IJMB Detailed Syllabus

PREFACE

The Interim Joint Matriculation Board Examination (IJMBE) is a qualifying examination into Nigerian and Foreign Universities. The examination is primarily for Advanced Level subjects for Direct Entry (200 level) into the Universities and two (2) Ordinary Level subjects (English and Mathematics), which are basic requirements for admission into Universities.

The syllabus for the examination was last reviewed in 2004 and the current review exercise (2012) was undertaken to revise the subject content in line with global changes. The review exercise was conducted in phases, in collaboration with Nigerian Educational Research and Development Council (NERDG) and participants were drawn from subject teachers in IJMB affiliated institutions, Joint Admissions and Matriculation Board (JAMB) and Chief Examiners of the various subjects.

The revised IJMBE syllabus is designed to be covered in Nine (9) months over a two (2) semester period. The content is structured in such a way that all the topics to be covered in each semester cut across all the examinable papers in the subject so that all aspects of the syllabus "me covered concurrently. At the end of each subject syllabus, list of basic and other reading texts are provided to guide the operators of the syllabus. For effective coverage of the syllabus, a minimum of six (6) lecture hours per week and for subjects with practical component, an additional three (3) hours of laboratory work per week is recommended. Tutorial classes should run concurrently with the lectures.

This revised IJMBE syllabus will be operational in 2013 and students will be examined on the syllabus from . 2014. Detailed syllabus content for seventeen (17) Advanced Level subjects and two (2) Ordinary Level

Subjects are presented in this booklet.'

DETAILED SYLLABUS

INTERIM JOINT MATRICULATION BOARD EXAMINATION (IJMBE)

MATHEMATICS SYLLABUS (REVISED 2012)

1. The IJMB Mathematics syllabus is designed to provide a guide for instruction at colleges of advanced studies (A Levels), which prepare students for entry into the 200 level Biology programme in Nigerian Universities. It assumes that students of Biology at this

level have completed the 'O' Level biology syllabus as prescribed by WAEC/ NECO. The syllabus is planned for delivery over a contact period of **at least 9 months**.

FIRST SEMESTER

S/NO.	TOPICS AND CONTENDS	ACTIVITIES/PRACTICAL GUIDE	DURATION
1.	SET, RELATIONS FUNCTIONS AND OPERATIONSThe definition of a set, finite and infinite sets, equality of sets, subsets union, intersection, universal set, complements, empty set, Venn diagram symmetric difference, power sets and De Morgan's laws. Inclusion-exclusion principle. Elements of relations functions and operations	Generate elementary examples of functions. Also form simple example - to elucidate inclusion-exclusion principle. De Morgan's laws need to be proved analytically. Proofs by Venn diagram are acceptable	2weeks/l2hrs
2.	SOME PROPERTIES OF NUMBER SYSTEM Natural numbers, integers, rationals, irrationals and real numbers. Order relations on the set of real numbers. Open and closed intervals on the number line	Generate examples of rational and irrational numbers. Manipulate the algebraic properties of real numbers by concrete examples. No analytic proof of properties is needed	1week/6hrs
3.	INEQUALITIES Definition of absolute value for modulus of a real number. Solving inequalities involving linear and quadratic functions. Solution sets of inequalities	Generate specific examples of inequalities such asax + b > 0,ax^2 + bx + c> 0, x – a > x-b 1, 1, etc. and solve them.	1 week/6hrs
4.	PRINCIPLE OFMATHEMATICAL INDUCTION AND ITS APPLICATIONS	Generate concrete examples of Arithmetic and Geometric progressions. Also evaluate Arithmetic and Geometric means and know their relationships. Only finite cases need to be treated except in Geometric progression where common ratio is less	1week/6hrs

	Intuitive definition of a sequence and a series. Arithmetic and Geometric progressions and means. The sigma notation. Evaluation of $\sum n$, $\sum n^2$ by using mathematical induction	than one	
5.	QUADRATIC AND OTHERPOLYNOMIAL FUNCTIONSElementary properties of quadratic expressions. Sums and products of roofs of quadratic equations. Applications to symmetric functions. polynomial functions of 3^{rd} and 4^{th} degrees that can be reduced to quadratic ones. Remainder and factor theorems.	Master the determination of roots by taking some concrete ex. quadratic equations. Learn to also determine the range of variable in a quadratic expression under given conditions	2week12hrs
6.	INDICES AND LOGARITHMIC FUNCTIONSIndex notation, multiplying and dividing expressions involving indices. Negative and fractional indices. Laws of logarithms. Solutions of simple exponential and logarithmic equations	To demonstrate the application of various bases of logarithms, e.g$\log_a b = \log_c b \log_c a$ Proof of various laws of logarithms be given	1week/6hrs
7.	PARTIAL FRACTIONSTypes of partial fractions. Applications of partial fractions in summation of series and expansion of rational functions	Master the techniques to resolve functions such asA – A(x + a)(x+b), $x^2 + bx + c$, A $(x + a)(x^2 + bx + c)$, etc.	1week/6hrs
8.	DETERMINANT AND MATRICSDefinition and properties of second and third order determinants. Applications of determinants to solve simultaneous linear equations using	Need to work out several concrete examples of determinants and matrics. Not to go beyond Cramer's rule	2weeks/12hrs

	Cramer's rule. Algebraic operations, addition, subtraction and multiplication of matrices. Multiplication of a matrix by a scalar. Restricted to 3 x 3 matrices.		
9.	BINOMIAL THEOREMBinomial expressions. Pascal's triangular array. The expansion of $(a + x)^n$, where n is a positive integer, and its use where n is a rational index. Determination of the interval of x for which a given Binomial expansion is valid. Approximation and errors	Generate examples to demonstrate the use of Binomial expansion in calculating errors. Confine to expression involving two terms only	2weeks/12hrs
10.	PERMUTATIONS ANDCOMBINATIONSFactorial notation, ^nP_r, "C_r and simple examples	Generate concrete examples to illustrate how to apply the formulae of "P_r and "C_f. Only simple cases need to be treated	1week/6hrs
11.	CIRCULAR MEASURESFunctions and their graphs. Odd, even and periodic functions. Trigonometric ratios of angles of any magnitude. Inverse trigonometric functions. Graphs of trigonometric functions	Generate examples of trigonometric functions and determine the periods, amplitude, phase, etc.	2weeks/12hrs
12.	COMPOUND ANGLEFORMULAETRIGONOMETRIC EQUATIONS The formulae sin (A + B), cos (A + B), tan (A + B) and their proofs. Multiple and half angles. Simple identities. The solution of simple trigonometric equations, e.g. acos9 + bsin9 = Rcos(q"a). Factor formulae	Master the methods of proof involving half and multiple angles in particular. Workout various examples of trigonometric equations	2weeks/12hrs
13.	SINE AND COSINE RULES Application of sine and cosine rules to the solution of triangles. Heights and distance	Master various methods of solutions of triangles excluding ambiguous case	1week/6hrs
14.	PLANE AND POLAR CO-ORDINATESRelations between	Master the sketch of simple, polar graphs, e.g. r = a + bcosq.	2weeks/12hrs

