ST. XAVIER'S COLLEGE (AUTONOMOUS), AHMEDABAD
GUJARAT UNIVERSITY B.Sc. 5th Semester ZOOLOGY SYLLABUS
(Effective from June 2020)

The syllabus is to be completed by assigning FOUR hours for each Theory Paper/TWO hours for each SEC Paper and a total of TWELVE hours for the Practical Papers, per week.

Pattern of Examination :

Theory (Ext. 280 marks & Int. 120 marks)

Practicals (Ext. 140 marks & Int. 60 marks)

Examination	Duration	External Marks	Internal Marks	Total Marks
Theory-Paper ZO-5501 **(** Animal diversity (nonchordates) **)**	3 hours	70	30	100
Theory-Paper ZO-5502 **(** Animal diversity (chordates) **)**	3 hours	70	30	100
Theory-Paper ZO-5503 **(** Animal Biochemistry& Metabolism**)**	3 hours	70	30	100
Theory-Paper ZO-5504 **(** Cytology, Developmental Biology **)**	3 hours	70	30	100
SEC Paper ZO-5401	3 hours	70	30	100
Theory (Total)		350	150	500
Practical-Paper ZO-5505L (A-1) **(** Based on Theory Paper ZO-5501 **)**	5 hours	35	15	50
Practical-Paper ZO-5505L (A-2) **(**Based on Theory Paper ZO-5502 **)**	5 hours	35	15	50
Practical-Paper ZO-5505L (B-1) **(** Based on Theory Paper ZO-5503 **)**	5 hours	35	15	50
Practical-Paper ZO-5505L (B-2) **(** Based on Theory Paper ZO-5504 **)**	5 hours	35	15	50
Practicals (Total)		140	60	200

INSTRUCTIONS

1. Each theory question paper comprises of FIVE QUESTIONS. All questions carry equal marks, i.e. 14 marks (hence 14 x 5 = 70) in the End-Sem/Final Examinations.
2. The theory question papers will have to be set according to the paper-style and the pattern of marksdistribution provided on page no. 9, as-well-as all other instructions mentioned in this syllabus.

3. The practical question papers will have to be set according to the paper-style and the pattern of marksdistribution provided on page nos. 12, 17, 21 & 26, as-well-as all other instructions mentioned in this syllabus.
4. In order to be qualified to appear for the Final Practical Examinations, the student must submit his/her duly certified journals during the examinations.

B.Sc. 5th Semester
ZOOLOGY SYLLABUS

PAPER ZO-5501
(ANIMAL DIVERSITY (nonchordates))

Unit I ***TYPE STUDY : LEUCOSOLENIA & SHEEP LIVER FLUKE*****;**

A. General structure & morphology with functional anatomy of the following animal **:**

Porifera **:** Type – *Leucosolenia* - Classification, Habits & Habitat, Ext. characters, Histology of Body wall, L.S. of Leucosolenia, Reproduction & Development.

B. General structure & morphology with functional anatomy of the following animal **:**

Platyhelminthes **:** Type – **Sheep Liver Fuke** (*Fasciola hepatica*) – Classification, Habits & Habitat, Ext. characters, Histology of Body Wall, Digestive system, Excretory system, Respiration, Nervous system, Reproductive systems & Reproduction.

Unit II ***TYPE STUDY: SCORPION & GENERAL TOPICS OF NONCHORDATES*****;**

A. General structure & morphology with functional anatomy of the following animal **:** *Arthropoda* : Type – **Scorpion** – Classification, Habits & Habitat, Ext. characters, Digestive system, Book-lungs, Circulatory system, Excretory organs, Nervous system, Sense organs and Reproductive systems.

B.General topics **:**

1. *Porifera***:** Skeleton and Canal systems
2. *Coelenterata* **:** Polymorphism
3. *Platyhelminthes* : Parasitic adaptations
4. *Annelida***:** Nephridia & Coelomoducts.

Unit III ***TYPE STUDY: CUTTLEFISH AND GENERAL TOPICS OF NONCHORDATES*****;**

A. General structure & morphology with functional anatomy of the following animal **:**

Mollusca **:** Type – **Cuttlefish** (*Sepia officinalis*) - Classification, Habits & Habitat, External Characters, Digestive System, Respiratory system, Circulation system, Excretory system, Nervous system, Sense organs and Reproductive systems.

B. General topics **:**

1. *Arthropoda***:** Crustacean larvae (Nauplius, Zoea, Megalopa) and Excretory organs.
2. *Mollusca***:** Foot and Torsion & Detorsion.

Unit IV ***TYPE STUDY: STARFISH AND GENERAL TOPICS OF NONCHORDATES;***

A. General structure & morphology with functional anatomy of the following animal **:**

*Echinodermata***:** Type- **Starfish** (*Asterias*) - Classification, Habit & Habitat, External Characters, Body wall, Digestive system, Water vascular system, Reproductive system.

B. General topics **:**

1. *Echinodermata* **:** Larval forms (Bipinnaria, Brachiolaria, Echinopluteus, Ophiopluteus, Auricularia, Doliolaria)

2. *Minor phyla***:** General characters of Phoronida, Brachiopoda and Echiuroidea with suitable example

***Reference Books for* Units I, II, III & IV:**

1. **Textbook of Invertebrates**, R. L. Kotpal, Rastogi Publications, Meerut.
2. **Manual of Zoology**, E. K. Ayyer, Vol. I & II.
3. **Invertebrate Zoology**, Jordan and Verma, S. Chand & Company, Delhi.

PAPER ZO-5502

(ANIMAL DIVERSITY (chordates))

Unit I ***TYPE STUDY : LABEO & GENERAL TOPICS OF FISHES;***

A. General structure &morphology with functional anatomy of the following animal **:**

*Osteichthyes***:** Type **-Labeo** (*Labeo rohita*) - Classification, Habits & Habitat, External characters, Digestive System, Respiratory system, Heart, Arterial & Venous systems, Brain and Urinogenital systems.

B. General topics**:**

1. *Pisces***:** Differences between Chondrichthyes & Osteichthyes, Swim bladders, Accessory respiratory organs, Parental care, Migration, Types of Scales and Types of fins.
2. *Dipnoi***:** Habits, habitat and peculiarities of Protopterus, Lepidosiren and Neoceratodus.

Unit II ***TYPE STUDY: GARDEN LIZARD & GENERAL TOPICS OF AMPHIBIANS AND REPTILES;***

A. General structure & morphology with functional anatomy of the following animal **:***Reptilia* **:**

Type - **Garden lizard** (*Calotes versicolor*) - Classification, Habits & Habitat, External characters, Digestive System, Respiratory system,

Heart, Arterial & Venous systems, Brain and Urinogenital systems.

B. General topics **:**

1. *Amphibia***:** Neoteny and Parental care.
2. *Reptilia* **:** Dinosaurs (Brontosaurus, Triceratops, Tyranosaurus, Dimetrodon, Stegosaurus, Pteranodon, Ichthyosaurus, Iguanodon), Theories of extinction of dinosaurs, Temporal openings

Unit III ***TYPE STUDY: PIGEON & GENERAL TOPICS OF AVES AND MAMMALIA;***

A. General structure & morphology with functional anatomy of the following animal **:**

Aves **:** Type **- Pigeon** (*Columba livia*) - Classification, Habits & Habitat, External characters, Digestive system, Respiratory system, Circulatory systems, Brain, Excretory System, Reproductive systems and Types of feathers.

