

GUJARAT UNIVERSITY
CORRICULUM IN BIOLOGY FOR F. Y. BSc.
Effective From June, 2003

Introduction : Recent years have seen Biology advance in very big strides-a reflection of modern times ? However according to CDCs (Curriculum development committees), these advances go unnoticed in the existing syllabi. These UGC formed committees, deplore the fact that national concerns and priorities are yet to be identified ? Little wonder, therefore, that the scores of graduate and post-graduate students find themselves completely out of tune with the present times. They often end up finding jobs which have nothing to do with what they have studied.

Worse still, many hesitate to make a decision about their careers. Education must restore their confidence in the system, retain their child-like curiosity and develop an attitude to learn and learn more ? In fact we all live to learn.

Objectives :

1. To ensure a more or less equal weightage of curricula at the under-graduate and post-graduate levels all over the country;
2. To update course contents by introducing in good measure recent developments in Biology to ensure the students of this country do not have any academic disadvantages over their counterparts overseas;
3. To ensure that the curricula are not overloaded by minimizing the descriptive aspects and eliminating repetition of contents between higher secondary, under-graduate and post-graduate syllabi;
4. To provide the students of Master's programme in Biology an opportunity to opt one or more courses in allied disciplines to help them pursue specialization/research in interdisciplinary areas;
5. To make provision for the improvement in the quality of the laboratory and field work for want of which the students are not able to appreciate the beauty and variety of form structure, function and ecological significance of plants, animals and their biological services;
6. To increase the awareness of young learners about the abuse to which plants and animals have been subjected by human greed, and train them in exploration, identification and evaluation of biodiversities, conservation of nature and natural resources and in the protection of endangered plant species and other biota development on them;
7. To prepare the curriculum such that it can attract, enthuse, sustain and promote the interest of learners for selecting Biology and allied disciplines as their career and make them realize that their choice is intellectually rewarded, and
8. To provide for mobility of the students among institutions and different disciplines.

*****This syllabus is to be completed by assigning there periods of 55 minutes per paper per week for theory and one practical of 4 periods per paper per week.**

For practicals the class should be divided in batches of fifteen students only.

Pattern of Examination :

There will be two papers in theory and one practical at university examination.

The pattern will be as follows :

Theory (Papers)	Duration	Marks		Total
		External	Internal	
Biology-I	3 hours	70	30	100
Biology-II	3 hours	70	30	100
Practical (one)	5 hours	70	30	100

F. Y. BSc.
(Based on UGC model Curriculum)
Biology Paper - I (Botany)
Effective From June, 2003

Unit I & II : * Diversity and classification of plant kingdom.

Plant Kingdom :

1. Classification of kingdoms and the criteria (according to Mayr, the seven kingdoms of living organisms).
2. Origin, evolution and phylogeny of land plants.

Algae :

1. General characters
2. Classification according to Smith and
3. Economic importance of algae as a source of food, fodder and fertilizer.
4. Important features and life histories of the following excluding development.
Chlorophyceae : Volvox, Spirogyra
Xanthophyceae : Voucheria
Phaeophyceae : Sargassum
Rhodophyceae : Batrachospermum

Fungi :

1. General characters
2. Classification according to Ainsworth and
3. Economic importance of fungi as food (Yeast and Mushrooms) and medicine (Ergot and Penicillin)
4. Important features and life histories of the following excluding development :
Mastigomycotina : Pythium
Zygomycotina : Mucor
Ascomycotina : Saccharomyces
Basidiomycotina : Agaricus
5. General account of Deuteromycotina
6. General account of Lichen

Bryophytes :

1. General characters
2. Classification according to Rothmaler & Proskauer
3. Important features and life histories of the following excluding development.
Hepaticopsida : Riccia
Anthocerotopsida : Only important features
Bryopsida : Funaria

Unit III :

Pteridophytes :

1. General characters
2. Classification according to Riemers
3. Important features and life histories of the following excluding development.
Psitopsida : Only important features
Lycopsida
Sphenopsida : Equisetum
Pteropsida : Nephrolepis

Gymnosperms :

1. General characters
2. Classification according to Bierhorst (1971)

3. Important features of cycadales, coniferales & Gnetales
4. Life histories of the following excluding development.

Cycadales :

Cycas (structure, reproduction including morphology and anatomy of coralloid root, rachis & Leaflet).

