

JUPEB BIOLOGY SYLLABUS

GENERAL OBJECTIVES

At the end of the series of courses, candidates should be able to:

1. Describe the fundamentals and levee of organization in living things;
2. Explain functional units of biological molecules and principles of interactions among organisms;
3. Describe cells as living organisms and their rules in nature
4. Describe cells as living organisms and their roles in nature
5. Explain the application of Cell Biology in medical, industrial and biotechnological sub-sectors of economy;
6. Discuss diversity, characteristics, structures, functions and taxonomy of living organisms (micro-organisms, plants and animals);
7. Enumerate economic importance of living organisms;
8. Describe the morphological and biochemical characteristics of micro-organisms;
9. Conduct laboratory and field practical in Biology, Botany, Microbiology and Zoology;
10. Highlights and explain the basic concepts of ecology;
11. Explain the role of evolution in the hierarchical classification of living organism's vis a vis the theories of evolution; and
12. Define basic terminologies of Genetics and state Mendelian Laws of inheritance.

FIRST SEMESTER COURSES

BIO 001: GENERAL BIOLOGY (3 UNITS)

BIO 003: MICROBIOLOGY (3 UNITS)

SECOND SEMESTER COURSES

BIO 002: BASIC BOTANY (3 UNITS)

BIO 004: FUNDAMENTAL OF ZOOLOGY (3 UNITS)

COURSE DESCRIPTION

BIOLOGY 001: General Biology (3 Units)

Specific Objectives

At the end of the course, the students should be able to:

1. Explain living things in nature and biological molecules;
2. Discuss cell as fundamental unit of living things
3. Describe levels of organization of living things
4. Discuss biological methods and their applications (Biostatistics, taxonomy and nomenclature);
5. Discuss principles of genetics, variation and heredity; and
6. Conduct laboratory and field practical in biology

Course content

S/N O	TOPIC	SUB-TOPIC	DETAILS
1.	Origin of Living Things	<ul style="list-style-type: none">• The Science of Biology• Origin of Organic Molecules• Origin of the First Cells• The Earliest Cells:<ul style="list-style-type: none">-Living-Fossils	<ul style="list-style-type: none">• Definition of biology• Importance of biology• The nature of science<ul style="list-style-type: none">-Scientific methods-Testing of hypothesis-Data collection and analysis• Application of scientific methods in biological experiments• Relationship between Biology &

			Medicine, Agriculture, etc
2.	Living things in nature and biology molecules	<ul style="list-style-type: none"> • Diversity of Living Things • Biological Molecules 	<ul style="list-style-type: none"> • Different kingdoms and characteristics • Carbohydrates, lipids, protein and nucleic acids
3.	Cell organisation structure and functions	<ul style="list-style-type: none"> • Cell theory • Cell structure and functions • Cell organizations • Forms in which cells exist 	<ul style="list-style-type: none"> • Demonstration of cell structure on microscopes • Biological drawings of palm and animal cells • Comparisons of plant and animal cells
4.	Cell division principles of Genetics, variations and heredity	<ul style="list-style-type: none"> • Cell divisions • Mitosis in somatic cells • Meiosis in Germ cells • Principles of Genetics • Variation and Heredity • Mendel's Laws of Inheritance • Human Inheritance • Human Genetic Disorders e.g sickle cell anaemia, albinism • Rhesus Factors • Polyploidy • Sex-linked Traits • Application of Genetics in Agriculture, Medicine, Criminology etc 	<ul style="list-style-type: none"> • Basic concepts in genetics: Chromosome, Gene, allele, dominant, recessive, homozygous, heterozygous, hybrid, genotype, phenotype etc • The nature of genes and chromosomes • Practical class <ul style="list-style-type: none"> -Determination of inheritance using coloured seeds e,g, beads, grains, etc -Verification of principles of Mendel's law and its deviation • Cell division experiment using onion root