B. General topics **:**

1. *Aves***:** Birds are glorified reptiles, Migration.
2. *Mammalia***:** - Adaptations of aquatic mammals,

- Dentition(Types, Dental formulae of Rat, Cat, Dog, Rabbit, Human, Cow, Horse, Elephant).

Unit IV*ANIMAL DIVERSITY* (Chordates) – *General topics* : Comparative anatomy of **:**

a) Alimentary canals
b) Aortic arches
c) Venous systems
d) Brain
e) Heart
f) Urinogenital system

***Reference Books for* Units I, II, III & IV:**

1. **Textbook of Vertebrates**, R. L. Kotpal, Rastogi Publications, Meerut.
2. **Chordate Zoology**, P. S. Dhami, and J. K. Dhami, S. Chand & Co., Delhi.
3. **Introduction to Chordates**, T. C. Majupuria, Pradeep Publications, Jalandhar.

PAPER ZO-5503

(ANIMAL BIOCHEMISTRY and METABOLISM)

Unit I *CARBOHYDRATES* :

1. Asymmetry, Isomers, Optical isomerism and Mutarotation.
2. Introduction, definition and classification of Carbohydrates.
3. **Monosaccharides (*No particular example should be asked as a short note or full question*) :**
   - ▪▪Definition, General formula.
   - ▪▪Classification upto Hexoses (with structures of suitable examples)
   - ▪▪Ring/Cyclic structures (Fischer & Haworth) ▪▪Chemical properties **:**
     a) Reaction involving glycosidic –OH group.
     b) Reaction involving alcoholic –OH group (Etherification).
     c) Reactions involving both, glycosidic as-well-as alcoholic –OH groups (Esterification).
     d) Reactions involving both, –OH as-well-as –CHO/-C=O groups **:**▪▪Oxidation **:** Sugar acids, Oxidation with metal hydroxides. ▪▪Reduction **:** Reaction with sodium amalgam, Reaction with dilute alkalis.
   - ▪▪Osazone formation **:** Reaction with phenyl hydrazine.
4. **Disaccharides :**
   - ▪▪Definition.
   - ▪▪Flow-chart of classification, based upon the type of glycosidic linkages.
   - ▪▪Occurrence, formation, structure and general properties of Maltose, Lactose, Cellobiose and Sucrose.
5. **Polysaccharides :**
   - ▪▪Definition.
   - ▪▪Flow-chart of classification, based upon structures and functions.
   - ▪▪Occurrence, formation, structure and general properties of **:**
     a) Homopolysaccharides – Starch, Glycogen, Cellulose and Chitin.
     b) Heteropolysaccharides – Mucopolysaccharides **:** Hyaluronic acid,Chondrotin, Chondroitin sulphate.
6. Biological significance of Carbohydrates.

Unit II *LIPIDS* :

1. Introduction and definition.
2. **Components :**
   a) Alcohols
   b) Fatty acids
3. **Types of Fatty Acids :**
   a) *Saturated acids* **:** Butyric, Palmitic, Stearic and Arachidic.
   b) *Unsaturated acids* **:**Monoethenoid, Diethenoid, Triethenoid and Tetraethenoid.
4. **Classification of Lipids :**
   a) *Simple***:** i. Triglycerides (Fats) ii. Waxes (*Formulae not required*)
   b) *Compound***:** Phospholipids **:** Phosphoglycerides **:**
      i. Lecithin
      ii. Cephalins iii.Plasmalogens
   c) *Derived Lipids* **:** Steroids (*Basic steroid nucleus and Cholesterol only*).
5. **Properties :**
   a) *Physical* - Colour, Odour, Taste, Solubility, Melting point, Specific gravity, Insulation and Emulsification.
   b) *Chemical* -
      i) Reactions involving –COOH group (Hydrolysis, Saponification and Hydrolytic rancidity)
      ii) Reactions involving double bonds (Hydrogenation, Halogenation and Oxidative rancidity)
6. Biological significance of Lipids.

Unit III *ENZYMES*:

1. Nomenclature & Classification.
2. Chemical nature of enzymes.
3. Mechanisms of enzyme action.
4. Factors affecting enzyme activity/enzyme catalyzed reaction **:**
   a) Temperature
   b) pH
   c) Inhibitors
   d) Enzyme concentration
   e) Substrate concentration

3.Some clinically important enzymes **(*to be asked only as objective questions in Q.5 only*)** *Serum acid phosphatase, Serum alkaline phosphatase, SGOT, SGPT, LDH, Serum creatine phosphokinase, Serum amylase, Serum lipase and Serum isocitrate dehydrogenase*

Unit IV *METABOLISM* :

A. *Metabolism of Carbohydrates***:**

1.Glycogenesis (structures not required)
2.Glycogenolysis (structures not required)
3.Glycolysis (EM Pathway) (structures required)
4.Krebs Cycle (structures required)
5.ETS (structures not required)
6.Glucogenesis (structures required)

7.Gluconeogenesis (structures not required)
8.HMP Shunt Pathway (structures required)

B. *Metabolism of Proteins***:**

1.Deamination
2.Transamination
3.Decarboxylation
4.Urea synthesis (structures required) **C.** *Metabolism of Lipids***:**

1. Glycerol metabolism (structures not required)
2. Fatty acid metabolism **:**
   ---β-oxidation of saturated fatty acids (structures required).

***Reference Books for* Units I, II, III & IV :**

1. **Elementary Biochemistry,** J. L. Jain, S. Chand & Company, Delhi.
2. **Biochemistry,** I. Stryer, Freeman.
3. **Harper's Biochemistry,** Lange,McGraw-Hill.
4. **Principles of Biochemistry,** Lehninger, CBS Publications.

PAPER ZO-5504

(CYTOLOGY, DEVELOPMENTAL BIOLOGY)

Unit I *CYTOLOGY* (Tools and Techniques) :

1. Phase contrast microscope
2. Confocal microscope
3. Electron Microscopes (TEM, SEM)
4. Paper chromatography (Ascending, Descending and Circular)
5. TLC
6. Column Chromatography
7. General principle of electrophoresis; SDS-PAGE (vertical slab)

Unit II *CYTOLOGY* :

1. Karyotyping & Karyotype
2. Ultrastructure and functions of Plasma membrane **:**
   a) Brief concept of chemical composition.
   b) Fluid Mosaic model of plasma membrane
   c) Specialized structures of plasma membrane **:**
      - Specialization due to outpushings/evaginations.
      - Specialization due to inpushings/invaginations.
      - Specializations due to contact **:**
        Desmosomes, Hemi-desmosomes, Septate desmosomes, Tight junctions, Gap junctions, Terminal bars and Interdigitation.
   d) Functions of plasma membrane **:**
      Permeability, Osmosis, Diffusion, Facilitated transport, Active transport, Endocytosis, Exocytosis.
3. Classification of chromosomes based upon **:**

- the location of their centromeres
- their functions (i.e. somatic & sex chromosomes)

4. Chromosomes:
   A) Structural organization of the Metaphase Chromosome
   B) Giant chromosomes - Polytene chromosome and Lampbrush chromosome.
5. Typical Cell Cycle
6. Mitosis
7. Meiosis
8. Ultrastructure & general functions of Centrioles/Basal bodies.
9. Ultrastructure & general functions of Cilia/Flagella.
10. Cell differentiation.

