SYLLABUS FOR CREDIT BASED SEMESTER SYSTEM

B.Sc. ZOOLOGY – JUNE - 2021

SEMESTER - I

GUJARAT UNIVERSITY CBCS BASED PROPOSED COURSE
(Effective from June 2021)
B.Sc. SEMESTER – I ZOOLOGY - 101 (Theory)

(Non Chordate Animal Diversity, Mammalian Anatomy, Histology and Physiology of Urinary system; Genetics and Economic Zoology)

Unit: 1 A. Non Chordate Animal Diversity :

- General characters of Invertebrate
- Type study : **Paramoecium**

- Systematic position with salient features
- External & Internal structure (Brief)
- Locomotion
-Food & feeding mechanism
-Osmoregulation
-Reproduction: Binary fission and Conjugation

B. General Topics: 1. Developmental stages in Platyhelminthes (Liver fluke, Tapeworm)
2. Parasitic adaptations in Platyhelminthes

Unit: 2 Mammalian Anatomy (Human): Histology & Physiology of the Urinary System

1. Structure of Urinary system of Mammals
2. Anatomy and Histology of the kidneys:
   - External and Internal Anatomy of the Kidneys
   - Overview of kidney functions
   - Blood Supply to Kidneys
3. The Nephron :
   - Parts of a Nephron
   - Histology of the Nephron and Collecting Duct
4. Renal Physiology
   - Glomerular Filtrations
   - The Filtration Membrane
   - Net Filtration Pressure
   - Tubular Reabsorption
   - Tubular Secretion
   - Hormonal Regulation in brief (Name of the Hormones and their function only)
5. Clinical Connection: (Brief introduction)
   - Proteinurea
   - Ketonurea
   - Dialysis

Unit III Genetics

1. Concept of Gene
2. Mendelian laws of Heredity
3. Incomplete dominance (e.g. Mirabilis jalapa)
4. Co-dominance (e.g. Roan cattle)
5. Multiple alleles e.g.- ABO blood groups in human
   - Rh Factor- Erythroblastosisfoetalis
6. Complementary genes (Flower colour in *Odoratus lathyrus*)
7. Epistasis (Dominant and Recessive)
8. Extra chromosomal inheritance (Kappa particles in Paramoecium & Shell coiling in Snail)
9. Human pedigree analysis

Unit IV Economic Zoology

1. Brief account of Beneficial & Harmful Insects
   - Beneficial insects: Honey bee; Silkworm ; Lady bugs
   - Harmful insects: Mosquitoes; Bedbugs ; Aphids

2. Vermiculture and Vermicomposting Introduction, Definition, Scope and Importance of Vermitechnology, Suitable breeds, Construction of vermicompost pits (Outdoor & Indoor spaces), Properties and benefits of vermicompost.

3. Pearl Culture-Introduction, Formation & uses of Pearl, Pearl oyster farming (brief study)

Reference Books:

1) Textbook of Invertebrates, R.L. Kotpal, Rastogi publications, Meerut
2) Invertebrate Zoology, Jordan and Verma, S.Chand & Company, Delhi
3) Integrated Principles of Zoology, C.P.Hickman,JR., L. S. Roberts , A.Larsed
4) The McGraw Hill Companies, New York
5) Principles of Anatomy & Physiology, Tortora and Grabowski, Harper Collins College Pub.
6) Animal Physiology and Related Biochem. H.R.Singh, Shobhan Lal Naginchand & Co. Edu. Pub., Jalandhar.
7) Textbook of Animal Histology. A.K.Berry, Emkay Pub, New Delhi.
8) Genetics, P.K.Gupta, Rastogi Publications, Meerut.
9) Genetics, V.B.Rastogi, Kedarnath Ramnath, Meerut
10) Introduction to Genetics, R.P.Meyyan, rastogi Publication, Meerut
11) Economic Zoology, Sarkar, kundu & Chaki, New Central Book agency(P) Ltd. New Delhi
12) Economic Zoology (5th edition), G.S Shukla, V. B. Upadhyay, Rastogi Publications, Meerut, New Delhi
13) Applied Zoology, N. Arumugam, MuruganRajeswar & Prabhu, Saras Publication,Tamilnadu