			<ul style="list-style-type: none"> • Identification of the stages of meiosis • Traits controlled by Multiple alleles e.g blood group, eye colour • Determination of inheritance using coloured seeds e.g. beads, grains etc • Verifications of the principles of Mendel's laws
5.	Systematics: Taxonomy and Nomenclature	<ul style="list-style-type: none"> • Basic of Taxonomy • Rules of Systematics • Naming of Organisms (Nomenclature) 	<ul style="list-style-type: none"> • Practical class: <ul style="list-style-type: none"> • Classification and identification of organisms • Highlighting adaptive features and their uses
6.	Ecology	<ul style="list-style-type: none"> • Basic concept in Ecology • Biological Associations and Interactions • Ecological Studies • Types of Habitats • Ecology and Natural Selection 	<ul style="list-style-type: none"> • Symbiosis • Mutualism • Parasitism • Environmental studies • Practical use of ecology equipment • Population study in a specific habitat • Environmental studies • Practical use of ecological equipment • Population study in a specific habitat • Environmental changes

			<ul style="list-style-type: none"> • Biological impacts of climate change
7.	Biology Methods and Application	<ul style="list-style-type: none"> • Rules of Biological Drawings 	<p>Standard drawing rules governing: use of pencils, specimen proportions, magnification, size of specimen drawing and labelling.</p> <ul style="list-style-type: none"> • Diagrams must be according to length specification. • Lines must not be woolly or broken • Drawings must carry appropriate titles at the correct positions • Labelling must be horizontal & parallel with ruled guidelines • Drawing must not be artistic i.e. no shading or painting • Spellings must be correct and touched by labelling lines.
8.	Evolution	<ul style="list-style-type: none"> • Geological Times, and Mega Geological Events ‘ • Evolutionary Trends in Animals and Plants • Theories of Evolution: Landmark and Darwin Theories of Evolution • Evidence of evolution from Anatomy, Embryology, Biochemistry 	<ul style="list-style-type: none"> • Definition of evolution • Types of evolution • Application of Evolution to Plants & Animal Taxonomy

BIO 002 (BASIC BOTANY)

(3 UNITS)

SPECIFIC OBJECTIVES

At the end of this course, candidates should be able to:

1. Discuss the general characteristics of plants;
2. Explain the taxonomy of lower and higher plants;
3. Discuss biodiversity and conservation of plants
4. Explain plant structures and functions
5. Explain physiological processes in plants; and
6. Enumerate economic and ecological importance of plants.

Course Content

S/N O	TOPIC	SUB-TOPIC	DETAILS
1.	General characteristics and diversity of Plants	<ul style="list-style-type: none">• Plant Diversity and Classifications (Lower and Higher Plants)• Characteristics of Lower and Higher Plants groups• Morphology and Life Cycle of Lower and Higher Plants	<ul style="list-style-type: none">• Classification of major plant groups (Lower and Higher plants)• Divisions up to generic level• Level plants-stage, fungi, bryophytes, Pleridophytes.• Morphological and life cycle of named example in each major group considering the simplest and the complex in each group of the lower plants• Economic and ecological importance of plant groups

			<ul style="list-style-type: none"> • Practical class-classifications and morphological drawing of lower plants: • Algae (Chlorella, England/Chlamydomonas, Volvox, Spirogyra) • Fungi e.g. yeast, Rhizopus, Mucor, Aspergillus, Penicillium, mushroom, phytophthora, • Bryophytes eg, Riccia, Marchantia, Funaria • Pteridophytes eg (Lycopodium), Selaginella, Nephrolepis • Higher plant (Non-Vascular and vascular plants) • Spermatophytes e.g. Cycas, Pinus, Gnetum, Hibiscus rosa-sinensis • Eleusine indica and Talinum triangulare treated comparatively
2.	Taxonomy of Lower and Higher Plants	<ul style="list-style-type: none"> • Plant Taxonomy and systematics • Taxonomy of lower and higher plants 	<ul style="list-style-type: none"> • Plant nomenclature • Plant classification • The difference between taxonomy and systematics