***Reference Books for* Units I and II :**

1. **Principle and Techniques of Biochemistry and Molecular Biology,** keith Wilson, John Walker,Cambridge University Press.
2. **Principal & Techniques of Biophysics, V.Kumaresan, Saras Pub.** Nagercoil, Kanyakumari.
3. **Cytology**, P. S. Verma & V. K. Agarwal, S. Chand & Company, Delhi.
4. **Cell Biology**, C. B. Power, Himalaya Publishing House,Nagpur.
5. **Introductory Cytology,**V.B.Rastogi, Kedarnath Ramnath Publication**.**,Meerut.
6. **Cellular and Molecular Biology**, De Robertis and De Robertis, Saunders Pub.
7. **Cell and Molecular Biology, Phililip** ,Sheeler and Donad Bianchi.,John Wiley a & Sons.,INC.

Unit III *DEVELOPMENTAL BIOLOGY* :

1. Gametogenesis
2. Types of eggs depending upon the quantity of yolk. (Microlecithal/Oligolecithal, Mesolecithal and Polylecithal/Macrolecithal/Megalecithal)
3. Types of eggs depending upon the distribution of yolk. (Homolecithal/Isolecithal, Centrolecithal and Telolecithal)
4. Laws of cleavage
5. Patterns of cleavage - radial, biradial, spiral(dextral, sinistral), bilateral, incomplete/meroblastic and complete/holoblastic.
6. Regeneration
7. Embryonic induction
8. Growth - Measurement of growth - Types of cell growth
   - Factors controlling growth
9. Types of Placentation in mammals (histological).

Unit IV *DEVELOPMENTAL BIOLOGY* :

Chick Embryology (upto 72 hours) **:**

---Structure of a hen's unfertilized egg.
---Fertilization, Fate map, Cleavage, Blastulation, Gastrulation.
---Description of 21hr. 33hr. 48hr. and 72hr. old chick embryos.
---Development of brain upto 72 hrs.
---Development of heart upto 72 hrs.
---Flexion & Torsion.
---Extra-embryonic membranes.

***Reference books for* Unit III & IV :**

1. **Chordate Embryology**, P. S. Verma & V. K. Agarwal, S. Chand Pub., New Delhi.
2. **Elements of Chordate Embryology**, R. Prakash & P. C. Jain, S. Nagin Pub., ND.
3. **Embryology**, R. MAthur & M. Mehta, Anmol Pub., New Delhi.
4. **A Textbook of Animal Embryology**, A. K. Berry, Emkay Pub., Delhi.
5. **Embryology**, N. Arumugam, Saras Publications, Kanyakumari.
6. **Introduction of Embryology**, Balinsky, CBS College Publishers.
7. **Vertebrate Zoology**, R. L .Kotpal, Rastogi Publication, Meerut.
8. **Developmental Biology**, V. B. Rastogi, Rastogi Publications, Meerut.

PAPER ZO-5401

(BIOSTATISTICS, HUMAN REPRODUCTIVE HEALTH, ZOOLOGICAL PARKS, NUTRITION)

SUBJECT ELECTIVE COURSE (SEC)

Unit-I *BIOSTATISTICS* :

1. Mean
2. Mode
3. Median
4. SD, SE
5. Student's t-test
6. Chi-square test
7. ANOVA

***Reference books for* Unit I :**

1. **Genetics and Biostatistics**, R.P. Meyyan, Saras Pub., Nagercoil, Kanyakumari dist.

Unit-II *HUMAN REPRODUCTIVE HEALTH* :

1. Anatomy of ♂&♀ reproductive systems
2. Causes of Infertility (in ♂&♀)
3. Methods of Contraception (in ♂&♀)
4. STDs (Gonnorhea, Syphillis, Genital herpes, Trichomoniasis, Non-gonococcal Urethritis (UGA).
5. Personal hygiene

Unit-III *ZOOLOGICAL PARKS* :

1. History of Zoological parks in India **(*not to be asked in the exams*)**
2. Aim of zoological parks
3. *ex situ* &*in situ* conservation
4. Classification of zoological parks, with suitable examples
5. Career opportunities in zoological parks
6. Wildlife Protection Act, 1972 and National Zoo Policies 1998

Unit-IV *NUTRITION* :

1. Macronutrients and their main sources :
   Carbohydrates, Proteins and Lipids
2. Micronutrients and their main sources **:** Vitamins and Minerals

***Reference books for* Unit-IV**

1. **Elementary Biochemistry,** J. L. Jain, S. Chand & Company, Delhi.
2. **Biochemistry,** C.B.Powar and G.R.Chatwal, Himalaya Publication,Nagpur.

PAPER ZO-5505L (A-1)

(*Based on Theory Paper ZO-5501*)

1. *ANIMAL DIVERSITY* (Nonchordates):

Study of Leucosolenia by charts/models/specimens/ppt **:**

1. W.M. of *Leucosolenia*
2. L.S. of *Leucosolenis*

2. *ANIMAL DIVERSITY* (Nonchordates):

Study of Sheep Liver Fluke by charts/models/specimens/ppt **:**

1. WM of liver fluke
2. T. S. through bodywall of liver fluke
3. Reproductive systems of liver fluke
4. Life cycle of liver fluke (larvae)

3. *ANIMAL DIVERSITY* (Nonchordates):

Study of Scorpion by charts/models/specimens/ppt **:**

1. External characters of scorpion
2. Digestive system of scorpion
3. Nervous system of scorpion
4. Male reproductive system
5. Female reproductive system
6. Booklungs and Pectine

4. *ANIMAL DIVERSITY* (Nonchordates):

Study of Cuttlefishby charts/models/specimens/ppt **:**

1. Study of external characters.
2. Study of Digestive system
3. Study of Nervous system
4. Jaws, Spermatophore, Cuttle bone

5. *ANIMAL DIVERSITY* (Nonchordates):

Study of Starfish by charts/models/specimens/ppt **:**

1. Study of external characters.
2. Study of Water-vascular system.
3. Tube feet.

6. ***ANIMAL DIVERSITY*** **(Nonchordates):**

Study by charts/models/specimens/ppt to study peculiaritiesof **:**

Canal systems in Porifera, Spicules, Porpita, Physalia, Obelia (W.M. & Medusa), Crustacean larvae(Nauplius, Zoea, Megalopa), Echinoderm larvae(Bipinnaria, Brachiolaria, Echinopluteus, Ophiopluteus, Auricularia, Doliolaria), Bonelia, Lingula, Phoronis.

PAPER ZO-5505L (A-2)

(*Based on Theory Papers ZO-5502*)

1. ***ANIMAL DIVERSITY*** **(Chordates) :**

Study of Labeoby charts/models/specimens/ppt **:**

External characters, Digestive system, Urinogenital system, Respiratory system, Brain.

2. ***ANIMAL DIVERSITY*** **(Chordates) :**

Study of Calotesby charts/models/specimens/ppt **:**

External characters, Digestive system, Arterial system, Venous sysem, Urinogenital system, Brain.

3. ***ANIMAL DIVERSITY*** **(Chordates) :**

*Study of Pigeonby charts/models/specimens/ppt of***:**

External characters, Digestive system, Heart, Arterial & Venous systems, Brain, Excretory System, Reproductive system, Types of feathers and Air-sacs.

4. ***ANIMAL DIVERSITY*** **(Chordates) :**

Study by charts/models/specimens/ppt to study peculiarities of **:**

Swim bladder, Accessory respiratory organs in fishes, Petromyzon, Myxine, Protopterus, Eel, Neoteny(Siren, Necturus, Axolotl larva), Parental care(Male Hippocampus, Male Kurtus, Male Arius, Female Tilapia, Alytes, Pipa, Rhacophorus, Hyla, Rhinoderma).