	Polar and Cartesian coordinates. Plotting and sketching of simple curves whose polar equations are known	Only linear cases are to be treated	
15.	COMPLEX NUMBERS Definition of a complex number, addition, subtraction, multiplication and division of complex numbers. Modulus, conjugation argument. Geometric interpretation. Polar representation. De Moivre's theorem. Nth roots of Unity	Generate, various, examples of complex numbers to find their magnitudes and arguments. To determine nth roots of a given complex quality. e.g. $(1 + i)^{1/3}$, $i^{1/5}$. No. proof of De Moivre's theorem for fractional index is needed	2weeks/12hrs
16.	LIMITS AND CONTINUITY OFFUNCTIONSDefinition of limit , and continuity of functions with simple examples. Proof of lim Sinq-1, qª0 qAsymptotes (parallel to the axes only) in graph sketching. Graphs of algebraic functions (polynomials and simple rational functions), trigonometric functions. Exponential and logarithmic functions to various bases. Knowledge of the series expansion of e* for all x and In (1 + x), for-1 < x < 1.	Generate examples to find limits and test continuity at a given point.: No analytic proofs are needed	2weeks/12lirs

Total 150hrs

SECOND SEMESTERS

1.	DIFFERENTIATIONDifferentiation from the first principle. Meaning of derivative and interpretation as a rate of change. Differentiation of elementary functions. Differentiation of sums, differences, products and quotients. The chain rule. Implicit differentiation. Higher derivatives. Differentiation of inverse trigonometric functions, logarithmic and exponential functions. Application to curve sketching. Maxima and minima. Newton's approximation and errors	Generate examples of Implicit, inverse trigonometric, logarithmic and exponential functions and find their derivatives. First and second order derivatives only	3 weeks/18hrs
2.	INTEGRATIONDefinite integral and its representation as an area. Integration as die inverse of differentiation. Integration of elementary functions. Techniques of integration (by	Master various methods of integration. Application of definite integral to determine area under the curves for simple	2weeks/12hrs

	partial fractions, by substitution and by parts). Integration using identities and standard formulae. Applications of integration to areas and volumes	cases. Only proper integrals need to be treated	
3.	DIFFERENTIAL EQUATIONSFirst order differential equations only	Generate some simple examples of first order differential equations and integrate them. Only intuitive understanding of the concept need tobe given	1week/6hrs
4.	VEC'IORSNotion of a vector, position vector, modulus of a vector. Scalar product of vectors. Representation as a directed line segment. Equal, unit, zero and parallel vectors. Position vector of a point dividing a line in a given ratio. Commutative, distributive, associative and parallelogram laws.Components of a vector. Resolution of vectors into orthogonal components. Resultant of coplanar. Vector products of vectors. Perpendicular vectors. Scalar product of parallel vectors. Subtraction of a vector as the addition of its additive inverse. Angle between two? Vector equation of a line. Direction vector. Direction ratios and cosines. Distance of a. point from a line. Linear dependence and independence of vectors	Master the representation anddetermination of magnitude and direction cosine of vectors. Need to concentrate on concrete and simple examples	12weeks/12hrs
5.	CO-ORDINATE GEOMETRY OF LINES AND CIRCLES Gradient of a line. Distance between two points. Equation of a linear graph from the gradient and the y-intercept. Division of a line in a given ratio. Equation of a line from two points on the line. Midpoints equation of a line (including the gradient and intercept forms). Point of intersection of two lines. Equation of a line through the point of intersection of two given lines. Equation of a line from a given point and the gradient. Angle between two lines. Parallel and perpendicular lines. Distance of a point from a line. Equation of a circle with a given	Construct concrete examples of equations of lines. Find out the equations of tangents and normals. Only standard forms need to be considered	3weeks/18hrs

	Centre and radius; with a given diameter. Equation of tangent to a circle.		
6.	CONIC SECTIONSProperties of Parabola, Ellipse, Hyperbola, Rectangularhyperbola, their Cartesian and Parametric equations. Problems involving elimination of Parameters. Equations of tangents and normals. General equation of second degree and conditions under which it represents a pair of lines, circles and other conies	Only standard forms of conies should be considered	2weeks/12hrs
7.	STATISTICAL MEASURES AND GRAPHSMeasures of control tendency and variation: Mean, Median, Mode, ranges, variation and standard deviation. Histograms and cumulative frequency polygons	Construct concrete examples of the two measures. Also draw inferences from graphs and interpret. Simple cases only	2weeks/12hrs
8.	PROBABILITYAxiomatic definition of probability. Discrete sample space. Events. Frequency interpretation. Sum and product laws. Conditional probability. Dependent and independent events. Tree diagrams	Perform illustrations with coin and dice throwing experiments. Some simple examples of probability trees should be also constructed	2weeks/12hrs
9	RANDOM VARIABLES Types of random variables. Probability density function. Cumulative distribution function. Expectation, standard deviation and variance	Use concrete examples of both discrete and continuous random variable. Also calculate and interprete expected values and standard deviation of discrete random variable.	1week/6hrs
10.	PROBABHJTYDISTRIBUTIONSBinomial, poison and normal distributions; their means and variances	Concrete examples of these distributions should be constructed. Derivations of these distributions are not required	2weeks/12hrs
11.	REGRESSIONScatter diagrams. Regression line and its characteristics. Linear regression equation and curves. Fitting of regression lines by the method of least squares. The meaning of regression coefficient and its estimation from graphs. The use of regression lines	Some simple concrete examples should be constructed. No exponential or multiple regression is required	2weeks/12hrs
12.	CORRELATIONCOEFFICIENTProduct moment correlation	Simple examples of these coefficients should be constructed	2week/12hrs

coefficient and Spearman's rank

correlation coefficients

13. Revision 1week/6hrs

Total 144hrs

INTERIM JOINT MATRICULATION BOARD EXAMINATION (IJMBE)

BIOLOGY SYLLABUS (REVISED 2012)

1. The IJMB Biology syllabus is designed to provide a guide for instruction at colleges of advanced studies (A Levels), which prepare students for entry into the 200 level Biology programme in Nigerian Universities. It assumes that students of Biology at this level have completed the 'O' Level biology syllabus as prescribed by WAEC/ NECO. The syllabus is planned for delivery over a contact period of **at least 9 months**.

As much as possible, students are expected to expand their skills in observation, classification and interpretation of biological data, and to develop a scientific attitude to problem solving. It is also expected that their abilities to apply biological principles in everyday life will increase

2. **Aims and Objectives:**

This syllabus has the following aims and objective

1. To **further develop** candidates' understanding of levels of organization in living organism
2. To **enhance** knowledge of the natural (taxonomic) relationships between the various plant and animal phyla,

iii. To **increase** candidates' capacity to relate structure and function within living systems.

1. To **develop** candidates' competence in application of simple statistical concepts in biological studies.
2. To **introduce** candidates' to basic concepts in microbiology, as relevant to plant, human and animal life.
3. To **increase** candidates' understanding of simple ecological concepts and their applications in everyday life.

vii. To **enhance** candidates' understanding of the major principles of genetics and their relevance to heredity.

viii. To **expose** candidates to the theories of evolution and the role of natural selection in the evolution of living organisms.