3.	Plant conservation	<ul style="list-style-type: none"> • Importance of Plant Conservation • Measures in Plant Conservation • Climate change 	<ul style="list-style-type: none"> • In-situ and ex-situ conservation • Advantages and disadvantage of each • Biological control • Poor management • Impact of climate change on plants
4.	Plant tissues and functions	<ul style="list-style-type: none"> • Plant tissues anatomy • Functions 	<p>Emphasis on composition, distribution, forms and functions of each limits:</p> <ul style="list-style-type: none"> • Parenchyma • Collenchyma • Sclerenchyma • Epidermal • Peridermal • Vascular (cambium, phloem, xylem) • Practical class in osmosis and transpiration in plants.
5.	Plant Morphology/Anatomy	<ul style="list-style-type: none"> • Morphology of Plant Parts • Anatomy of Plant Parts <ul style="list-style-type: none"> • Types of Root 	<ul style="list-style-type: none"> • Morphology of roots, stems, leaf types and their modifications due to functions • Anatomy of monocot and dicot roots, stems and leaves with emphasis on tissue arrangement in relation to functions and environment. • Practical class- • Roots –

		<ul style="list-style-type: none"> • Types of Leaves • Types of Flowers • Types of Fruits 	<ul style="list-style-type: none"> • Advantages and tap root systems, modification and adaptations • Anatomical observation and drawing of permanent/temporary mount of monocot and dicot roots (T.S and L.S) Locate, draw and label different plant tissues (parenchyma, collenchyma etc) • Leaves- <ul style="list-style-type: none"> -Simple and compound leaves, arrangements, modifications to suit habitats. - T.S of leaves of both monocot and dicot and label different plant tissues (parenchyma, collenchyma etc) <ul style="list-style-type: none"> • Flowers- <ul style="list-style-type: none"> -L. S of dicot flowers e.g. regular and irregular flowers floral diagrams and formula • Fruits- <ul style="list-style-type: none"> -L. S and T.S of various types of
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			fruits (dry dehiscent indehiscent and fleshy fruits should be observed and drawn).
6.	Nutrition in Plants	<ul style="list-style-type: none"> Nature and Types of Nutrition 	<ul style="list-style-type: none"> Autotrophic (photosynthesis and chemosynthetic) Dark and light reaction in photosynthesis Heterotrophic Holozoic nutrition Mineral requirements of plants their sources, roles and deficiency symptoms Composition of chemical fertilizers Composition of chemical fertilizers Practical class- <ul style="list-style-type: none"> Demonstration of etiolation Measurement of photosynthesis in leaf Growth experiments to show deficiency symptom Field study of deficiency symptoms in plants

7.	Transport system in plants	<ul style="list-style-type: none"> • Need for transport system • Water relation 	<ul style="list-style-type: none"> • Mineral requirements of plants • Transport in xylem • Transport in phloem • Transport media in plant and materials to be transported • Practical class • Transpiration, osmosis, and food transport in plants
8.	Respiration	<ul style="list-style-type: none"> • Mechanism of Gaseous Exchange 	<ul style="list-style-type: none"> • Stomata apparatus • Lenticels • Aerobic and anaerobic respiration
9.	Plant reproduction	<ul style="list-style-type: none"> • Asexual and sexual reproduction 	<ul style="list-style-type: none"> • Angiosperm flower and differences between monocots and dicot flowers
10.	Growth regulators	<ul style="list-style-type: none"> • Roles and interactions of growth regulators 	<ul style="list-style-type: none"> • Auxins • Gibberellins • Cytokines • Ascorbic acids • Ethylene
11.	Crop improvement	<ul style="list-style-type: none"> • Importance of GMC 	<ul style="list-style-type: none"> • Generally Modified Crops (GMC) • Challenges of resistant plant species • Ethical implications of genetic modifications
12.	Economic and ecological importance of plants	<ul style="list-style-type: none"> • Plants of Economic & Medical Importance 	<ul style="list-style-type: none"> • Economically important food plants

			<ul style="list-style-type: none"> • Economically valuable medicinal plants • Ornamental plants
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BIO 003 (MICRO BIOLOGY)