Coniferales :

Pinus (structure, reproduction including morphology and anatomy of root stem and leaf).

Unit IV :

***(A) Angiosperms :**

1. Unique features of Angiosperms
2. Diversity and their affinities with Gymnosperms
3. Classification system of Bentham and Hooker and Comparison with Engler and Prantl.
4. General features of the International code of Botanical Nomenclature
5. Study of the following families with general characters, floral structure, floral formula, floral diagram and common examples of economic and medicinal importance :
 1. Malvaceae
 2. Leguminosea - sub. - family Caesalpineae
 3. Cucurbitaceae
 4. Solanaceae
 5. Nyctaginaceae
 6. Amaryllidaceae

(B) Morphology :

*** Leaf Morphology :**

- (a) Stipules-Types and modifications
- (b) Simple and Compound leaf
 - * Pinnate Compound leaf
 - * Palmate Compound leaf
- (c) Phyllotaxy

*** Inflorescence and Bracts :**

- Bracts : (a) Scaly bracts
(b) Foliaceous bracts
(c) Involucral bracts
(d) Petaloid bracts
(e) Spathe bracts

Inflorescence :

Racemose (Simple only) :

- (a) Raceme (b) Corymb (c) Spike (d) Catkin
(e) Spadix (f) Spikelet (g) Umbel (h) Capitulum

Cymose :

- (a) Unbranched :
 - (i) Solitary - Terminal
 - (ii) Solitary - Axillary
- (b) Branched :
 - (i) Uniparous cyme : Helicoid
 - (ii) Uniparous cyme : Scorpioid
 - (iii) Biparous cyme
 - (iv) Multiparous cyme

*** Morphology of Flower :**

- (a) Aestivation
- (b) Androecium : Adhasion & Cohesion
- (c) Gynoecium : Apocarpous & Syncarpous
Placentation : Definition & its types

UNIT V :

***Anatomy :**

- (a) The Tissues :
 - (a) Meristematic Tissue : Definition only.
 - (b) Permanent Tissues
 - * Simple tissues & their functions
 - * Complex tissues & their functions
- (b) Study of various types of vascular bundles.
- (c) Study of stele and its types
 - * Protostele
 - * Siphonostele &
 - * Dictyostele
- (d) Internal structure of Plant Organs with tissue systems
 - (a) Root, stem and leaf of Maize
 - (b) Root, stem and leaf of Sunflower.

Pattern of setting the question papers during the University Examination

While drawing the question paper the paper setters should observe that the topics from each unit should have covered and tried to stick the weightage scheme.

Each question should be of mixed topics and divided into 3-Sub divisions i.e. (a), (b) & (c).

Long descriptive questions should be avoided.

Each question should be opted internally.

- | | | |
|----|--|---|
| 1. | (a) Plot Kingdom + Algae/Algae | 5 |
| | (b) Fungi/Fungi | 5 |
| | (c) Bryophytes/Bryophytes | 4 |
| 2. | (a) Bryophytes/Bryophytes | 5 |
| | (b) Algae/Algae | 5 |
| | (c) Fungi/Fungi | 4 |
| 3. | (a) Pteridophytes/Gymnosperms | 5 |
| | (b) Pteridophytes/Gymnosperms | 5 |
| | (c) Gymnosperms/Pteridophytes | 4 |
| 4. | (a) Angiosperms-general/Angiosperms-general | 5 |
| | (b) Family/Morphology | 5 |
| | (c) Morphology/Family | 4 |
| 5. | (a) Tissue/Internal structure of Orgon | 5 |
| | (b) Vascular bundle/stale/Tissue | 5 |
| | (c) Internal structure of orgon/V.Bs. or stele | 4 |