The syllabus is therefore organized into eight (8) major sections, viz:

SECTION A: SUBCELLULAR AND CELLULAR LEVELS OF ORGANIZATION SECTION B: DIVERSITY OF ORGANISMS

SECTION D: BIOSTATISTICS

SECTION E: BASIC MICROBIOLOGY

SECTION F: ECOLOGY

SECTION G: GENETICS

SECTION H: EVOLUTION

Examination Scheme:

The IJMB Examination in Biology will consist of two Theory Papers of 3 hours each, which together will constitute 60% of the final mark.

1. **Paper I: GENERAL BIOLOGY AND BOTANY (Statistics, Ecology, Botany and Basic Microbiology)**

Candidates will be required to answer **FOUR** out of **SIX** questions. The first question, which will include statistics. in addition to short answer questions covering relevant areas of the syllabus, will be compulsory. The paper will cover the following sections of the syllabus:

Section A: Plant Tissues (see Cellular and sub cellular levels of organization) .

Section B: Diversity of Organisms (Plants and Plant like organisms):

1. Protoctista
2. Algae
3. Fungi
4. Plants

Section C: Form and function of living systems:

1. Plants
2. a) Plant structures
3. b) Nutrition in plants (Autotrophic & heterotrophic Nutrition)
4. c) Vascular systems in plants

5. Transport in plants
6. d) Respiration (as applicable)
7. e) Reproduction in plants .
8. f) Growth and development
9. g) Co-ordination (as applicable)

Section D: Biostatistics

Section E: Basic microbiology

Section F: Ecology

1. **Paper II: GENERAL BIOLOGY AND ZOOLOGY (Genetics and Evolution, Cell Biology and Zoology)**

Candidates will be required to answer FOUR out of SIX questions. The first question, which will be drawn from Genetics and will include short answer questions covering the relevant areas of the syllabus, will be compulsory.

The paper will cover the following sections of the syllabus:
Section A: 1. Animal Tissues (see Cellular and sub cellular of Organization

2. Cell processes

3 Enzymes

Section B: Diversity of Organisms (Animals and Animal like organisms):

1. Protoctista
2. Protozoa
3. Animalia

Section C: Form and function:

2. Animals
3. a) Nutrition in Animals
4. b) Transport in vertebrates
5. c) Respiration (as applicable) ‘
6. d) Excretion in Animals
7. e) Support and Locomotion in Animals
8. f) Reproduction in Animals
9. g) Growth and development
10. h) Co-ordination (as applicable)

Section G: Genetics

Section H: Evolution

NOTE: The above grouping of the various sections of the syllabus is for Examination purpose only and is therefore purely for convenience, inevitably, there are a few areas of overlap (e.g. Cell Biology and Cell Physiology).

Historic background and experimental approaches, which Jed to major biological discoveries, are to be touched upon in appropriate topics to create interest and curiosity in students. While it is necessary that physical and chemical principles underlying biological phenomena be understood, the detailed study of complex chemical processes (e.g. Kreb's cycle, chloride shift, and unit effect) is not required.

1. **PRACTICAL WORK:**

Practical work will form an important and integral part of the course. Candidates will be taken through a course of practicals, based on theory wherever possible and thereby covering all the major topics of the syllabus. These shall be assessed internally and the marks obtained shall constitute a percentage of the Final Mark in Biology.

The IJMB Secretariat may, at any time, requ

In addition, each college will arrange a formal practical examination for its candidates during the course and the mark obtained during this examination shall constitute 20% of the final grade in Biology. The IJMB Secretariat may require the submission of the question papers and the scripts to the Chief Examiners and Moderators for scrutiny.

PAPER III: PRACTICAL WORK

In this course, practical techniques, such as the use of light microscope, risking slides (not permanent preparations), dissection of plants and animals and rft>w to make biological drawings, should be emphasized. There is no special syllabus for practical work. Some suggestions are listed below:

1. **Introductory Practical-** How to make drawings, use of microscope, cell study using plant cells (e.g. onion peels) and animal cells (e.g. cheek scrapings).

2. **Classification:**

(a) Protoctista

1. Algae
2. Protozoa

(b) Fungi

(c) Plants (Bryophytcs, Pteridophytes, Gymnosperms, Angiosperms) Animals (Cnidaria / Coelenterata, Platyhelminthes, Annelida, Nematoda, Mollusca, Arthropoda, Chordata)

3. **Morphology of Angiosperms**– Roots, steins, leaves, flowers (floral diagrams and floral formulae; one dicot, one hermaphrodite, one unisexual, one monocot).

4. **Plant Anatomy –** Sections of roots, stems and leaves of both monocots & dicots.

5. **Animal Form and Function –** A suitable vertebrate (e.g. rat, rabbit, guinea pig), fowl, lizard, etc. to show features and viscera; venous, arterial, digestive and urinogenital systems, heart. Display of external features of above.

6. **Physiology –** Food tests, digestion using enzymes, enzyme experiments (effects of varying concentrations, temperatures and pH). Osmosis (using potatoes, yams, onion peels or other suitable plaint materials). Plasmolysis Blood groups. Growth (rate of growth of leaves and, stems).

7. **Transpiration –** Relevant experiments (mostly demonstration), e.g. transpiration rates measured by loss of weight methods/cobalt chloride paper, photometer, root pressure (manometer).

8. **Respiration –** Use of respirometers (using small insects, plant materials, etc.).

9. Photosynthesis – Mostly demonstrations of the effects of varying light intensities, CO2 concentration and temperature. Extraction of chlorophyll, measurement of PPS in leaf disks.

10. Histology – Alimentary canal (stomach ileum and duodenum), liver, kidney, testis, ovary, muscle (cardiac, striated, non-striated, smooth), tissues (epithelial: ileum, duodenum and skin), skeletal tissues (bone, cartilage), connective tissue (including blood).

11. Ecology – Measurements of abiotic factors, Estimation of populations (plants and animals), investigations of soil organisms (not microorganisms), Moisture, organic matter, air. porosity and capillarity.

12. Statistics – Measurements of statistical variables, frequency distributions, cumulative frequency curves, histograms, frequency polygons, dispersion (ranges, standard deviation, variance), concepts of probability.

13 **Genetics –** Mitosis and meiosis (use of slides or squash preparations), demonstration of inheritance using coloured beads, beans, etc. Problems on Mendel's""laws", and deviations from them.