5. ***ANIMAL DIVERSITY*** **(Chordates) :**

Study by charts/models/specimens/ppt to study peculiarities of **:**

- Aquatic mammals (Dolphin, Whale, Walrus, Seal),
- Dentition in mammals (dental formulae of Human, Cow, Horse, Elephant, Rat, Dog, Cat), - -
Dinosaurs (Brontosaurus, Triceratops, Tyranosaurus, Dimetrodon, Stegosaurus, Pteranodon, Ichthyosaurus, Iguanodon).
- Temporal openings in reptiles.

6. ***ANIMAL DIVERSITY*** **(Chordates) :**

*Study of comparative anatomy by charts/specimens/ppt***:**

- Alimentary canals, Aortic arches, Venous systems, Brain.

PAPER ZO-5505L (B-1)

(*Based on Theory Paper ZO-5503*)

1. *CARBOHYDRATES* :

Detectionof carbohydrates **:**

--- Monosaccharides – Glucose and Fructose

--- Disaccharides - Lactose, Maltose and Sucrose

2. *PROTEINS* :

Detection of Proteins – Albumin and Casein

3. *LIPIDS* :

Study by charts/ppt of **:**

- Basic steroid nucleus and Cholesterol.

4. *COLORIMETRIC ESTIMATION OF*:

- Proteins (Preparation of Std. Curve by Biuret method).
- Glucose (Nelson-Somogyi method)
- Cholesterol in Serum/Plasma (Ferric chloride method). -Creatinine in urine.

4. *PREPARATION OF ATOMIC MODELS OF CARBOHYDRATES* :

--- Acyclic as-well-as all cyclic structures ofRibose, Arabinose, Ribulose, Glucose, Mannose, Galactose, Fructose and Tagatose.

--- Maltose, Lactose and Sucrose.

5. *PREPARATION OF ATOMIC MODELS OF PROTEINS* :

--- All amino acids except heterocyclic amino acids.

--- Glysyl-Alanine, Glysyl-Valine and Ala-Ser.

6. *PREPARATION OF ATOMIC MODELS OF LIPIDS* :

- Glycerol, Butyric acid, Crotonic acid, Tributyrin, Lecithins, Cephalins

3. *ENZYMES* :

Study by charts/ppt of **:**

Factors affecting enzyme activity **:**

1. Temperature
2. pH
3. Graph showing effect of [S] on the velocity of an enzyme catalyzed reaction.

4. *METABOLISM* :

Study by charts/ppt of **:**

1. Glycogenesis (structures not required).
2. Glycogenolysis (structures not required).
3. Glucogenesis (structures required).
4. Gluconeogenesis (structures not required).
5. Glycolysis (EM Pathway) (structures required)

6. Krebs Cycle (structures required).
7. ETS (structures not required).
8. HMP Shunt Pathway (structures required).
9. Urea synthesis (structures required).
10. β-oxidation of saturated fatty acids (structures required).

PAPER ZO-5505L (B-2)

(*Based on Theory Paper ZO-5504*)

1. *CYTOLOGY* :

Study by charts/models/ppt with brief description & applications of **:**

1. Electron Microscopes (TEM, SEM)
2. Confocal microscope
3. Phase contrast microscope
4. ***Demonstration only*** of Slab Gel Electrophoresis **2.*CYTOLOGY* :**

Study by charts/models/ppt of **:**

1. Fluid Mosaic model of Plasma membrane.
2. Specialized structures of plasma membrane **:**
   a) Specialization due to outpushings/evaginations
   b) Specialization due to inpushings/invaginations
   c) Specializations due to contact **:**
   Desmosomes, Tight junctions and Gap junctions
3. Transmission & Scanning electron micrographs of a metaphase chromosome
4. Nucleosome
5. Ultrastructure of primary constriction
6. Typical Cell cycle
7. Mieosis
8. Ultrastructure of Polytene chromosome and Lampbrush chromosome
5. Hammerling's experiment on *Acetabularia*
6. Bantook's experiment on zygote of *Mayetiola destructor*
7. Spemann's experiment on eggs of newt
8. Somatic hybridization **4.*CYTOLOGY* :**

Techniques **:**

1.Preparation of temporary slides of **:**
   a) Mitosis in Onion root tip
   b) Barr-body in cheek cells

2. Human Karyotyping (preparation of chart only)

3. Ascending Paper Chromatography.

***2. DEVELOPMENTAL BIOLOGY* :**

Study by charts/ppt of **:**

1. Spermatogenesis, Oogenesis
2. Types of eggs depending upon the amount of yolk (as per theory syllabus)
3. Types of eggs depending upon the distribution of yolk (as per theory syllabus) 4.Patterns of cleavage (as per theory syllabus)

5.Regeneration **:**

- Regeneration in *Planaria*
- Regeneration in *Salamander*

Histological process involved in regeneration

6. Embryonic induction **:**
   - Spemann and Manglod's experiment of embryonic induction in *Triturus*
   - Curtis' experiment of embryonic induction in *Xenopus*
7. Types of cell growth.
8. Types of placenta in mammals (histological).

3. *CHICK EMBRYOLOGY* :

1. *Study by charts/ppt of***:**

   -Blastula and Gastrula stage of chick embryo
2. *Study & preparation of permanant slides of* W.M. of 21, 33, 48 & 72 hrs. old chick embryos

ST. XAVIER'S COLLEGE (AUTONOMOUS), AHMEDABAD GUJARAT UNIVERSITY B.Sc. 6th Semester ZOOLOGY SYLLABUS (effective from June 2016)

The syllabus is to be completed by assigning FOUR hours for each Theory Paper/TWO hours for each SEC Paper and a total of TWELVE hours for the Practicals, per week.

Pattern of Examination :
Theory (Ext. 280 marks & Int. 120 marks)
Practicals (Ext. 140 marks & Int. 60 marks)

Examination	Duration	External Marks	Internal Marks	Total Marks
Theory-Paper ZO-6501 **(** Ecology, Pollution, Animal diversity (chordates), Mol. Biol.& Genetics **)**	3 hours	70	30	100
Theory-Paper ZO-6502 **(** Human Physiology **)**	3 hours	70	30	100
Theory-Paper ZO-6503 **(** Toxicology, Animal Biotechnology, Animal Behaviour, Mammalian Histology **)**	3 hours	70	30	100
Theory-Paper ZO-6504 **(** Applied Zoology **)**	3 hours	70	30	100
SEC Paper ZO-6505	3 hours	70	30	100
Theory (Total)		350	150	500
Practical-Paper ZO-6506L (A-1) **(** Based on Theory Paper ZO-6501 **)**	5 hours	35	15	50
Practical-Paper ZO-6506L (A-2) **(** Based on Theory Paper ZO-6502 **)**	5 hours	35	15	50
Practical-Paper 6506L (B-1) **(** Based on Theory Paper ZO-6503 **)**	5 hours	35	15	50
Practical-Paper 6506L (B-2) **(** Based on Theory Paper ZO-6504 **)**	5 hours	35	15	50
Practicals (Total)		140	60	200

INSTRUCTIONS

1. Each theory question paper comprises of FIVE QUESTIONS. All questions carry equal marks, i.e. 14 marks (hence 14 x 5 = 70) in the End Sem/Final Examinations.
2. The theory question papers will have to be set according to the paper-style and the pattern of marksdistribution provided on page no. 38, as-well-as all other instructions mentioned in this syllabus.
3. The practical question papers will have to be set according to the paper-style and the pattern of marksdistribution provided on page nos. 44, 48, 52 & 56, as-well-as all other instructions mentioned in this syllabus.
4. In order to be qualified to appear for the Final Practical Examinations, the student must submit his/her duly certified journals during the examinations.