**F. Y. BSc.
Biology Practicals**

1. Study of types as per theory syllabus (through fresh, preserved materials and permanent slides).
2. Study of the root and stem of Pteridophytes and Gymnosperms through permanent slides.
 - (i) Dissection of Equisetum cone
 - (ii) T. S. of Equisetum stem
 - (iii) T. S. of Nephrolepis rachis
 - (iv) T. S. of Nephrolepis leaflet passing through sori
 - (v) T. S. of Cycas rachis
 - (vi) T. S. of Cycas leaflet
 - (vii) Dissection of Cycas microsporophyll.
 - (viii) T. S. of Pinus needle.
 - (ix) Dissection of Pinus male cone is expected.
3. Study of Angiosperms families as prescribed in theory syllabus with locally available plants. Study should be through a twig with flower, L.S. of flower, description of flower (i.e. calyx, corolla, androecium, gynoecium, T.S. of ovary), floral formulas and floral diagrams.
4. Study of morphological specimens as per theory syllabus.
5. Anatomy of Plants :
 - (a) Study of simple and complex tissues through
 - (i) Cucurbita stem
 - (ii) Cycas rachis &
 - (iii) Nephrolepis rachis.
 - (b) Study of various types of vascular bundles and stele through permanent slides.
 - (c) Study of Tissue systems - Internal structures in :
 - (i) Root and stem of Maize
 - (ii) Root of Sunflower (Young) through permanent slides.
 - (iii) Stem of Sunflower (Young-i.e. excluding secondary growth).

GUJARAT UNIVERSITY

Details of Syllabus

F. Y. BSc.

Question wise list of specimens and marks

Biology Practical Paper - I

1. (a) Specimens A & B : Any two of the following types may be asked :
Algae : Volvox, Spirogyra, Voucheria Sargassum and Batrachospermum.
Fungi : Pythium, Mucor, Saccharomyces, Agaricus and Lichen.
Bryophytes : Riccia and Funaria.

- (b) Specimens C & D : Any two of the following types may be asked :
Pteridophytes :
 (i) Equisetum stem (ii) Equisetum cone
 (iii) Nephrolepis rachis (iv) Nephrolepis leaflet with sori
Gymnosperms :
 (i) Cycas rachis (ii) Cycas leaflet
 (iii) Cycas microsporophyll (iv) Pinus needle
 (v) Pinus male cone

2. (a) **Specimen—E** : Reproduction organ of any one of the following types may be asked :
- | | | |
|----------|-----------------|---------------------------|
| (i) | Spirogyra | : Scalaritorm conjugation |
| (ii) | Spirogyra | : Lateral Conjugation |
| (iii) | Vaucheria | : Sex organs |
| (vi) | Batrachospermum | : Cysto carp |
| (v) | Mucor | : Sporangium |
| (vi) | Funaria | : Antheridia |
| (vii) | Funaria | : Archegonia |
| (viii) | Equisetum | : Cone |
| (ix) | Nephrolepis | : Sporangium |
| (x) | Cycas | : Microsporophyll |
| (xi) | Pinus | : Male cone |
- (b) **Specimen—F** : Angiosperms Families as per theory syllabus.
2. (a) **Specimen—G** : Any one of the following may be asked for Internal structure i.e. Transverse Section :
- | | |
|---------|--|
| (i) | T. S. of Nephrolepis leaflet passing through sori |
| (ii) | T. S. of Cycas leaflet |
| (iii) | T. S. of Maize root (Adv.) |
| (vi) | T. S. of Maize stem |
| (v) | T. S. of Sunflower stem-excluding secondary growth |
- (b) study of complex Tissues i.e. conducting tissue.
- | | |
|---------|------------------------------|
| (i) | L. S. of Cacurbita stem |
| (ii) | L. S. of Cycas rachis |
| (iii) | L. S. of Nephrolepis rachis. |

GUJARAT UNIVERSITY
Practical Examination in Biology
F. Y. BSc.