CONTINUOUS ASSESSMENT:

Continuous assessment shall form an element of the final examination, accounting for 20% of the Final Mark. This shall consist of:

1. Continuously assessed practical work – 10%

2. Essays and Quiz – 10%

DETAILED SYLLABUS

FIRST SEMESTER SYLLABUS

SECTION A: SUBCELLULAR AND CELLULAR LEVELS OF ORGANIZATION

S/NO	TOPICS AND CONTENTS	ACTIVITIES/PRACTICAL GUIDE	INSTRUCTIONAL MATERIALS	DURATIONP Hours	
	THE GENERALIZED CELL(a) The cell as a fundamental unit of structure and functionA brief definition of ceil and summarized form of cell theory				
1.	i. Microscopes and Microscopy Light and electron microscopes. The parts, drawing and naming of the parts, functions, advantages and disadvantages of a light microscope should be enumerated. Brief account of function of electron microscope, types, functions, advantages and disadvantages. Use of dissecting microscopes	A. Practical class on how to make Biological drawings, recording and reporting of practical should be introduced. The use, handling, drawing, labeling and functions of a light microscope should be emphasized Practicals should be conducted to study plant cell (using onion bulb/tomato fruit) and animal cell (e.g. cheek scrapings). Emphasis	Provide simple and compound light microscopes, as well as dissecting microscopes	18	9

	should be placed on simple cells constituting the bodies of both plants and animals
ii. Animal and plant cells as seen under light microscope, A simple treatment of the structure of cellular constituents of plant and animal cells as seen under. Light microscope with emphasis on -shape, structure and functions	
iii. Ultrastructure/Fine structure of the cell A. detailed treatment of the fine structure and functions of various cellular constituents as illustrated by the electron microscope in plant and animal cells especially: plant cell wall, membranes, nucleus, endoplasmic reticulum, golgi bodies, lysosomes, vacuoles, mitochondria, cytoskeleton, centrioles, cilia, flagella and chloroplasts, ribosome	
iv. Molecular structure of the plasma membrane	
– – Different and similarities between the fine structures of plant and animal cells should	Permanent/prepared slides should be used to allow candidates observe, draw and label chromosomes (e.g.

be highlighted A simple illustration of a triple-layered structure of the cell membrane (i.e. protein-lipid-protein molecules)	Onion or Lilly root tips under light microscope in a practical class. Emphasis should be given to different stages, nature and behaviour of chromosomes and other associated organelles	
(b) Mitosis and meiosis as a basic processes of cell multiplication i Mitosis- Definition of mitosis, where it takes place and its significance in multiplication for growth and development of living organisms, illustrating the different stages/phases of mitosis and the role played by each phase	Permanent/temporary prepared slides should be used to identify, draw and label the stages and sub-stages of meiosis. Emphasis should be placed on the nature, number and orientation of the chromosomes to identify the stages	Provide plain glass slides with cover slips. Provide relevant permanent slides. Provide relevant stains, etc. provide plant materials/specimens
ii. Meiosis- Simple definition of meiosis, where it takes place and its significance in the evolution of plants and animals illustrating the different stages and sub-stages of meiosis in both first and second meiotic division		
iii. Gametogenesis- Meiosis as a means of		

gamete formation with reference to spermatogenesis, oogenesis, microsporogenesis and macrosporogenesis should be briefly discussed and illustrated	Study of permanent slides of stem (T.S.) to locate, draw and label parenchyma, collenchymas and sclerenchyma cells, relating the structures of these cells to their functions	
iv. Comparison between Mitosis and Meiosis- Emphasis should be given to points highlighting contrasting differences between mitosis and meiosis		
v. Introduction to concept of organization in organisms: tissues, organs and systems Definition and classification of tissues, organs and system as levels of organization	Permanent slides of the different types of epithelial, connective, skeletal, muscular and nervous tissues should be provided in a practical class stressing the distinguishing features of each and their location in animals body	
		Provide relevant permanent slides

(c) Plant Tissues

i. Parenchymatous tissues

ii. Collenchymatous tissues

iii. Sclerenchymatous tissues

	iv. Vascular or Conducting tissues v. Epidermal and Peridermal tissue A study of (i-v) plant tissues, emphasizing composition, distribution, forms and functions of each tissue. **(d) Animal Tissues** i. Ephithelial tissue ii. Connective tissue Skeletal iii. Muscular tissue iv. Nervous tissue A study of (i-iv) animal tissues, emphasizing types, classification, structures, arrangement, functions and importance of each tissue				
2.	CELL PROCESSES **(a) Biological processes in cells** i. Osmosis ii. Diffusion iii. Plasmolysis Outline of definitions and principles. Discuss the significance of these processes in regulating the internal and external	Conduct simple experiments to demonstrate these processes, using plant and animal materials	Provide potato osmometer, spirogyra filaments, red blood cells, etc. Provide hypotonic and hypertonic solutions	12	6

	environment of cells. Details of physio-chemical equations and equilibria involved are not required. Brief mention of other processes such as haemolysis, phagocytosis and pinocytosis ENZYMES **(a) Characteristics of enzymes and role in biochemical reactions** The importance of biochemical reactions and industrial usage of enzymes should be stressed				
3.	**(b) Mechanism of enzyme action** i. Lock and key hypothesis ii. Induced fit hypothesis The specific nature of enzymes should be emphasized	Experiment should be undertaken to determine factors such as temperature. pH, enzymes concentration and substrate concentration that affect the rate of enzyme catalysed reactions	Provide relevant enzymes (e.g. invertase) and substrates (e.g. sucrose), etc.	6	3
	(c) Enzyme inhibition i. Competitive ii. Non-competitive irreversible Examples of enzyme inhibitors should also				

	include drugs and poison				
	(d) Co-factors i. Inorganic ions ii. Prosthetic groups, and iii. Co-enzymes Examples and types of reaction they act on should be given				
4.	DIVERSITY OF ORGANISMS**(a) The principal groups of organisms. The super kingdoms and the five kingdom system of classification**A general survey of the Super Kingdoms. Eukaryotae. The major differences between Prokaryotae and Eukaryotae. An overview of the 5 Kingdoms of organisms: Prokaryotae, Protoctista, Fungi, Plantae and Animalia. A note on the status of the protozoa and algae. Distinguishing features of each of the kingdoms. Major differences between plants and animals	Engage students in colleqtion, identification and classification of locally available specimens into their various groups and sub-groups based on observable external features to illustrate the value of classification and the use of taxonomic keys in identification	Relevantspecimens, simple taxonomic keys . (such as numbered. keys and indented keys)	12	6
	(b) Classification A general idea of the meaning and value of classification of				

	organisms. Definitions of taxonomic terms: Classification, Systematic, Taxon, etc. A mention of the use of molecular biology in taxonomy. A brief discussion of the binomial system of nomenclature and its rules				
5.	PROTOCTISTA**(a) Algae**i. Morphology and classification. Outline the major classes/divisions of the algae. Study die general characteristics of the phylum. Classify algae up to the generic level. Outline major diagnostic characteristics of individual classes Discuss the range of forms as seen in unicellular, colonial, filamentous, siphonaceous and thalloid genera (e.g. *Chlorella, Chlamydomonas, Volvox,Spirogyra, Fucus, Larninaria,* etc.) **ii. Importance** Discuss economic/ecological	Students. should collect and classify specimens of algae Students should observe and draw specimens of algal species	Relevant specimensRelevantprotozoan specimens Relevant .fun an	12	6

	importance of algae (e.g. as basis of aquatic food chains, roles in eutrophication, of water treatment, limestone formation, uses/products, etc.)			
	(b) Protozoa			
	i. Morphology and classification Outline the major phyla of the protozoa and their characteristics. Classify the protozoa up to generic level. Outline major diagnostic characteristics of individual classes Discuss the range of forms as seen in simple and complex. types using examples such as *Amoeba, Trypanosoma, Trichomonas, Paramecium* and *Plasmodium* Discuss die economic importance of protozoa	Students . should collect and classify specimens of protozoa Students . should observe and., draw specimens and slides or protozoans		
6.	FUNGIi. Morphology and classification Outline the major fungal classes/divisions. Study the general characteristics of the phylum. Classify the fungi up to generic level. Outline major diagnostic features of individual classes	Students should collect and classify specimens of the fungi	Relevant fungal specimens	12 6