B.Sc. 6th Semester
ZOOLOGY SYLLABUS

PAPER ZO-6501

(ECOLOGY, POLLUTION, ANIMAL DIVERSITY (chordates), MOL. BIOL. & GENETICS)

Unit I *ECOLOGY* :

A) *Adaptations* **:**

Arboreal, Cursorial, Volant, Desert and Deep-sea. **B)**

Marine Ecosystem **:**

1. Physico-chemical aspects of Marine Environment **:** Light, Temperature, Pressure, Salinity, Currents and Tides.
2. Zonations in Marine Environment/Sea.
3. Biodiversity in Rocky shore and Sandy shore. **C)** *Fresh water ecosystem***:**

a)Characteristics **:** Salinity, pH, Water current, Transparency, O_2, CO_2, Pressure, Density, Light, Temperature and Thermal stratification (Summer & Winter stratifications).

b)Lentic system - Ponds **:** Characteristics, Types, Zonations, Flora and Fauna. Lakes **:** Characteristics, Types.

c)Lotic system - Rivers **:** Characteristics (Current, Land-water interchange, O_2)
Zonations (Flowing-water, Rapid/Riffle, Pool zones)
Types of river-beds (Eroding, Depositing, Sandy). **D)** *Terrestrial ecosystems* (Biomes) **:** Tundra, Savanna, Grassland, Taiga, Desert and Tropical Rain Forest and Temperate Forest. **E)** *Ecological Succession* **:**

- Kinds of Succession
- Process of succession
- Patterns of succession (Hydrosere, Xerosere)
- Monoclimax & Polyclimax theories of Ecological Succession.

***Reference Books for* Unit I :**

1. **Fundamentals of Ecology**, P. S. Odum, Saunders.
2. **Concepts of Ecology**, N. Arumugam, Saras Publication, Nagercoil.
3. **Ecology and Environment**, P. D. Sharma, Rastogi Publications, Meerut.
4. **Ecology**, Ricklefs. W. H. Freeman.
5. **Concepts of Ecology**, 4th Edition, E. J. Kormondy, Prentice-Hall of India.

Unit II *POLLUTION* :

A) Various pollutants & their effects on animal life (***maximum 6-8 sentences for each pollutant***) **:**

1. Air pollutants :
   a) Gaseous - CO, SO_2, NO_2.
   b) Particulate - Dust, Lead, Aerosol.
2. Water pollutants :
   Biological organisms (bacteria & protozoa), acids, alkalies, dyes, hydrogen sulphide, pesticides, fertilizers, toxic metals (Fluoride, Hg, Arsenic), faeces, domestic wastes, and suspended matters.
3. Soil/Land Pollutants :
   a) Industrial solid wastes - Toxic metals like Cu, Pb, Ni.
   b) Urban wastes - Garbage, paper, glasses, metal cans, plastics, faeces.
   c) Agricultural sources - Wastes from cattle sheds & poultry farms, fertilizers, pesticides and fumigants.

4. Radioactive Pollution
5. Noise Pollution

B) Biological Treatment of Effluents **:**1.Trickling filters system
2. Stabilization Ponds.
3. Aerated lagoons.

***Reference Book for* Unit II :**

1. **Environmental Pollution (Popular Science)** , N. Manivasakan, National Book Trust, New Delhi.
2. **Ecology and Environment**, P. D. Sharma, Rastogi Publications, Meerut.

UNIT III*ANIMAL DIVERSITY* (Chordates) – *Type Study* &*General topics* :

A) General structure and morphology with functional anatomy of the following animal **:** *Mammalia***:** Type **-Rat** (*Rattus rattus*) - External characters, Digestive system, Respiratory system, Heart, Arterial & Venous systems, Brain, Excretory System and Reproductive systems. **B)** General topics **:**

1) Types of beaks and feet in birds
2) Basics of birding
3) V.S. of mammalian skin
4) Derivatives of mammalian skin (Claw, Nail, Hoof, Horn and Hair) ***Reference Books for* Unit III:**

1. **Vertebrates**, R. L. Kotpal, Rastogi Publication, Meerut.
2. **Chordate Zoology**, P. S. Dhami, and J. K. Dhami, S. Chand & Co., Delhi.
3. **Introduction to Chordates**, T. C. Majupuria, Pradeep Publication, Jalandhar.

UNIT IV*MOLECULAR BIOLOGY&GENETICS* :

A) *Molecular Biology* **:**

1) DNA Replication in Prokaryotes and Eukaryotes
2) DNA Synthesis **:** Basic idea of DNA polymerases, primer DNA, template (*in vitro*) DNA, Proof-reading by polymerases, Continuous & Discontinuous synthesis, DNA ligase, DNA helicases, DNA-binding proteins and DNA topoisomerases.
3) Types of DNA **:** A-DNA, B-DNA, Z-DNA
4) Types of RNA **:** m, t, r and sn
5) Protein synthesis (in details)
6) Southern Blotting Technique 7)Northern Blotting Technique
8) Western Blotting Technique
9) Polymerase Chain Reaction (PCR)
10) Sanger's method of DNA Sequencing
11) DNA Fingerprinting **B)** *Genetics***:**

1) Linkage of genes **:** Definition, Types (with examples), Factors affecting linkage.
2) Crossing over **:** Definition, Mechanism, Types (with examples), Factors affecting crossing over, Crossing over in *Drosophila*
3) Chromosome maps

***Reference Books for* Unit IV :**

1. **Molecular Cell Biology**, Lodish et. al., Scientific American Books.
2. **Cell Biology**, C. B. Powar, Himalaya Publishing House.
3. **Cytology and Genetics**, P. K. Gupta, S. Chand & Company, Delhi.
4. **Elements of Biotechnology**, P. K. Gupta, S. Chand & Company, Delhi.

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PAPER ZO-6502

(HUMAN PHYSIOLOGY)

Unit I*HUMAN PHYSIOLOGY – LYMPHATIC SYSTEM* :

1.Brief introduction. **(*can be asked only as objective questions in Q. 5 only*)**

2.Lymphatic vessels.

3.Structure of lymph node.

4.Lymph circulation **:**

---Route, Thoracic duct, Right Lymphatic duct, Maintenance.

5. Lymphatic organs **:**

---Tonsils, Spleen, Thymus gland.

6. Non-Specific Resistance to Disease **:**---Skin & Mucous Membranes **:**

---Mechanical factors

---Chemical factors -

--Antimicrobial substances **:**

---Interferon

---Complement

---Properdin

---Phagocytosis

---Kinds of phagocytes

---Mechanism

---Inflammation

---Fever

7.Functions of the Lymphatic system.

Unit II*HUMAN PHYSIOLOGY – IMMUNITY* :

1. Brief introduction. **(*can be asked only as objective questions in Q. 5 only*)**
2. Immunity (Specific Resistance to Disease) ---Antigens/Immunogens : ---Definition

---Characteristics

- Major Histocompatible Complex Antigens

---Antibodies/Immunoglobulins **:**

---Definition

---Structure

---Cellular & Humoral Immunity :

---Formation of T cells & B cells

---T cells & Cellular Immunity -

--B cells & Humoral Immunity

3. Disorders, Homeostatic Imbalances :

---Hypersensitivity (Allergy) -

--Tissue rejection

---Autoimmune diseases

---AIDS

---SCID 4.Types

of Immunity :

- Naturally acquired active & passive immunities -Artificially acquired active & passive immunities

5.Functions of Immunity.