[Total Marks : 70]

[Time : 5-00 hours]

Intructions :

- | | | |
|-------|---|----|
| (1) | “X” candidates should start with Q. 1, 2 and 3. | |
| (2) | “Y” candidates should start with Q. 4, 5 and 6. | |
| (3) | The candidates shall attempt Q. 7 whenever they are called for. | |
| 1 | (a) Identify and classify giving reasons. Draw the labelled diagrams of the peculiarities observed in the given specimens A and B. | 6 |
| | (b) Indentify and describe the structures with labelled diagrams as observed in the given specimens C and D. | 6 |
| 2 | (a) Expose the reproductive structure (organ) from the specimen “E”. Make a labelled sketch and show your preparation to the examiner. | 3 |
| | (b) Refer the specimen “F” to its respective family giving reasons including floral formula and floral diagram. Draw labelled diagrams. | 5 |
| 3 | Make a stained preparation of T.S. of the given material “G”. Show it to the examiner. Draw a neat and labelled diagram. | 4 |
| 7 | Identify and desribe as per instrutions : | 20 |

- Specimen - 1 : Identify and describe briefly (All types)
- Specimen - 2 : Identify and describe briefly (All types)
- Specimen - 3 : Identify and describe morphologically
- Specimen - 4 : Identify and describe morphologically
- Specimen - 5 : Identify and describe (Types of vascular bundle or stele).

- N.B. :**
1. The partial Examination will be of 5-00 hours duration and will be conducted in accordance with the skeleton paper and the appendix provided by Boards of Studies of Botany and Zoology jointly.
 2. The students are expected to record the work done in laboratory in journal.
 3. The journal is to be certified by teacher concerned and Head of the Department. Certified journal shall have to be produced while appearing at the time of Examination.

FOREWARD

Francis Bacon said almost three centuries ago that 'Knowledge is power'. Knowledge has played a vital role in shaping human civilization. Knowledge in science & technology (S & T) has annihilated distance, integrated nations and has made the world "global village".

India has made considerable progress in science and technology since independence. The development of India's human capital is an area where we have failed and could have done much better which is the real wealth today. There is lack of enthusiasm among students for higher studies in science and career in scientific research. It must be arrested at this stage if we do not want to face a serious shortage of good quality teachers and research scientists.

Biology and its allied disciplines have changed at a breathtaking pace over the past fifty years. Experiments, procedures and knowledge that once seemed completely beyond reach of biologists have now become almost commonplace. At the same time, our rapidly expanding understanding of the world of biology already is finding practical applications that affect our lives in never-before imaginable ways. Contrarily, there are number of difficult questions also raised. This demonstrates how biology is fraught with both promises and perils as we learn more and increase our power to transform the world around us.

Universities are gold mine of human capital and are the nurseries for creative talents to sprout. Powerful higher education set up and skilled human resources are the main strength of India. Looking into the future needs, several structural changes are taking place to improve the quality of higher education. University Education system is passing through dangerous phase. There are number of committees have been formed to reform the present situation. Curriculum Development Committee (CDC) constituted by UGC has also proposed Model Curriculum for Zoology. In connection, Gujarat University has also decided to update the curricula.

Objectives :

1. To update course contents in balanced state between basic science verses applied science, classical verses modern aspects.
2. To introduce learners to the diversity of life and various disciplines of biology. So as, they can get wisdom and will take keen interest while learning.
3. To prepare the curriculum such that it can attract, enthuse, sustain and promote the interest of learners for selecting biology and allied disciplines as their career and make them realize their choice is intellectually rewarded.
4. To evaluate suggested curriculum from CDC-UGC and accepting after making necessary alterations.
5. One important element of a nation's scientific enterprise is the production of qualified manpower. There has been a dramatic decline in the number of students registering in basic science courses across the country compare to booming in technical and management courses. This is presumably because the graduates do not normally get any meaningful job at the end of their three years. The education of degree level must ensure that they receive the academic rigour, the ability to function systematically and objectively, retain curiosity, and develop competence to learn, learn to work and learn to live.
6. To fulfil the reflection of recently announced Science & Technology Policy-2003. It reflects to advance scientific temper and fully intergrate S & T into all spheres of national activity on a sustainable basis.
7. To aim science education at producing students capable of updating knowledge independently, utilizing

acquired knowledge in problem-solving, working in multi-disciplinary teams, utilizing technology effectively and putting in a systematic and responsible work effort.