	Discuss the range of forms and mode of nutrition as seen in unicellular and multi-cellular types, e.g. Yeasts, *Rhizopus, Mttcor, Aspergilus Penicillium, Phytophtora,*Mushrooms, etc. ii. Importance Study the economic/ecological importance of fungi (see section E)	Students should observe and draw specimens of fungi			
7.	LICHENSTypes and range of forms. Economic/ecological importance, e.g. in succession, as sources of dyes, etc.			6	–
8.	PLANTAEOutline the major groups of plants. Discuss their major differences and characteristics **(a) Bryophyta** i. Morphology and classification Outline the major classes of the bryophyta and their characteristics. Classify the bryophytes up to the generic level. Outline major diagnostic characteristics of the individual classes with reference to representative species, e.g. *Riccia, Marchantia, Funaria, Polytriclium,*etc.	Students should collect and classify specimens of bryophytes	Relevant specimens of bryophytes	18	9

Discuss alternation of generations in these plants Discuss major morphological features that facilitated the transition from water to land		
ii. Importance Outline economic/ecological roles of these plants, e.g. in succession, soil enrichment, retardation of erosion.		
(b) **Pteridophyta**		
i. Morphology and classification Outline the major classes of the pteridophytes and their characteristics. Classify the pteridophytes up to the generic level. Outline the major characteristics of the individual classes with reference to representative species, e.g. the club mosses (e.g. *Selaginella),* the ferns (e.g. *Nephrolepis, Dryopteris,* etc.). Discuss alternation of enerations, emphasizing the dominance of the sporopliyte and separate existence of the two generations at maturity. Highlight heterospory and its significance. Highlight the factors which contributed to the success of pteridophytes as land plants	Students should examine and draw specimens of bryophytes	Relevant Specimens of pteridophytes
ii. Importance Outline economic/ecological		

importance of the pteridophytes, including .their possible roles in formation of fossil fuels		
c) Spermatophyta		
i. Morphology and classification Outline the major classes of Spermatophyta and their characteristics. Classify the spermatophytes up to generic level. Comparatively study the major characteristics of gymnosperms and angiosperms. Mention extinct orders of the gymnosperms. Discuss the range of forms (trees, shrubs, herbs) in angiosperms with regards to their adaptations to habitats (aquatic and terrestrial). Discuss the diagnostic vegetative and reproductive features of monocots and dicots with reference to representative species of gymnosperms (e.g. *Pinus)* and angiosperms (e.g. any flowering plant). Highlight the development of the seed habit and its significance. Emphasize the dominance of the sporopliyte and progressive increase in its complexity iv. Importance Discuss the economic/ecological roles of spermatophytes as dominant land flora, which provide food, shelter, clothing, energy, etc. to humans and other animals	Students should collect and classify specimens of pteridophytes Students should examine and draw specimens of the pteridophytes	Relevant specimens of Spermatophytes

			Students should collect, classify and draw specimens of gymnosperms and angiosperms, monocots and dicots, various groups of dicots as adapted to different habitats		
	ANIMALIAOutline the major groups of invertebrates and vertebrates.Discuss their major differences and characteristics				
9.	**(a) Cnidaria (formerly coelentcrata)** i. Morphology and classification Outline the major classes of cnidaria and their characteristics. Classify the cnidarians up to generic level. Outline the major characteristics of the classes, with reference to representative species such as		Students should collect and classify cnidarians specimems	Relevant fresh/ Preserved specimens cnidaria	18 9

Hydra and *Obelia.* Highlight polymorphism. Discuss the range of forms/increase in complexity and level of organization of cnidarians as a factor in evolution		
ii. Importance Highlight the economic/ecological roles of cnidarians in the ecosystems (e.g. marine food chains, corals, etc.)	Students should examine and draw specimens of cnidarians	Relevant fresh/preserved specimens of platyhelminthes
(b) Platy helminthes i. Morphology and classification Outline the major classes of the Platy helminthes, and their characteristics. Classify the Platy helminthes up to the generic level. Outline the major diagnostic characteristics: of the classes, with reference to representative species such as *Taenia, solium, Fasciola hepatica, Macrogyrodactylus/ Gyroclactylus/Planaria*		
Discuss the range of forms/increase in complexity and level of organization as a factor in evolution	Students should collect and classify specimens of platyhelminthes	
ii. Importance Highlight the economic/medical roles of platyhelminthes		

		Students should examine and draw specimens of platyhelminthes	
S/NO	**TOPICS AND CONTENTS**	**ACTIVITIES/PRACTICAL GUIDE**	**INDTRUCTIONAL MATERIALS**
	(c) Nematodai. Morphology and classification Outline the major classes, of the nematodes, and the characteristics of the phylum. Classify the nematodes up to the generic level. Outline the major diagnostic characteristics of the classes, with reference to representative species, such as *Ascaris, Trichinella,Necator, Onchocerca* Discuss the range of forms/increase in complexity and level of organization as a factor ; in evolutionii. Importance; Highlight the economic/medical roles of nematodes(e.g. in soil & as. parasites of plants, animals, including man)	Students shouldcollect and classify Nematode specimens Students should examine and draw nematodes specimens	Relevant fresh/preserved specimens of Nematodes

(d) Annelida

i. Morphology and classification
Outline the major classes of annelids, and discuss their characteristics.
Classify the annelids up to the generic level.
Outline major diagnostic characteristics of the; classes, with reference to representative species, such as *umbricus,.Nereis* and *Hirudo.*

Discuss the range of forms/increase in complexity and level of organization as a factor in evolution. Highlight metameric segmentation, true coelom.

ii. Importance

Highlight the economic/ecological roles of annelids (e.g. in the soil, marine and freshwater ecosystems)

Students should collect and classify annelid specimens

Relevant fresh/ preserved of specimens Annelids

(e) Mollusca

i. Morphology and classification
Outline the major classes of the mollusca and their characteristics.

Classify the mollusca up to the generic level. Outline major

Students should observe and draw specimens of annelids.

diagnostic characteristics of the classes, with reference to representative species, such as snails, clams/bivalves, *Octopus* Outline features of evolutionary significance such as advanced coelom, cephalization, presence of gills shells, etc. Mention fossil molluscs ii. Importance Outline the economic/ecological significance of molluses (e.g. as intermediate hosts of disease causing organisms, food, source of ornaments, roles in aquatic food chains, etc.)		
(f) Arthropoda		
i. Morphology and classification Outline the major classes of the arthropods and their characteristics. Classify the arthropods up to the generic level. Outline major diagnostic characteristics of the classes, with reference to representative species, such as spiders, scorpions, millipedes, centipedes, crayfish, crabs, and insects from different orders. Highlight complete and incomplete metamorphosis using examples such as mosquitoes/housefly, cockroach /grasshopper, butterfly/bee. Highlight features of evolutionary significance, such as reduction of the coelom, development of the exoskeleton, heart and related structures	Students should collect and classify" mollusca specimens Students should observe and draw Mollusc specimens	Relevant fresh/preserved specimens of Molluscs

molting and ecdysis, social behaviour and flight in arthropods. Factors related to success of insects

ii. Importance

Outline the economic / ecological / medical significance of arthropods

(g) Chordata

i. Morphology and classification Outline the major classes of the chordate and their characteristics. Classify chordata up to the generic level. Outline major diagnostic features of the classes, with reference to representative species of hemichordata *(Balanoglossus)* and urochordata (e.g. sea squirts/tunicates, cephodochordata (e.g. *Amphioxus)* and vertebrata (e.g. fishes, frogs/toads, lizards/snakes, birds and mammals)

