

Semester II

Paper VII (Pedagogy of biological Science)

Unit I

**Topic Nature and scope of science
And biological science**

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Cytology : Study of the structure and functions of cells and their organelles.

Ecology : Study of relationship between organisms and environment.

Embryology : Study of developmental stages of organisms upto hatching or birth.

Endocrinology : Study of endocrine glands and hormones action in animals.

Evolution : Study of the origin of life and the gradual differentiation or descent of species.

Histology : Study of tissues by microscopy.

Immunology : Study of resistance of organisms to infection.

Limnobiology : Study of fresh water lakes, ponds and streams.

Morphology : Study of form and structure of animals.

Palaeontology : Study of fossils and their distribution in time.

Palaeozoology : Study of fossil animals.

Physiology : Study of functions of various parts within the organisms.

Psychology : Study of related areas of psychology and biology.

Radiobiology : Study of effects of radioactivity on life.

Taxonomy : Study of classification of organisms and their evolutionary relationships with other organisms.

Zoogeography : Study of the distribution of animals over the earth.

Zoopathology : Study of diseases of animals.

Serendipity and Science

Serendipity is associated with scientific method and it refers to discoveries made unexpectedly or by chance.

Biology is a Science of Exceptions

Exceptions are inherent in biology due to evolutionary divergence. Not only living organisms, but viruses and biomolecules also exhibit exceptional forms. A student of biology must be prepared to accept and enjoy this gesture of nature.

Some exceptions have been explained logically, while for others, the reasons are yet to be searched out.

Science and Technology

Scientific investigations may be basic or applied. Inventions of new technology extend new hopes and open avenues for the work and research which was not possible earlier. Discovery of radioactive isotopes enabled tracing metabolic pathways, development of microscope and then electron microscope provided useful tools to study biology. X-ray crystallography

helped in the study of the structure of DNA, protein and many other biomolecules .Biotechnology and genetic engineering are fruitful due to accumulation of knowledge from different sources

Scope of Biology

Biology creates an awareness of vast array of forms of life which normally goes unseen. Biology offers a large scope and provides a large field for study.

(1) **Helps us to understand ourselves better :**

It unfolds different queries of life alongwith its cultural, social, philosophical and economical aspects. So it helps in understanding the life better.

(2) **Biology and inter-relationship of living beings :**

Study of biology helps us in understanding the wonderful phenomenon and laws of nature which finally tell us to predict the behaviour of different living beings under changed conditions.

(3) **Biology and resources :**

Biology helps us to know how to tap and conserve the resources available to us *e.g.* fishes, birds, forests etc.

(4) **Biology and literature :**

Knowledge of Natural Biology has greatly enriched the literature with their references in stories and poems etc. Poets and other authors have been inspired by the beautiful and interesting plants and animals and frequently figure them in stories, poems and dramas.

(5) **Study of nature is a rewarding experience :**

Many plants like *Narcissus*, *Dahlia*, *Gloriosa*, Roses, Marigold, Aster, etc. are used for ornamental purposes. The variety available in animals is widely enjoyed in zoological parks. Students enjoy excursions to remote places watching never seen before plants and animals.

(6) **Solving problems :**

Biology makes us to understand the present day problems such as population growth, pollution, conservation of wildlife and survival of man etc. The future directions of biotechnology, conservation of biodiversity, maintenance of environment and human welfare remain in the hands of biologists.

(7) **Biology-Medicinal aspect :**

Several plants like *Atropa belladonna*, *Cinchona* are sources of atropine, quinine etc. Many members of fungi such as *Penicillium* and *Streptomyces* give rise to antibiotics like penicillin and streptomycin. Plants are the major source of vitamins. Drugs are first tested on animals before being used for treating man. Animals provide scientific hints for the production and use of medicines. Animals are widely used for scientific research and results thus obtained are finally applied to man. The study of animal play an important role in health, nutrition and control of pests. Many diseases like malaria are caused and transmitted by animals.

(8) **Solving approach of biology :**

Knowledge for eradication of diseases like malaria, small pox, etc. have been achieved by scientists basically due to desire and determination to solve the problem.

(9) **Ecosystem and living organisms :**

Biology helps us in understanding the various ecosystems. The living community and non-living environment interact with each other and exchange of material in them takes place.

(10) **Biotechnology :**

Biotechnologists have produced many genetically modified (GM) crops. Plenty of studies are being made by geneticists, evolutionists and cytologists to fudge the efficacy of biotechnology.

Careers in Biology

Some interrelated disciplines of biology (career options in biology) from which any field can be selected for further rewarding career.

(1) **Virology :** It is the study of viruses.