After long discussion, members have found out some pit falls in the Curriculum suggested by CDC. Law of nature suggests unity in diversity of life. How a learner is allowed to learn only two disciplines of Biology ? So, Curriculum suggested by CDC may not be accepted *in toto*. In addition, we also made alterations with background of previous syllabus, infra-structures of university and affiliated colleges, financial assistance of State Government etc.

GUJARAT UNIVERSITY
First Year B.Sc. (F. Y. B.Sc.)
(Biology - Zoology - Paper - II)
Details of Theory Paper

Unit I : Animal Diversity-Systematics (Non-Chordates) :

Salient feature and classification upto classes of non-chordates (excluding minor phyla) with suitable examples.

Phylum : Protozoa, Porifera, Coelenterata, Platyhelminthes, Nematelminthes, Annelida, Arthropoda, Mollusca, Echinodermata, Hemichordata.

(Classification as in Invertebrate Series by R.L. Kotpal, Rastogi Publication, Meerut).

Unit II : Animal Diversity-Type Study (Non-Chordates) :

General structures and morphology with functional anatomy of following Type animals :

- A. *Phylum : Protozoa* : Type- *Amoeba* (Structure, Locomotion, Nutrition, Excretion, Osmoregulation, Reproduction).
- B. *Phylum : Annelida* : Type-*Earthworm (Pheretima)* (External characters, Body wall, Digestive system, Blood vascular system, Excretory system, Nervous system, Reproductive system)

Unit III : Animal Diversity-Type Study (Non-Chordates) :

General structures and morphology with functional anatomy of following Type animals :

- A. *Phylum : Coelenterata* : Type-*Hydra* (Morphology, Locomotion, Histology, Nutrition, Nervous System, Reproduction)
- B. *Phylum : Arthropoda* : Type-*Cockroach (Periplanata)* (External Characters, Sexual dimorphism, Mouthparts, Compound eye, Digestive system, Respiratory system, Nervous system, Reproductive system). Excretory system, circulatory system.

Unit IV : Histology and Physiology (With reference to Mammals) :

- A. Histology : Stomach, Intestine, Liver, Pancreas, Kidney.
- B. Physiology :

1. Nutrition : Digestion and absorption of dietary components
2. Reproduction : Role of sex hormones in human beings
3. Integration of Functions (Steady state) :
 - 3.1 Necessities for sustenance of life (light, temperature, oxygen, water).
 - 3.2 Nature & characteristics of life (Metabolism, Reproduction, Growth, Responsiveness, Genetic material and Mutations)
 - 3.3 Control & Regulation of steady state (enzymatic, genetic, hormonal, nervous)

Unit V : Cell Biology, Genetics & Biotechnology :

- A. Cell Biology :
 1. Structure & working of light microscopes (Simple & Compound)
 2. Structure & working of Electron Microscopes (SEM & TEM)
 3. Diversity of cell size and shape
 4. Ultrastructure and General functions of :
 - (a) Typical Eukaryotic Cell.

- (b) Eukaryotic nucleus
- (c) Mitochondria
- (d) Endoplasmic reticulum
- (e) Eukaryotic ribosomes

B. Genetics :

1. Mendelian inheritance patterns & Laws of heredity.
2. Co-dominance (eg. Roan cattle and Blue birds)
3. Incomplete dominance (e.g. *Mirabilis jalapa*)
4. Varieties of gene expressions :
 - (A) Multiple alleles (e.g. ABO blood groups in Human)
 - (B) Lethal genes (e.g. Yellow mice, Sickle cell anaemia)
 - (C) Gene interactions - Collaboration (e.g. Comb in poultry birds)
5. Non-chromosomal / Cytoplasmic inheritance (e.g. Shell coiling in Snails)

C. Biotechnology :

- A Scope and Application of Biotechnology
- B Ethical issues & Biosafety regulations.