Students should collect and classify arthropods

Relevant

fresh/preserved

specimens

Arthropods

Highlight features of evolutionary significance in the various subgroups. Briefly discuss the position of Amphibia as the first terrestrial vertebrates, and the various adaptations for life on land

Students should observe and draw arthropods – •

ii. Importance Outline the economic / ecological / medical importance of the chordate

Students should

collect and classify chordates

Students should observe and draw chordates

			Relevant fresh/ preserved specimens of Chordates		
SECTION C: FORM AND FUNCTION OF LIVING SYSTEMS					
10.	PLANTS(a) Structures in flowering plantsi. Their morphology – Root Types of roots, e.g. pneumatophores, fibrous, stilt, tap root, etc. Their distinguishing characteristics related to function – Stem Types of stems, e.g. corm, rhizome, runner, etc. Their distinguishing characteristics related to function – Leaves Leaf arrangement and modifications to suit habitat. Dicot and monocot leaf shape and structure in relation to function – Flower Types and structure of dicot and monocot flower and function of each part. Differences between the two should be highlighted. – Fruits	Named examples of each should be observed and drawn Diagrams of L.S. dicot flower examples. Floral diagram and formula should be introduced.	Provide plants with each type of root, stem, leaf, flower Provide relevant slides. Refer to relevant wall charts during teaching	12	6

Types of fruits and placentation; Fruit and seed dispersal mechanisms. ii. Anatomy of monocot and dicot: – Root – Stem – Leaf General arrangement of tissues in the three organs in relation to function and ecological environment (leaf) should be discussed. Root hair structure and function	Specimens of various fruit types should be dissected (L.S. and T.S.) observed and drawn Slides of T.S. and L.S. of the three organs.	Provide materials for experimental set-ups
(b) Nutrition in Plants i. Types of Nutrition – Autotrophic- photosynthesis and chemosyn thesis Requirements and the process of photosynthesis. Dark and light reactions with cycles drawn to illustrate them. (No need for the biochemical details of substances named). Final products and their significance should be discussed. An outline of chemosynthesis with examples -Holozoic/ Heterotrophic Mention of plants which trap and digest insects, their habitats	Growth of maize seedling in dark and light to demonstrate etiolation. Measurement of photosynthesis in leaf disks	Provide materials for experimental set-ups

and		
Designs, e.g. Venus fly trap – Mineral requirements of plants Their sources including chemical fertilizer compositions, roles and deficiency symptoms		Provide materials for experimental set-ups. Refer **to** relevant wall charts during teaching
– Transport Systems Explain need for transport system due to increase in size and change in habitat. Importance of the following processes, their composition, structure and function should be stressed	Growth experiments to show deficiency symptoms	Provide materials for' experimental set-ups. Refer to relevant wall charts during teaching
– Water relations Explain concepts of Osmotic, Suction and Turgor pressure, plasmolysis (see section A 2a) – Transport in Xylem Movement of water and dissolved mineral salts from soil through root hair to Xylem vessel and ascent of sap together with diagrams – Transport in Phloem		Provide materials for experimental set-ups. Refer to relevant wall charts during teaching

Movement of . synthesized food from leaves to other parts of plants, active transport, effect of ringing should be explained		
– Transpiration		
Process and factors affecting transpiration		
(c) **Respiration**		
i. Ventilation structures	Experiments to	Provide materials e.g. for
Stomata apparatus, lenticels.	demonstrate each	experimental set-ups. Refer, to relevant wall charts during teaching
Mechanism of gaseous exchange		
and utilization of end products	Experiments to	
ii. Aerobic and Anaerobic	demonstrate effect	
respiration	of changing light	Provide materials e.g. for
Definitions, equations and examples and uses. Differences between aerobic and anaerobic respiration.	intensity, – temperature, wind, measurement of	experimental set-ups. Refer to relevant wall charts during teaching
	transpiration rates by loss of weight method/cobalt	
(d) Reproduction	chloride paper,	
General outlines of Sexual and Asexual reproduction in plants.	photometer	Provide relevant pollen types
(e) Plant growth and development	Set-up an	
Various definitions of growth	observation to take	Provide relevant
Should be stated. Rate, pattern	12-48 hours	fruit and seed types.

	and stages of growth with explanation of sigmoid curve various methods of measurement of growth. Meristems should be introduced. Germination, types with named examples. Conditions necessary for growth, light, temperature and mineral requirements, etc. Plant growth substances (auxins, gibberellins, cytokinins, ethylene as inhibitors and promoters). Their location, movement and effects should be mentioned	Diagrams of named examples mount and observe pollen and animal pollinated flowers to show difference Named examples should be examined and drawn Grow maize and measure growth. Observe L.S. Onion root tip as e.g. of meristem Grow *Amaranthus/Bryophyllum* and show lateral bud inhibition	Refer to wall charts, etc. during teaching Provide materials for experimental set-ups. Refer to relevant wall charts during teaching		
	ANIMALS**(a) Nutrition in animals** i. Food substances:	Test for starch, reducing sugar, protein, fats and oil.Test for starch, reducing sugar, protein, fats and oil.			
11.	Carbohydrates, proteins, lipids, vitamins, mineral salts and water. Nutritional deficiencies. Brief mentioning of the component of animal and plant carbohydrates, their sources, roles and function. Sources and functions of vitamins, mineral	Compare digestive systems of Reptile or Amphibian, bird and that of a mammal indicating their differences and similarities	Provide specimens for dissection. Refer	12	6

salts, and water		to relevant
	Histology and	models/wall charts. Provide relevant
ii. Nutritional types in animal Discuss and give examples of Heterotropic: Holozoic, Parasitic and Saprophytic. Briefly mention subtypes	functions of various sections of the digestive tract, including liver and pancreas	slides
iii- Structure of teeth Herbivores, carnivores and omnivores, dental formula of each, and their specialization to types of diet		Provide relevant models/ wall charts
iv. Digestion Organs associated with digestion, absorption and assimilation of digested food in animals. Mention digestive enzymes, and their function-;		
v. Histology and function of deuodenum, stomach, small and large intestines and liver Structure and functions of different parts of alimentary canal should be highlighted	Examine and draw slides of composition of blood, arteries, veins, capillaries and heart tissues. Dissect a mammal; expose the circulatory system and draw.	Provide slides specimens dissection
(b) Transport in vertebrates: Mention the need for transportation i. Structure and function of the mammalian heart and major blood vessels. Mention the structure and functions of main arteries; capillaries and veins,		

and their differences. General pattern of blood vessels to be treated briefly for understanding of transport of materials between blood and tissues. Mention names of blood vessels, heart diseases/

arteriosclerosis. Transportation of materials such as excretory products, gases, digested food and nutrients should be treated briefly