Unit III*HUMAN PHYSIOLOGY – RESPIRATION* and *CARDIOLOGY* :

A. *Respiration*:

1. Exchange of respiratory gases
2. Transport of respiratory gases :
   a) Oxygen
   b) Carbon dioxide 3.Carbon monoxide poisoning

4.Control of respiration :

a) Nervous control - Respiratory centre : Medullary rythmicity area, pneumotaxic area and apneustic area.
- Regulation of respirator centre activity : Cortical influences and Inflation reflex.

b) Chemical stimuli - Hypercapnia

c) Other factors - body temperature, sudden pain, etc.

B. *Cardiology*:

1. Origin and Conduction of heart beats
2. Normal cardiac cycle
3. Concept of ECG
4. Factors affecting rate of heart beats :
   - Antonomic control
   - Carotid sinus reflex
   - Aortic reflex
   - Right heart reflex
   - Chemicals
   - Temperature
   - Emotions
   - Sex & Age

Unit IV*HUMAN PHYSIOLOGY – REPRODUCTION* and *MUSCLE CONTRACTION* :

A. *Reproduction* :

1. Role of male sex hormones in men.
2. Role of female sex hormones in women.
3. Constituents of normal semen.
4. T.S. of uterus
5. Menstrual cycle.
6. Menopause.

B. *Muscle contraction* :

1. T.S. of a skeletal muscle
2. Histology of a striated muscle fibre
3. Motor unit, NMJ
4. Mechanism of muscle contraction and relaxation

***Reference Books for* Units I, II, III & IV:**

1. **Principles of Anatomy and Physiology,** Tortora and Anagnostakos, HarperCollins College Publishers, 4th Edition.
2. **Animal Physiology and Related Biochemistry**, H. R. Singh, Shobhan Lal Naginchand & Co. Edu. Pub., Jalandhar.
3. **Textbook of Animal Physiology**, A. K. Berry, Emkay Pub., New Delhi.

PAPER ZO-6503

(TOXICOLOGY, ANIMAL BIOTECHNOLOGY, ANIMAL BEHAVIOR, MAMMALIAN HISTOLOGY)

Unit I *TOXICOLOGY* :

1. Brief Introduction. **(*can be asked only as objective questions in Q. 5 only*)**
2. Definitions of Toxicology, Toxicity, Toxicants and Xenobiotics. **(*only for Q. 5*)**
3. Classification of Toxicants **:** Corrosives, Irritants, Neurotics and Cardiac poisons.
4. Types of toxicity **:** Acute, Subacute, Chronic.
5. Toxicity rating chart **(*for information only, not to be asked in the exam*)**.
6. Economic Toxicology **:**
   a) Food Toxicology (Major Food Contaminants)
   b) Drug Toxicology
7. Areas of Toxicology **(*individual areas should not be asked in the exam*) :** Mechanistic, Regulatory, Forensic, Clinical, Environmental, Industrial and Ethnic/Geographical.
8. Factors affecting Toxicity **:** Size of animal, Age, Sex, Species, Strain, Feed & Feeding, Changes in internal environment, Habitually used drugs, Route & Rate of administration, Environment, Plasma-Protein binding.
9. Entry of toxicants into the animal's body **:** Gastro-intestinal route, Skin, Lungs, Parenteral administration.

***Reference Books for* Toxicology:**

1. **Fundamentals of Toxicology**, Pandey, Shukla and Trivedi, New Central Book Agency (P) Ltd., Kolkata.
2. **Modern Toxicology. Volumes 1-3**, P. K.Gupta and D. K. Salunkhe, Metropolitan Book Co. Pvt. Ltd., New Delhi.

Unit II*ANIMAL BIOTECHNOLOGY* :

1. Advantages and disadvantages of Tissue Culture
2. Substrates on which cells grow and Gas phase for Tissue Culture - in brief.
3. Disaggregation of tissue.
4. Tissue Culture techniques.
5. Organ Culture techniques.
6. Whole Embryo Culture technique.
7. IVF and ET in humans & livestock.
8. Hybridoma technology.

***Reference book for* Animal Biotechnology :**

1. **Elements of Biotechnology**, P. K. Gupta, Rastogi Publication, Meerut.
2. **Culture of Animal Cells-A Manual of Basic Technique**, R. Ian Freshney, 5th Ed., A John Wiley & Sons Inc. Pub.

Unit III*ANIMAL BEHAVIOUR* (Ethology) :

1. Introduction to Ethology **(*not to be asked in the exam*)**
2. Learning **:**
   - Definition.
   - Types of Learning **:** (a) Imprinting
     (b) Habituation
     (c) Classical conditioning (e.g. Pavlov's expt.)
     (d) Insight learning
     (e) Instinctive learning
     (f) Operant learning (e.g. Skinner's expt.) (g) Instrumental conditioning **:**
     ---Discrete trials procedures
     ---Active avoidance learning
     ---Escape learning
     ---Passive avoidance learning
3. Reproductive behavior patterns **:**
   - Courtship **:** Introduction, Need of courtship.
     ---Courtship signals **–** e.g. Balloon Fly (*Hilara sartor*)
     ---Persuasion & Appeasement **–** e.g. ♂ Stickleback's zigzag dance, Herring gull.
     ---False information – e.g. Scorpion fly (*Hylobittacus apicalis*)
   - Concept of Polygamy and Polyandry.
4. Communication in/between bats and moths.
5. Social organization in baboons.

***Reference Books for* Animal Behaviour :**

1. **Animal Behaviour**, Mohan P. Arora, Himalaya Publishing House.
2. **Essentials of Behaviour**, P. J. B. Slater, Cambridge Univ. Press.
3. **An Introduction to Animal Behaviour**, Manning, Addition Wesley.

Unit IV *MAMMALIAN HISTOLOGY* :

Histophysiology of the following endocrine glands **:**

1. Hypothalamus (*Histology not needed*)
2. Pituitary
3. Testis
4. Ovary
5. Thyroid
6. Parathyroid
7. Adrenal.

***Reference Books for* Histology :**

1. **Principles of Anatomy and Physiology**, Tortora and Grabowski, HarperCollins College Publications.
2. **A Textbook of Animal Histology**, A. K. Berry, Emkay Publications, Delhi.
3. **Bailey's Textbook of Histology**, The Williams & Wilkins Company, Baltimore.

PAPER ZO-6504
(APPLIED ZOOLOGY)

Unit-I *APICULTURE* :

1. Introduction. **(*Not to be asked in the exams*)**
2. Classification of *Apis*
3. Different species of honey bees
4. Castes in honey bees
5. Structures and functions of each caste of honey bees
6. A typical natural bee hive/honey comb
7. Communication in honey bees
8. Life cycle of honey bee
9. Apiculture - choice of flora
   - choice of bees
10. Apiculture methods **:** Old and Modern methods
11. Honey
12. Beeswax

Unit-II *SERICULTURE* :

1. Introduction **(*Not to be asked in the exams*)**
2. Classification of *Bombyx mori*
3. Introduction to different species of silkworms used for sericulture 4.External features and Life cycle of *Bombyx mori*
5. Sericulture industry **:**
   - Requirements for sericulture
   - Mulberry
   - Rearing of silkworm **:** Grainage management
   - Post-cocoon processing
6. Chemistry and uses of silk

***Reference books for* Units I & II :**

1. **Arthropoda**, R. L. Kotpal, Rastogi Publications, Meerut.
2. **Economic Zoology**, G. S. Shukla and V. B. Upadhyay, Rastogi Publications, Meerut.
3. **Economic and Applied Entomology**, Kumar and Nigam, Emkay Pub., Delhi.