**Details of Practical Paper
(Based on Biology Paper - II)**

Unit I : Animal Diversity (Non-Chordates) :

A. Identification and Classification of Non-chordates :

- (a) Protozoa : Amoeba, Paramecium, Polystomella, Opalina, Vorticella.
- (b) Porifera : Leucosolenia, Euspongia, Grantia.
- (c) Coelenterata : Hydra, Obelia, Physalia, Aurelia, Gorgonia, Pennatula, Coral, Sea anemone, Cerianthus.
- (d) Platyhelminthes : Planaria, Liverfluke, Tape worm.
- (e) Nematoda : Enterobius, Ascaris
- (f) Annelida : Earthworm, Nereis, Aphrodite, Arenicola, Sabella, Leech.
- (g) Arthropoda : Apus, Cyclops, Balanus, Sacculina, Prawn, Crab, Lobster, Shrimp, Millepede, Centipede, Silver fish, Cockroach, Termites, Butterfly, Scorpion, Daphnia, Spider, Rat-flea.
- (h) Mollusca : Chiton, Dentalium, Pila, Aplysia, Unio, Octopus, Sepia, Cowry, Oyster.
- (i) Echinodermata : Brittle star, Sea urchin, Sea cucumber, Feather star, Starfish
- (j) Hemichordata : Balanoglossus

B. Visit to place(s) with rich biodiversity concerned to animals as mentioned above to study in their natural habitat.

C. Visit to museum.

Unit II & III : Animal Diversity-Type Study (Non-Chordates) :

A. A Permanent slides & Specimens :

1. Amoeba : Animal whole mount, binary fission, multiple fission.
2. Hydra : Hydra whole mount, Hydra with gonads (whole mount), T. S. Hydra, L. S. Hydra, Nematocysts in tentacles, T. S. passing through testis, T. S. passing through ovary.
3. Earthworm : T. S. passing through pharynx, T. S. passing through gizzard, T. S. passing through typhlosolar region, Ovary.

B. Dissections & Temporary mountings :

1. Earthworm :

- * External characters
- * Dissection of Digestive, Nervous and Reproductive systems.
- * Mountings of setae, septal nephridia, blood glands and spermatheca ovary,

2. Cockroach :

- * External characters
- * Dissection of Digestive & Nervous Systems.
- * Mountings of cornea, thoracic spiracles, mouthparts, walking leg.

Unit IV : Histology & Physiology :

1. Histology :

- * Permanent slides of T. S. mammalian stomach, intestine, liver, pancreas and kidney.
- * Temporary mountings of Squamous epithelium, Aereolar connective tissue, Striated muscles, Medulated nerve fibres from preserved frog.

2. Physiology :

- * Demonstration of human amylase on starch.
- * Slides/Specimen to study Integration of functions (Steady state)
 - (i) Reproduction-Budding in Hydra, Binary fission in Amoeba.
 - (ii) Growth-Metamorphosis in Frog & Insect.
 - (iii) Responsiveness in millepede.
- * Study through charts/model :
 - (i) Synapse
 - (ii) Feed back mechanism (hormonal)

Unit V : Cell Biology, Genetics & Biotechnology :1. Cell Biology :

- * Study through charts/models
 - 1. Light microscopes (Simple & Compound)
 - 2. Electron microscopes (SEM & TEM)
 - 3. Diversity of cell size and shape
 - 4. Ultrastructure of Typical animal cell, eukaryotic nucleus, mitochondria, endoplasmic reticulum, eukaryotic ribosome.
- * Visit to EM laboratory.

2. Genetics :

- (a) Solve the given genetic problem (as per appendix-A)
- (b) Study of genetics topic through chart/models (examples as per theory paper)
- | | | |
|---------------------------|-------------------------------|----------------|
| * Monohybrid cross | * Dihybrid cross | * Co-dominance |
| * Incomplete dominance | * Multiple alleles | * Lethal genes |
| * Collaborations of genes | * Non-chromosomal inheritance | |
- (c) Visit to research institute/industry concerned with biotechnological applications.

