, clayey, loamy, small potted plants, aluminium foil, test tubes, large flowers, Maize inflorescence, Cactus/*Opuntia*(model).

B. List of Practicals

1. Study of flowers adapted to pollination by different agencies (wind, insects).
2. Study of Mendelian inheritance pattern using beads/seeds of different sizes/texture.
3. Study of emasculation, tagging and bagging by trying out an exercise on controlled pollination.
4. Comment upon the morphological adaptations of plants found in xerophytic conditions.

Note: The above practicals may be carried out in an experiential manner rather than recording observations.

BIOLOGY -XII (Zoology) Detailed Practical syllabus

A. EXPERIMENTS/ OBSERVATIONS:

1. To test the action of salivary amylase on starch; study the effect of pH and temperature
2. To test the presence of sugar in urine/ given sample solution
3. To test the presence of urea in urine/ given sample solution
4. To determine the pH of three water samples collected from water bodies (using pH paper).
5. To study the prepared pedigree charts of genetic traits in man, such as rolling of tongue,blood groups, widow's peak and color blindness.

B. SPOTTINGS/ IDENTIFICATION:

a. Study of specimens and identification with reasons- Shark, Rohu, Frog, Garden lizard, Cobra, Krait, Pigeon and Rat.
b. TS/ VS through spinal cord, ovary, testis, kidney, stomach .
c. Axial and appendicular skeleton of rabbit (excluding skull).
d. Identification of common disease causing organisms- Entamoeba, Plasmodium, Taenia, Ascaris and Ringworm (permanent slides/ specimens). Commenton the symptoms of the diseases they cause.

Book Recommended :

Bureau's Higher Secondary (+2) Zoology, Practical, Published by Odisha State Bureau of Text Book Preparation and Production, Bhubaneswar.

Question Pattern for Practical

1. Major Experiment 6 ½ Marks
   (Theory & Procedure = 2 ½ Marks, Experiment & Result = 4 Marks)
2. Spotting 1 ½ x 3 = 4.5 Marks
3. Record = 2 Marks
4. Viva = 2 Marks

Total= 15 marks

BIOLOGY - XII (Zoology) visually impaired students

A. Items for Identification/ familiarity with the apparatus for assessment in practicals (Allexperiments) Beaker, flask, starch solution, iodine, ice cubes, Bunsen burner/spirit lamp/water bath, model of developmental stages highlighting morula and blastula of frog, beads/seeds of different shapes/size/texture *Ascaris*.

B. List of Practicals

1. Identification of T.S of morula or blastula of frog (Model).
2. Preparation of pedigree charts of genetic traits such as rolling of tongue, colour blindness.
3. Identify common disease-causing organisms like *Ascaris* (model) and learn some common symptoms of the disease that they cause.

Note: The above practicals may be carried out in an experiential manner rather than recording observations.

Prescribed Books:

1. Biology, Class-XII, Published by NCERT
2. Bureau's Higher Secondary Biology, Vol-II : Published by Text Book Bureau, Odisha
3. Other related books and manuals brought out by NCERT
4. Biology Supplementary Material (Revised). Available on CBSE website.