Provide relevant specimens for dissection

(c) Respiration in vertebrates:

i. Ventilating structures
General characteristics of

respiratory surfaces. Mechanism of gaseous exchange in fish, toad and mammal should be explained, including body surface, cutaneous, gills and lungs as ventilating structures. Mention importance of mouth-to-mouth resuscitation and the use of ventilators. Muscular depletion of oxygen during heavy exercise

Examine and draw the respiratory structures of fish, toad and mammal

(d) Excretion in animals

Discuss need for excretion

i. Excretory organs
Discuss the kidney (including the
nephron), liver, lungs and

skin, their structure, function,		
environmental temperature. Mention types and causes of disease of kidney, liver and skin	Muscular depletion of oxygen during running	
ii. Osmoregulation and excretion, and their relationship Osmoregulation in freshwater, marine and terrestrial environment, and give" specific examples, e.g. *Tilapia* (in freshwater), dog fish (in marine) and humans (in terrestrial)	Examine and draw the L.S. of mammalian kidney, skin and liver	
(e) Support and locomotion in animals:		
Definition and reasons for locomotion, function of skeleton, the skeleton and supporting systems in animals. Candidates should be familiar with the general plan of mammalian skeleton and different types of joints	Individual bones of the mammalian skeletal system should be emphasized	
Mechanism of Locomotion		Provide relevant models/ wall charts
– In water		
Amoeboid, ciliate flagellate, and swimming, different types of swimming as found in fish. Mention types and functions of fins		Provide relevant models/wall charts

– On land

Leaping, looping, hopping, crawling and walking in tetrapods. Mention importance of muscles and the main muscles responsible for locomotion, and how locomotion is achieved by muscles and skeleton

– In air

Treatment of flight in insects and birds. Brief mention of muscles responsible for flight in insects and birds

(f) Reproduction in Animals:

Sexual and asexual, significance and differences between them (e.g. binary, multiple, sporulation, budding, regeneration, conjugation, etc.)

i. Formation of gametes Discuss methods of ensuring fertilization; sexual dimorphism and sexual display/behaviour relating to ensuring fertilization process

ii.Male and female reproductive systems in higher vertebrates Mention their differences;

histology of testis and ovary, structure of sperm and ovum iii. Rhythmic cycles in animals Brief mention of monoestrous, polyestrous and menstrous cycles (e.g. fox, dogs, rabbits/humans)	Observe slides of sections of the mammalian testis and ovary. Dissect a small mammal to the male and female urinogenital systems and associated organs	
iv. The sexual cycle in mammals Use humans as examples, discuss the need for birth control mention the dangers involved in early pregnancy and unwanted pregnancy. Brief mention of associated with unprotected sex, including HIV/AIDS. Describe the event of pregnancy, (fertilization), development of embryo and birth. Childhood diseases.		Provide relevant permanent slides. Provide suitable mammalian Dissection
v. Comparison of reproduction in insects, fish, amphibians, reptiles, birds and mammals Include method of fertilization, number of eggs, complete and incomplete metamorphosis, parental care, viviparity, ovovivipaprity, oviparity in animals should be highlighted,		Refer to relevant models/ wall charts during teaching

and their significance as it relates to survival of the young

(g) **Chemical co-ordination in animals**

Pituitary hormone, ‘ thyroxin, adrenalin, insulin, gonadal

hormones, including their site, secretions, functions, effect of over and under secretions should be mentioned. Feedback mechanisms

(h) Nervous co-ordination in Animals

Including parts of brain and their functions structure and function of spinal chord

– Reflex and voluntary actions

Including reflex arc, and actions

such as blinking of the eye, knee

jerk, withdrawal of hand from hot

objects. Conditioned reflex

– The central nervous system

– Autonomic nervous system

	(i) Structure and function of mammalian ear and eye Describe accommodation. stereoscopic vision and inversion of retina; Defects of the eye and their correction; Hearing and balancing		
		Observe and draw from models of eye and ear	Provide relevant models charts for exercises

SECTION D: BIOSTATISTICS

12	BIOSTATISTICALVARIABLES. (a) Measurement Classification of physiological concentration of biological fluids, measurements of some optical machinery into continuous variables (e.g. size, height and weight) and discontinuous variables, should be outlined and discussed (b) Attributes Attributes such as colour of skin, eye, hair coat of animals, seeds, types of flowers, tongue rolling,	Candidates are to observe and record these attributes of animals and plants Candidates to collect height and weight of students of the same age group	Suitable plant and Animal populations should be used for generating data The class should be used as a population for collecting these data	12	6

	taste of phenylthio carbamide (PTC) and Blood Group (ABO system) should be highlighted and explained DATA COLLECTION AND PRESENTATION(a) Data Collection i. Sources of data Different sources where data can be collected should be outlined and explained ii. Methods of data collection Methods experimentation, interviews, questionnaires, **etc.** and the advantages and disadvantages of each method should be discussed	The data collected on heights, weight, etc. could be used to classify and construct frequency tables, Histograms and Pie-charts		
13	(b) Data Presentation i. Tabulation Classification of data, by tallying, construction of frequency tables should be taught. Characteristics of frequency table (class size, class interval, class limits and class mid-point should be outlined and explained ii. Presentation * Charts Processes of constructing histograms, frequency polygons. Cumulative frequency polygons should be taught * Pie-Charts **“** pie-chart highlighting how sections represent different proportion of data	The data collected on heights, weight, etc could be used to classify and construct frequency tables, Histograms and Pie-charts	12	6

14.	MEASUREMENT OFPOPULATION PARAMETERS a) Measure of Location Definition of mean, mode and median, simple formula and basic computation methods using single and grouped as data should be highlighted (b) Measure of Dispersion The computation of range, standard deviation, standard error and variance should taught	Measurements oil height and weight or other generated data could be used to for this exercise		6	3

SECOND SEMESTER SYLLABUS

SECTION E: BASIC MICROBIOLOGY

SNO.	TOPICS AND CONTENTS	ACTIVITY/ PRACTICAL GUIDE	INSTRUCTIONAL MATERIALS		
15.	VIRUSES(a) General characteristics of viruses (b) Viruses and Diseases i. Plant diseases Mosaic diseases of plants, mosaic disease of flowers, swollen shoot diseases of plants should be outlined and explained. Mode of transmission and control should be discussed ii. Human and Animal diseases Role of viruses in diseases like poliomyelitis. Yellow influenza,measles, rabies and common cold should be outlined.		Refer to relevant wall charts during teaching	12	–

	Others such as HIV/AIDS, SARS, MAD-COW and their mode of transmission should be mentioned BACTERIAa) General characteristics of bacteria (b) Bacteria and Diseases i. Plant diseases Blight diseases giving relevant examples should be discussed (e.g. blight of cassava, potatoes) ii. Animal diseases Pathogenic effects of bacteria on human and animals. Relevant examples of diseases should be outlined and discussed, with emphasis on sexually transmitted diseases		
16.	(c) Uses of Bacteria i. Agriculture Role of bacteria in decaying of organic compounds, Nitrification of proteins in dead plants and animals in soil, Nitrogen fixation and conversion of cow dung and animal wastes should be outlined and discussed. De-nitrification of nitrates to free nitrogen ii. Industrial uses – Food Ripening of cheese, flavouring of	Refer to relevant wall charts during teaching	18

foods, fermentation, curding of milk should be discussed

– Manufacture

Curing and ripening of tobacco and tea leaves; fermentation of leaves, retting of fibres, tanning, and formation of vinegar from alcohol should be discussed

iii. Sanitation The degradation of sewage in septic tanks should be mentioned and explained

v. Medical uses of bacteria MBacteria as sources of antibiotics. Names of the bacteria and antibiotics should be outlined and discussed. The role of bacteria in the control of putrefactive and pathogenic bacteria in the intestine should be mentioned. Production of cellulobiose for the digestion of cellulose in ruminants should be highlighted

v. Research The use of bacteria in biotechnological research should be highlighted (e.g. single cell proteins – SCP)