First Year B.Sc. Biology - Paper - II
Skeleton Paper for Practical Examination

Total Marks : 35

Time : 2.5 Hours

- Que. 4** Dissect the given animal so as to expose _____ system and show it to the examiner. Draw alabelled diagram. **12**
- Que. 5** Make a temporary preparation of _____ from the given animal. Stain if necessary and show it to the examiner. **6**
- Que. 6** Solve the given genetic problem with explanation. **5**
- Que. 7** Identify and Describe as per instructions. **20**
- Specimen-6-7 and 8 Animal Diversity (Chart/Specimen/Permanent Slides)
- Specimen-9 Histology/Physiology (Chart/Model/Specimen)
- Specimen-10 Cell Biology/Genetics (Chart/Model)
- Que. 8** Journal **4**

INSTRUCTIONS

1. A student selecting Bioogy group to the first year B.Sc. level, one of the paper will be offered as a "Zoology" i.e. Biology Paper-II.
2. This syllabus is to be completed by assigning There lectures of 55 minutes each per week and one paractical of Four periods of 55 minutes each per week.
3. The number of students in a practical batch should not exccceed fifteen.
4. There will be one Theory paper (i.e. Biology-II) and one practical at University examination. The pattern will be as follows :

Examination	Duration	External Marks	Internal Marks	Total Marks
Theory Paper	3 Hours	70	30	100
Practical	2.5 Hours	35	15	50

5. The distribution of marks and work load allotted as follows :

Unit No.	Topic of the Unit	Workload in hrs.	Marks allotted
I	Animal Diversity-Systematics (Non-chordates)	8	14
II	Animal Diversity-Type Study (Non-chordates)	18	14
III	Animal Diversity-Type Study (Non-chordates)	18	14
IV	HlStology & Physiology	23	14
V	Cell Biology Genetics & Biotechnology	23	14

6. Pattern of setting the question paper during the university examination :

The paper setter should observe that the topic from each unit should have coverd and tried to stick the weighted scheme. Each question should be opted internally.

7. No candidate will be allowed to appear in Practical examination in Zoology unless he/she performed 85% of practical work during academic year
8. No. candidate will be allowed to appear in practical examination in Zoology unless he/she produces his/ her duly certified journal.
9. Vists as mentioned in practical syllabus are suggested.

List of Recommended Books

1. **Ayer, E. K.** : Manual of Zoology, Vol. I & II
2. **Bagnara and Turner** : General Endocrinology, W. B. Saunders
3. **Barnes, R. D.** : Invertebrate Zoology, W. B. Saunders Co.
4. **Berrington, E. J. W. 1979** : Invertebrate structure and function. Boston-Houghton Mifflin and Elbs.
5. **De Robertis and De Robertis** : Cell and Molecular Biology. Saunders College.
6. **Farnsworth** : Genetics Harper & Row
7. **Ganong** : Review of Medical Physiology, Lange Publications.
8. **Gardner** : Principles of Genetics, Wiley Eastern Pvt. Ltd.
9. **Gupta P. K.** : Elements of Biotechnology, Rastogi Publications.
10. **Gupta P. K.** : Genetics Rastogi Publications
11. **Hyman L. H.** : The Invertebrates Vol. I & II , McGraw Hill Publicaton
12. **Jorden, E. L. and Varma P. S.** : Invertebrate Zoology.
13. **Kotpal, R. L.** : Investebrate Zoology Series, Rastogi Publication, Meerut.
14. **Lodish et al.** : Molecular Cell Biology, Scientific American Books
15. **Maglisch, P. A.** : Invertebrate Zoology
16. **Murray, R. K., Granner, D. K., Mayes, P. A. and Rodwell, V. W.** : 1990 Harper's Biochemistry Prantice-Hal Publications, London.
17. **Nalbandov, A. V.** : Reproductive Physiology
18. **Parker and Haswell** : Textbook of Zoology Vol. I & II
19. **Rastogi, V. B.** : Genetics
20. **Russel W. D. and Johnson G. B.** : Biology Wm. C. Brown Publishers, USA.