SPECIFIC OBJECTIVES

At the end of this course, candidates should be able to:

1. Discuss history and discovery of microorganisms;
2. Discuss the different types of microorganisms and the taxonomic groupings;
3. Explain microbial cellular structures, morphology and biochemical characteristics;
4. Explain microbial genetics and applications in biotechnology and
5. Enumerate economic importance of microorganisms

Course Content

S/N O	TOPIC	SUB-TOPIC	DETAILS
1.	History of the discovery of microorganisms	<ul style="list-style-type: none"> • Spontaneous generations • Microorganisms as the cause of some disease 	<ul style="list-style-type: none"> • The theory of spontaneous generation of organisms • Conflict over spontaneous generations • The golden era of microbiology (1860-1910)

			<p>The germ theory of disease</p> <ul style="list-style-type: none"> • The discovery of viruses • Microorganisms in the 20th century • Practical class-introduction to basic microbial laboratory equipment, principles of operation and drawings
2.	Types and taxonomic groupings of microorganism	<ul style="list-style-type: none"> • Seven levels of classification • Prokaryotic cells • Eukaryotic cells 	<ul style="list-style-type: none"> • Bacteria-size, shapes, motility, unusual types, general methods of bacteria classification • Fungi-yeast and mould-size, shape, general fungal classification • Protozoa-specific examples, motile and non-motile types, nutrition types • Viruses-sizes, bacteriophages, viroid, prions • Algae-sizes, types, diatoms, sea weeds, lichens, sexual and asexual evolution • Practical class-aseptic techniques in microbiology

3.	Structures, Morphology and Characteristics of Microorganisms	<ul style="list-style-type: none"> • Morphology and Structures of Microbial Cells • Biochemical Characterization • Reproduction, Growth Types and Phases 	<ul style="list-style-type: none"> • Structure of bacteria cells- capsule, flagella. Pilli and fimbrise, cell wall, plasma membrane, cytoplasm • Cell wall of fungal cells, cytoplasm • Cultural characteristics of bacterial growth-on solid and liquid media, forms of growth. • Cultural and cellular characteristics of mould and yeast on solid and liquid media, hyphal and mycelial types. • Biochemical characteristics of bacteria and fungi • Viruses and their structures • Reproduction and microbial growth phases • Practical class-cultivation and identification of bacteria from soil, water and decomposing food
4.	Microbial Ecology	<ul style="list-style-type: none"> • Microbial interactions with animals, plants and microbes 	<ul style="list-style-type: none"> • Predation • Competition • Synergism

			<ul style="list-style-type: none"> • Commensalism • Infectious diseases • Immunity • Spoilage of food • Control of microbial activities
5.	Microbial Nucleic Acids in information storage and transfer	<ul style="list-style-type: none"> • Genetic materials • Mutation and mutagenesis 	<ul style="list-style-type: none"> • Nature of DNA • Nucleosides and nucleotides • Types of RNA • Enzymes in DNA replication • Genetic code • Transcription and translation • Transfer of genetic materials in prokaryotes • Spontaneous mutation, induced mutation, expression of mutation • Biotechnological use of microorganisms in <ul style="list-style-type: none"> - Food industry: Environment, - Pharmaceuticals, Medical, and agricultural fields

BIO 004 (INDUCTORY ZOOLOGY)

(3 UNITS)

SPECIFIC OBJECTIVES

At the end of this course, candidates should be able to:

1. Discuss the general characteristics of kingdom Animalia;
2. Explain the taxonomy of invertebrates and vertebrates
3. Discuss diversity of animal species;
4. Explain physiological processes in animals; and
5. Enumerate the economic and ecological importance of animals