Unit-III *POULTRY SCIENCE* :

1. History **(*Not to be asked in the exams*)**
2. Importance of Poultry Science
3. Different characters to be considered for selection of the perfect poultry birds
4. Poultry breeds (***only external characters, separate breeds should not be asked in exam*) :**
   a) American Breeds (Plymouth rock, New Hampshire)
   b) Mediterranean Breeds (White Leghorn)
   c) English Breeds (Sussex)
   d) Asiatic Breeds (Brahmas)
5. Poultry houses – Necessity, Location, Types of roofs
6. Poultry equipments –Incubators, Waterers, Feeders, Brooders
7. Care of egg-laying hen
8. Gradation & Preservation of eggs
9. Poultry diseases – Symptoms, treatment and prevention of Ranikhet, Pulorium, Ascariasis and Coccidiosis

Unit-IV *FISHERY SCIENCE* :

1.Types of fisheries **:**

- Capture fisheries
- Inland fisheries
- Marine fisheries

2. Fresh-water, brackish water and marine water fisheries of Gujarat
3. Role of fisheries in Indian economy
4. Mariculture with reference to Prawn culture and Pearl culture
5. Fish by-products (*as per practicals syllabus*)
6. Shell fishery (*crustacean and molluscan*)
7. Preservation & Processing of fishes and prawns
8. Fish pathology

***Reference books for* Units III :**

1. **Poultry**, G. C. Banerjee, Oxford & IBH Publishings, New Delhi.
2. **Poultry Science**, N. T. Mehta and M. I. Ghasura, Univ. Granth Nirman Board, Gujarat.
3. **Economic Zoology**, g. S. Shukla and V. B. Upadhyay, Rastogi Publications, Meerut.

***Reference books for* Units IV :**

1. **A Textbook of Fishery Science and Indian Fisheries**, C.B.L. Srivastava, Kitab Mahal, Allahabad.
2. **Fish and Fisheries of India**, V.G. Jhingran, Hindustan Publishing Corp.(India), New Delhi.
3. **Economic Zoology**, g. S. Shukla and V. B. Upadhyay, Rastogi Publications, Meerut.

PAPER ZO-6401

(CANCER BIOLOGY, CYTOLOGICAL TECHNIQUES)

SUBJECT ELECTIVE COURSE (SEC)

CANCER BIOLOGY :

Unit I

1. What is cancer?
2. Types of cancer.
3. Physiological & Morphological characteristics of cancer cells.
4. Possible causes of carcinogenesis **:**
    a) Mutation theory.
    b) Virus theory.
    c) Metabolic theory.
    d) Hormonal disturbance theory.
    e) Irritation theory.

Unit II

1. Chemical carcinogens.
2. Mechanism by which carcinogens induce cancer.
3. Oncogenic viruses.

4. Retroviruses.

***CYTOLOGICAL TECHNIQUES*(Cytological study of dead cells) :**

Unit III

1. Introduction **(*not to be asked in the exam*)**.
2. Types of slide preparations – W.M., smears, squashes, sections.
3. Fixation & Fixatives **:**
   a) Purpose of fixation.
   b) Some commonly used chemical fixatives **:**
      Acetic acid, Potassium dichromate, Ethanol, Formaldehyde, Osmium tetroxide, Bouin's fixative, Carnoy's fixative.
   c) Some specialized chemical fixatives **:**
      Dichromate fixatives – Zenker's fluid, Helly's fluid, Heidanhain's fluid.
      Chromic acid fixatives – Lo Bianco's fluid.
      Mercuric fixatives – Gilson's fluid, Lebrun's fluid.
   d) Removal of fixatives – Lugol's solution, Lenoir's fluid, Lithium carbonate.

Unit IV

1. Fixation by Freezing **:**
   a) Freeze-Drying method.
   b) Freezing-Substitution method.
   c) Freeze-Etching method.
2. Dehydration.
3. Embedding.
4. Sectioning by Ordinary microtome, Cryotome, Ultramicrotome.
5. Staining & Stains for light microscopy and electron microscopy.

***Reference books* :**

1. **Cytology**, P. S. Verma & V. K. Agarwal, S. Chand & Company, Delhi.
2. **Cell Biology**, C. B. Power, Himalaya Publishing House.
3. **Handbook of Basic Microtechnique**, Peter Gray, McGraw-Hill Book Company.
4. **Cellular and Molecular Biology**, De Robertis and De Robertis, Saunders Pub.
5. **Essential Cell Biology**, Bruce Alberts, et. al., Garland Pub. Inc., New York.

Paper-style and pattern of marks-distribution

Q. No.	UNIT NO.	MARKS
Q.1.A	Unit-I **OR** Unit-I	**07**
Q.1.B	Unit-I **OR** Unit-I	**07**

Q.2.A	Unit-II **OR** Unit-II	**07**
Q.2.B	Unit-II **OR** Unit-II	**07**
Q.3.A	Unit-III **OR** Unit-III	**07**
Q.3.B	Unit-III **OR** Unit-III	**07**
Q.4.A	Unit-IV **OR** Unit-IV	**07**
Q.4.B	Unit-IV **OR** Unit-IV	**07**
Q.5	14 objective questions of 1 mark each. **(** 3 questions from each of the four Units and remaining 2 questions from any of the four Units **)**	**14**

PAPER ZO-6505L (A-1)

(***Based on Theory Paper ZO-6501*** **)**

1. ***ECOLOGY*** **:**

A) *Ecological adaptations of the following animals according to their habitat***:**

Adaptations		**Animals**
Sedentary & Fixed Animals	**:**	Sponges, Gorgonia
Tubeworms	**:**	Arenicola, Sabella
Planktons	**:**	Daphnia
Nectons	**:**	Fish, Prawn
Benthic	**:**	Solefish, Sting rayfish
Arboreal	**:**	Hyla, Squirrel
Burrowing	**:**	Snake, Hedgehog
Flying	**:**	Bird, Bat

B) *Study by charts of* **:**

1. Biomes (Tundra, Savanna, Grassland, Tropical Rain Forest, Tiaga and Desert)
2. Summer & Winter Thermal stratifications in Fresh water ecosystem.

2. ***POLLUTION*** **:**

Estimation of **(***in water samples***) :**

1. Titrimetric – Acidity, Alkalinity, Calcium hardness (using Murexide indicator),
   Total Hardness (using Eriochrome Black T indicator), Ca^{++} and Mg^{++}
2. Colorimetric – Phosphate

3. ***ANIMAL DIVERSITY*** **(Chordates) :**
Study by charts/specimens/models/ppt of **:**

1. Sympathetic nervous system of frog.
2. V.S. of mammalian skin.
3. Derivatives of mammalian skin (Claw, Nail, Hoof, Horn and Hair)

4. ***ANIMAL DIVERSITY*** **(Chordates) :** Basics of birding

5. ***ANIMAL DIVERSITY*** **(Chordates) :**

A) *Study of shark by charts/specimens/models/ppt of* **:**

1. The V, VII, IX, X cranial nerves.
2. Membranous labyrinth.

B) *Study of rat by charts/specimens/models/ppt of* **:**

1. External characters.
2. Digestive, Arterial, Venous, Respiratory & Urinogenital systems and Brain.
3. Striated muscle fibres and Medullated nerve fibres.