21. **Russel, W. D. and Hunter** : Biology of Higher Invertebrates, MacMillan.
22. **Russel, W. D. and Hunter** : Biology of Lower Invertebrates, MacMillan.
23. **Strickberger** : Genetics MacMillan.
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Appendix-A

Genetics problems

1. Gene A is dominated over gene a. What will be the Phenotypic ratio in the offsprings obtained from the folloing mating? (a) AaX aa, (b) AAXaa, (c) AaXAa. (d) AaXAA (*Solution : (a) Aa : aa=1:1 (b) All : equal (Aa); (c) 3:1 (AA, Aa, Aa=3; aa=1); (d) All equal (AA, AA, Aa, Aa).*
 2. Diagram a cross between a homozygous pea plant that produced yellow seeds (GG) and one that produced green seeds, (gg). Carry to the F₂ and summarize the expected results under the following headings : Phenotypes, Genotypes, Phenotypic riation.
 3. Red fruit ® is dominant to yellow (r) and tallness (T) is dominant over short (t) in Tomato plants. What phenotypic and genotypic ratio would result if one of the parent plants is red homozygous and tall homozygous and other is red heterozygous and tall hererozygous ? (*Solution : Phenotype -All equal; Genotype -RRTT, RRTt, RrTT, RrTt*)
 4. In rabbits, blacks skin (B) is dominated over brown skin (b) and Short hair (S) is dominated over long hair (s). If homozygous black-short haired male is crossed with a homozygous brown-long haired female, what will be the genotypes and phenotypes of F₁ and F₂ offsprings. (*Solution : F₁ -BbSs-all black-short haired; F₂- 9:3:3:1).*
 5. In Four O'Clock plants, red colour of flower (r) is incompletely dominant over white (r), the heterozygous having pink flower colour. What will be the offsprings in a cross between plants of red flowers and pink flowers ? (*Solution : Red : Pink=1 : 1).*
 6. A roan bull is bred to three cows. Cow A has the same fgenotype as the roan bull. Cow B is red and Cow C is white. What proportions of roan cows are expected in the offsprings of each group of cows ? (*Solution : (a) Roan bull X Roan cow =1 red : 2 Roan :1white; (b) Roan bull X Red cow =1 red; 1 Roan : (c) Roan bull X White cow =1 Roan : 1 white).*
 7. In Poultry birds two genes R and P are responsible for Inheritance of comb, what will be the Phenotypic ratio in the offspring obtained from the following crosses ?
 - (a) Homozygous Rose comb x Homozygous Walnut
 - (b) Heterozygous Walnut x Single comb
 - (c) Heterozygous Rose x Heterozygous Pea comb.
 8. A couple preparing for marriage. Both have blood group AB. They ask you what type of blood group their children may have. What would you tell them and how would you explain your conclusions ? (*Solution : Blood group of children can be A. AB or B).*
 9. A man has blood group A and his wife has blood group B. They have four children all having different blood groups) i.e. A, B, AB and O. Is it possible ? How ? (*Solution : yes it is possible, Heterozygous Parents).*
 10. A couple believed that they have brought the woring baby home from the hospital. The wife is having blood group 'O' could the baby be theirs? (*Solution yes).*
 11. The disease sickle cell anaemia is caused by a gene (Hb^S). Hb^A gene is for normal blood cells. If both the parents are carriers, then what will be the ratio of their children ? (*Solution : 1 Sickel Cell Anaemic : 2 Carrier : 1 Normal).*
 12. A pure sinistral female snail is crossed with a pure dextral male . Give the appearance of F₁ with reasons of each instance. Give the phenotype of F₂ and phenotypes of F₃ if F₂ snails are self-fertilized. (*Solution : F₁-all sinistral ; F₂-all dextral; F₃-3 dextral : 1 sinistral).*
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