(2) **Agronomy :** This branch deals with the management of farms and is the science of crop production.

(3) **Pathology :** It is the study of diseases (their nature, causes, symptoms, effects and control).

(4) **Breeding :** This branch is concerned with the production of new improved races by mating selected parents.

(5) **Entomology :** It is the study of structure, habits and classification of insects.

(6) **Anthropology :** It is the study of physical, cultural, mental and social nature of primitive and modern man.

- (7) **Veterinary science** : It deals with the study of domestic animals.
- (8) **Ichthyology or Fishery or Pisciculture** : It deals with the study of rearing fish.
- (9) **Apiculture** : It deals with the study of bee-keeping for obtaining honey and wax.
- (10) **Poultry** : It is the branch of science dealing with the study of raising domestic fowls as chicken, ducks and geese.
- (11) **Food technology** : It is the study of processing and preservation of foods, vegetables, fruits, etc.
- (12) **Nutrition** : It supplies information for proper nourishment of human and other organisms for healthy living.
- (13) **Forestry** : It is concerned with protection and development of forests and to explore the outcome and economic potential of forests.
- (14) **Horticulture** : It is the study primarily aimed at the improvement of ornamental and fruit yielding plants.
- (15) **Pharmacology** : It deals with study of drugs and preparation of medicines.
- (16) **Bacteriology** : It aims at the study of bacteria and includes the exploration of useful and harmful effects.
- (17) **Genetics** : The branch which is concerned with differences and resemblances among parents and progeny especially those due to heredity or inheritance.
- (18) **Pharmacy** : It deals with the preparation and compounding medicines and dispensing them as per doctor's prescription.
- (19) **Soil Science** : It aims at the study of soil, its structure, type and dynamics.
- (20) **Dairy technology** : It is the study of manufacture of milk products.
- (21) **Microbiology** : It is the study of microscopic organisms.
- (22) **Psychology** : The branch of science which deals with behaviour and qualities etc. of human mind.
- (23) **Forensic Sciences**: It is the application of scientific knowledge to the question of civil and criminal laws *e.g.*, study of finger prints, blood typing, identification of narcotics etc.
- (24) **Medicine**: The branch of science responsible for curing diseases with drugs or other curative substances.
- (25) **Surgery**: It is a branch of medicine which deals with physical operations to cure injuries and other diseases of body.
- (26) **Biomedical engineering**: It deals with the production of spare parts of man such as artificial limbs, implants and heart, lung machine etc.
- (27) **Physiotherapy** : It is the branch of science which mainly aims at curing the diseases, defects and body weaknesses by physical remedies as massage and exercise etc.
- (28) **Genetic engineering** : It is a branch of genetics which deals with production of organism with combination of new heritable characters at will (gene-manipulation).
- (29) **Occupational therapy** : It involves the cure of convalescents and physically handicapped by doing light work for diversion, physical exercise or vocational training.
- (30) **DNA finger printing** : By this technique a person can be identified on the basis of his genes as no two persons can have identical sub-genetic make up.
- (31) **Bioinformatics** : This branch of biology deals with the systematic development and application of computing systems and computational solution of techniques, analysing data obtained by experiments, modelling, database searching and instrumentation to make novel observations about biological processes.
- (32) **Computer simulation** : It is the conversion of physiological phenomena into graphical and multidimensional and multimedia presentation without actually involving plants/animals.

(33) **Computational biology** : It deals with systematic development, application and validation of computational hardware and software solutions for building simulation models of biological systems.

(34) **Prawn Farming** : It deals “with” rearing, transportation and marketing of prawns.

(35) **Medical transcription** : It deals with interpretation and typewriting (transcribing) dictation from physicians and other health care providers regarding patient assessment and work-up surgical, radiology and therapeutic methods, clinical course, diagnosis and prognosis etc.

Misuse of Biology

(1) **Amniocentesis** : However, these days, the amniocentesis is being misused also. Mothers even get their normal foetus aborted if it is a female. This is just equivalent to killing of a normal child. So Govt. of India enforced the Pre-natal Diagnostic Techniques (Regulation and Prevention of Misuse) Act, 1994 since January 1, 1994 under which all genetic counselling centres and laboratories are required to apply for registration. So this technique has been banned in some states like Maharashtra and is under consideration in other states.

(2) **Bioterrorism** : Now a days bio-techniques are being widely used for preparation of bioweapons like antibiotic resistant micro-organisms. Spores of *Bacillus anthracis* (cause of anthrax) are produced in biology research labs and stored for decades. Their release may cause anthrax and become the cause of bioterrorism. Such release of antibiotic resistant strains cause communicable diseases like anthrax and plague on endemic or epidemic scale.