6. ***MOLECULAR BIOLOGY & GENETICS*** **:**

A) Study by charts of **:**

--- DNA replication in Prokaryotes and Eukaryotes
--- DNA synthesis (*in vitro*)
--- Types of DNA
--- Types of RNA
--- Protein synthesis
--- Southern blotting
--- Thermocycler
--- DNA fingerprinting

B) Genetic Problems 1 to 5 (see **APPENDIX**)

APPENDIX for Paper ZO-6505L (A-1)

GENETICS PROBLEMS

1. A female animal with genotype AaBb is crossed with a double recessive male aabb. Their progeny include **:**

AaBb - 442
Aabb - 458 aabB - 054
aabb - 046

Explain these results.

Solution :

Two genes linked 10 map units apart. The female parent was of the type AB/ab.

2. In man, three genes are linked in one chromosome. Assume one parent in dominant for all three genes, the other recessive. In test cross the following numbers were obtained **:**

ABC	-	225
Abc	-	245
aBc	-	098
AbC	-	102
ABc	-	144
abC	-	156
aBC	-	014
Abc	-	016
Total	-	1000

(a) Arrange the series in the correct linear order.
(b) What is the crossing over percentage?
(c) Is there interference?
(d) What is coefficient of coincidence ?

Solution :

a) CAB
b) Double crossing over, Percentage between 1 and 2 = 3%
c) There is interference
d) Co-efficient of co dominance = 0.4%

3. Assume that an individual homozygous for ++ is crossed with one homozygous for ab and that F_2 from this cross is as follows **:**

++	334
+b	37
+a	38
Ab	87

Is this result different from that which you would expect if segregation of a and b were independent?

Solution :

(a) Yes – Here phenomenon of linkage has occurred (b)15% crossing over percentage.

4. In rabbit, two recessive genes produce a solid body colour and long-hair respectively in contrast to a spotted body colour and short-hair, which result from the dominant alleles. The result from a cross between the heterozygous spotted short-haired rabbit and solid long-haired rabbits are as follows **:**

Spotted short	-	48
Spotted long	-	05

Solid short - 07 Solid long - 40

In terms of crossing over units, how far apart are these genes on the chromosome?

Solution :

These two genes are 12 units apart on the chromosome.

5. In rabbit , black and short-hair are characters resulting from two dominant genes. The recessive alleles of these genes produce brown and long-hair . When we mate homozygous black, short-haired with brown, long-haired rabbits and test cross the offsprings, we obtain the following results **:**

Black short-haired	-	29
Brown long-haired	-	33
Black long-haired	-	35
Brown short-haired	-	27

From these results, would you conclude that these genes are located on the same chromosome? Why? If your answer is yes, what is the percentage of crossing over?

Solution :

(a) These two genes are located on the same chromosome. Out of 124 offsprings - 62 offsprings are recombinants due to crossing over between black short-haired and brown long-haired. (b)50% crossing over.

PAPER ZO-6505L (A-2)

(***Based on Theory Paper ZO-6502*** **)**

1. ***HUMAN PHYSIOLOGY*** **– Immunity :**

*Study by charts/ppt of***:**

1. Lymphatic circulatory system in humans
2. T.S. through a lymph node
3. T.S. through spleen
4. T.S. through thymus
5. Structure of a typical antibody
6. IgG, IgA, IgM, IgD, IgE

2. ***HUMAN PHYSIOLOGY*** **– Blood :**

1. Estimation of Hb in your own blood
2. Preparation of Haemin crystals from your own blood
3. Preparation of your own blood smear to identify different WBCs. (Stain with Geimsa stain only)
4. Total RBC count in your own blood
5. Total WBC count in your own blood
6. Determination of your own bleeding time
7. Determination of your own blood clotting time

3. ***HUMAN PHYSIOLOGY*** **- Respiration :**

Study by charts/ppt of **:**

1. Respiratory muscles
2. Alveolar-capillary (respiratory) membrane
3. Exchange of the respiratory gases

4. Oxygen-haemoglobin dissociation curve

2. ***HUMAN PHYSIOLOGY*** – **Cardiology :**

Study by charts/ppt of **:**

1. Origin & conduction of heart beats.
2. Normal ECG.

4. ***HUMAN PHYSIOLOGY*** **– Reproduction :**

Study by charts/ppt of **:**

1. T.S. of uterus.
2. Menstrual cycle.
3. Molecular structures of Testosterone, Estrogen and Progesterone.

5. ***HUMAN PHYSIOLOGY*** **– Muscle contraction :**

Study by charts/ppt of **:**

1. T. S. of muscle.
2. Ultrastructure of sarcomere.
3. Ultrastructure of Neuro-muscular junction.

PAPER ZO-6505L (B-1)

(***Based on Theory Paper ZO-6503*** **)**

1. ***HISTOTECHNOLOGY*** **:**

1. Study of microtome
2. Method of staining for preparation of permanant slides

2. ***MAMMALIAN HISTOLOGY*** **:**

Identification & histological study of the following organs by permanant slides/charts/ppt of **:**T.S. of Testis, Ovary, Thyroid,Parathyroid, Adrenal, V.S. of Pituitary

3. ***TOXICOLOGY*** **:**

*Study by chart/ppts of***:**

LD_{50} test

4. ***ANIMAL BIOTECHNOLOGY*** **:**

Study by chart/ppts of **:**

1. Classical organ culture technique
2. Trowel's type II culture chamber
3. Hybridoma technology

5. ***ANIMAL BEHAVIOUR*** **(Ethology) :**

Study by charts/ppt of **:**

1. Pavlov's experiment
2. Skinner's experiment
3. Insight learning
4. Communication in/between bats & moths
5. Social organization in Baboons
6. Reproductive behavior patterns **:**

a. Courtship signals – e.g. Balloon Fly (*Hilara sartor*)
b. Persuasion & Appeasement – e.g. ♂ Stickleback's zigzag dance, Herring gull.
c. False information – e.g. Scorpion fly (*Hylobittacus apicalis*)

6. ***ANIMAL BEHAVIOUR*** **(Ethology) :**
Study of human habituation by playing cards.

PAPER ZO-6505L (B-2)

(***Based on Theory Paper ZO-6504*****)**

1. *APICULTURE* :

Study by charts/ppt **:**

1. Castes in honey bee
2. A typical natural bee hive/honey comb
3. A typical artificial/movable bee hive
4. Round dance of honey bees
5. Waggle dance of honey bees
6. Life cycle of honey bees
7. Nutritional & medicinal value of honey

2. *SERICULTURE* :

Study by charts/ppt **:**

1. Life cycle of *Bombyx mori*
2. Chemistry of silk
3. Uses of silk

3. *POULTRY SCIENCE* :

Study by charts/specimens/ppt **:**

1. Different breeds of poultry birds **(*as per theory syllabus*)**
2. Types of incubators **(**Hot-air Flat type, Mammoth**)**
3. Types of feeders **(**Linear with rod, Linear with openings, Linear with wire grill-top, Hanging**)**
4. Types of waterers **(**Earthen bowl, Simple water fountain, Water trough**)**
5. Types of brooders **(**Kerosene, Electric)
6. Types of roofs **(**Shed type, Unequal double slanted, "A" shaped, Semi-Monitor type, Monitor type**)**
7. Visit to a poultry farm for knowledge of selection of site for the poultry farm, different breeds of poultry birds, poultry feeding & watering, Incubation, brooding and houses.

4. *FISHERY SCIENCE* :

1. Fish by-products **(**Conch, Cowry, Pearl oyster, Edible oyster, Isin glass, Fish glue, Fish meal, Fish flour, Fish selage, Fish fertilizer, Fish skin, Body oil, Liver oil**)**
2. Visit to any fresh water/ marine fisheries centre for the knowledge of induced breeding, preservation/processing of fishes, by-products and mariculture.