S/N O	TOPIC	SUB-TOPIC	DETAILS
•	Diversity and General Characteristics of Animals	<ul style="list-style-type: none">• What is Zoology? What are Animals• Scope and areas in Zoology• Importance of Zoology	<ul style="list-style-type: none">• General characteristics of animals• Diversity of lifestyles, habitants• Categories of animals
•	Systematics (Taxonomy) of animals	<ul style="list-style-type: none">• Classification of animals• Basic of animal organization• Phyls of animals• Tissues and organs in animals	<ul style="list-style-type: none">• Unicellular levels of organizational: metazoan• Classification of invertebrates<ul style="list-style-type: none">- Animals without tissues- Animals with tissues- Animals exhibiting bilateral symmetry (bilateral)- Animals with body cavity (coelomates)

			<ul style="list-style-type: none"> - Segmented animals - Animals with jointed appendages - Animals with backbone (vertebrates) • Major and minor phyla • Types of tissues and organ systems • Practical class- <ul style="list-style-type: none"> - Identification and classification of animal specimens the different phyla - Dissection of selected animals- cockroaches, fish, frog, rat, etc
•	Evolution of animals	<ul style="list-style-type: none"> • History and origin of animals • Major evolutionary adaption of animals 	<ul style="list-style-type: none"> • Adaption of animals in water • Adaptation of animals on land • Adaption of animals in air
•	Invertebrates	<ul style="list-style-type: none"> • Phylum protozoa • Phylum porifera • Phylum Cnidaria (Coelenterata) • Phylum Platyhelminthes • Phylum nematods • Phylum annelida 	<ul style="list-style-type: none"> • Taxonomy, characteristics, diversity, lifestyles, morphology and life cycle providing named representative

		<ul style="list-style-type: none"> Phylum arthropoda 	<p>examples in such order</p> <ul style="list-style-type: none"> Free living flat worms Parasite flat worms (trematodes and cestodes) of medical and veterinary importance Emphasize the body plan Why arthropods are successful
•	Introduction to Chordates	<ul style="list-style-type: none"> Adaptation of Chordates to water, land and air Protochordates Class pisces Class amphibia Class reptilia Class aves Class mammalia 	<ul style="list-style-type: none"> Challenges and adaption to living in the different habitats History and important adaptations Diversity, classification, morphology and life cycle, providing representative examples from the different orders History and importance of adaption Rise and fall of dominant reptiles Clearly state the taxonomic features that warrant the grouping into classes
•	Ecologic and economic importance of animals	<p>Diverse economic importance of Animals</p> <p>-Invertebrates</p>	<ul style="list-style-type: none"> Benefits of animals to man

		-vertebrates Ecological importance of Animals	<ul style="list-style-type: none"> Economics importance of arthropods
•	Physiological processes	Nutrition in animals	<ul style="list-style-type: none"> Types of nutrition in animals Nutrition in human Types of definition in animals Alimentary system in man Digestion (diverse enzymes) and absorption Practical class- food tsst
		Respiration in Mammals	<ul style="list-style-type: none"> Lung as a respiratory organ Role of a circulatory system in respiration
		Skeletal system	<ul style="list-style-type: none"> Morphology and function of human skeleton Forms of skeleton Components of and differences between bone and cartilage Parts of mammalian endoskeleton Definition and types of joint
		Reproduction	<ul style="list-style-type: none"> Vertebrate reproduction Structure and function of human female and male reproductive system
	Transport of substance across Membranes	Excretion	<ul style="list-style-type: none"> Morphology of the excretory system

			<ul style="list-style-type: none"> • Osmoregulation • Structure and function of the nephron – ultrafiltration, selective reabsorption and excretion • The effects of weather on excretion
		Circulatory system	<ul style="list-style-type: none"> • Human circulatory/transport system • Blood as agent of transport • Components of blood • The functions of blood • Types of circulation
		Growth and development	<ul style="list-style-type: none"> • Principles of development- stages in embryology
		<ul style="list-style-type: none"> • Diffusion • Osmosis • Plasmolysis • Flaccidity • Haemolysis • Crenation • Turgidity 	<ul style="list-style-type: none"> • Osmotic balance • Selective transport of substance across members • Osmotic pressure • Turgor pressure • Active transport • Practical class – experiment demonstration diffusion, osmosis and plasmolysis