(d) Control of bacterial activity

– Food preservation

Methods, e.g. salting, freezing,

	drying. mzatiuii, canning, smoking, etc. should be outlined and discussed – – Sanitation Use of antiseptics should be highlighted FUNGI(a) General characteristics of fungi (b) Importance of Fungi . i. Food processing Source of food, e.g. mushroom, vitamin B and use of yeast in baking should be mentioned ii. Industrial uses Fermentation for production of alcohol should be mentioned				
17.	iii. Medical uses Outline their roles giving examples iv. Agricultural Fungi as decomposers be discussed v. Plant and animal diseases Diseases like potato blight, smut of maize and wheat, rust of sugarcane, mildew of grapes, athletes foot, ringworm, candidiases etc. should be highlighted			12	–
SECTION F: ECOLOGY					
18.	BASIC ECOLOGICAL CONCEPTS- Niche, habitats	Candidates should also undertake a guided	Fieldwork	12	9(including field work

	and macro-habitats, species, population, community, ecosystem, biome and biosphere	detailed field study of simple ecological communities, such as a road-side pond or a small garden			
19.	THE ENVIRONMENT- Biotic and abioticfactors Mention should be made of how various biotic (e.g. parasites, predators, etc.) and abiotic environmental factors (e.g. temperature; rainfall, humidity, etc.) affect organisms and their populations – Ecological Succession and dominance in a simple community should be studied Balance in nature (i.e. the dynamics of populations) Mention should also be made of factors (e.g. natality, competition, mortality, immigration, emigration, predation, etc.) that maintain a balance in communities	Candidates should study how some abiotic factors are measured using appropriate equipment, e.g. thermometers, rain gauge, barometer, secchi disc, etc.	Provide field equipment for fieldwork	12	6
20.	SOIL BIOLOGY(a) The soil ecosystem- Soil formation – Soil profile Soil temperature, water and pH Simple treatment of soil formation processes, texture (particle sizes) and profile	Candidates should carry out simple experiments to determine soil moisture, organic matter and air contents, as well as porosity and capillarity	Provide relevant experimental equipment	6	3

	should be undertaken. Candidates should also study how environmental factors affect soil organisms and soli fertility THE WEB OF LIFE- Symbiosis Interactions between and among organisms (e.g. parasitism,commensalisms, predation, mutualism, co-operation, etc.) should be highlighted		
21.	– Food chains and food webs – Ecological pyramids Candidates should be able to draw common food chains or webs, and construct ecological pyramids of numbers, biomass and energy for simplified communities HUMANS AND THE ENVIRONMENT- Agriculture Ecological consequences of traditional and modern agriculture should be discussed; advantages and disadvantages of each system (e.g. monoculture and plant diseases, chemicalfertilizers and pollution,	12	*6*
22.	and loss of biological diversity, etc.) and other human related activities (e.g. overgrazing, deforestation, wild fires, urbanization, etc.) should be mentioned Air and water pollution	12	6

	Knowledge of sources of pollutants will be required of candidates. Candidates should also be able to list specific pollutants (e.g. radioactive materials carbon II oxide and carbon IV oxide, crude oil, chlorofluorocarbons [CFCs],, etc.) then-effects and how they can be controlled. Simple mention of the problems *of* global climate change, the greenhouse effect, acid rain, and ozone layer depletion				
23.	– Sewage treatment and sanitation Elementary consideration of septic tank and sewage treatment systems with emphasis on the importance of proper sewage disposal. The importance of the recycling of wastes should be outlined APPLIED ECOLOGY-Biological Control Some common examples of biological control should be given. Mention should be made of the advantages of biological control over conventional chemical control of pests – Conservation of nature (biodiversity) The importance of wise	A field trip to nearly natural reserve should be considered important	Fieldwork	12	6

(sustainable) use of renewable natural resources (i.e. wildlife and fisheries, water, forest, etc) should be emphasized. Some techniques widely employed to achieve conservation (e.g.) creation of nature reserves, legislation, etc) should be discussed management (IPM) Highlight the principles of IPM as a systematic-approach involving biological", chemical, physical, etc. means of pest control management

SECTION G: GENETICS

24.	HEREDITYDefinition of terms in genetics, heredity and variation, gene, phenotype, genotype, omozygous, heterozygous, homologous, dominant, recessive, monohybrid cross/ratio, dihybrid cross/ratio, Test cross/back cross, codominance, allele (allelomorphs), lethal genes, linkage, crossing over, sex-linkage, polyploid, clonings, genetic engineering, locus, traits, etc.	18	9

(a) Mendel's work- Inheritance of characters, General treatment of Mendelian principles and their deviations.

(b) The Mechanisms of

inheritance

i. Chromosome and gene theory of inheritance

A connection between the Mendelian laws of inheritance and the behaviour of the nucleus in cell divisions, i.e. mitosis and meiosis should be used to explain the theory of inheritance. Simple treatment of nature and structure of genes and DNA as the basis of inheritance

ii. Linkage and crossing over

Definition of linkage crossing over and their importance

(e) Mutation

– Definition of mutation and its importance in the evolution of plants and animals

– The different types of genome, chromosome, gene and plasma/extra nuclear mutations, nature and importance should be discussed

The types of mutagenic agents and effects, physical, chemical and high temperature should be briefly discussed principles of heredity

Students should be exposed to charts. Use of models, e.g. beaded chain to illustrate chromosomes

i. ABO blood group; Rhesus factor (system); Sickle cell anaemia
The ABO blood group and Rhesus factor/system should be discussed with special emphasis on antigen and antibody relationships. Use of blood grouping in marriage counseling, blood transfusion and Simple treatment of the significance of se. x- linkage of characters with examples (haemophilia, bald-headedness, and colour blindness)

iii. Plant and animal improvement through breeding and genetic engineering

– The applications of genetics in agriculture, behaviour, social structure, ecology, law and religion should be briefly discussed

– Genetics, medicine and genetic engineering.
The concept of *gsne* therapy, nuclear, cell and molecular cloning should be discussed

(d) Nature of Gene - Definition of gene. The structure, composition and significance, of DNA and RNA as hereditary materials highlighting their differences

should be discussed

– DNA replication and its theories should be briefly discussed

Use class as a population to generate data

A practical class should be conducted to allow candidates measure height, weight of individuals organisms of the same age group and explain, the variation

SECTION H: EVOLUTION

THE THEORIES EVOLUTION- Lamarck-Darwin

25.	The contributions of Lamarck and Darwin to the theory of evolution should be outlined. Simple mention of examples of convergent	6	–