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GUJARAT UNIVERSITY
CBCS BASED PROPOSED COURSE
(Effective from June 2021)
B.Sc. SEMESTER-I
ZOOLOGY - 102 (Practical)

1. Histology and Physiology of urinary system: (Charts / Photographs)
   - Frontal Section of kidney.
   - Renal corpuscle (Internal view)
   - Cortical and juxtamedullary nephron
   - Blood supply of kidney

2. Analysis of Normal and Abnormal constituents of urine:
   - Physical analysis
     Colour, Odour, Specific gravity (Urinometer), pH
   - Chemical analysis
     Sugar, Protein, Bile Salts, Ketones, Urea, Creatinine
   - Microscopies (Photographs) : RBC; WBC; Platelets, Epithelial cells and phosphate crystals

3. Study of Paramoecium : (Slides / Photographs)
   Paramoecium (W.M.)
   Locomotion by ciliary movement (slide preparation/video clip)
   Reproduction : Binary fission (through permanent slide)
   Conjugation (through permanent slide)

4. Developmental stages of liverfluke (Miracidium, Sporocyst, Radia, Cercaria, Metacercaria & Adult)

5. Developmental stages of Tapeworm (Cysticercus larva or bladder worm)

6. Genetics:
   a) Study of genetics through charts (example as per theory syllabus).
      - Monohybrid cross
      - Dihybrid cross
      - Incomplete dominance
      - Co-dominance
      - Multiple alleles
      - Complementary genes
      - Epistasis (Dominant and Recessive)
      - Extra chromosomal inheritance (Through chart)
      - Human pedigree analysis (through chart)
   b) Genetics problems (as per Appendix)

7. Economic Zoology (by photographs)
   - Economic importance of following insects (By photographs or by Permanent slides)
     - Beneficial insects : Honey bee; Silkworm ; Lady bugs
     - Harmful insects: Mosquitoes; Bedbugs ; Aphids
   - Vermiculture, Vermicomposting process, Indian Breeds of earthworm
   - Pearl Culture-Pearl oysters (*Pinctada fucta, Pinctada margaritifera*, *Pinctada maxima*), Structures used for pearl oyster farming.

GUJARAT UNIVERSITY
CBCS BASED PROPOSED COURSE
B.Sc. SEMESTER – I
Zoology Practicals-102

Total Marks- 70

Q.1. Analyse the following properties of urine. 15
(Physical analysis, Chemical analysis, Microscopies)

Q.2.Complete the nomenclature of given figure and describe about it. 10
(Charts of Urinary system)

Q.3 Explain the given Paramoecium chart. 07

Q.4 Solve the given genetic problem. 06

Q.5 Identify the specimens as per instructions. 21

1. Identify and describe. (Beneficial & harmful insects)
2. Identify and describe. (Genetics charts-Monohybrid cross / Dihybrid cross / Incomplete dominance / Co-dominance, Extra chromosomal inheritance/ pedigree chart)
3. Identify and describe. (Genetics charts- Multiple alleles / complementary genes/ epistasis)
4. Identify and describe. (Developmental stages of Liver fluke)
5. Identify and describe. (Parasitic adaptation in Platyhelminthes, Cysticercus or bladder worm larva of tapeworm.)
6. Identify and describe. (Economic zoology-Vermi culture)
7. Identify and describe. (Economic zoology- Pearl culture)

Q.6 Viva Voce 06

Q.7 Journal 05

Genetics problems: (Appendix for practical 4b)

1. In guinea pig a dominant gene B produces black and its recessive allele b produces white. What are the possible mating types ? What is the genotype and phenotype of the F1 offspring?

Solution Hint : Possible mating type : 1. BB × BB ; 2. BB × Bb ; 3. BB × bb ;

4. Bb × Bb ; 5. Bb × bb ; 6. bb × bb

2. In rabbit, the colored coat (C) is dominant to albino coat (c). What type of offspring would you expect if cross a pure line colored rabbit, with an albino rabbit ? Show both genotypes in the first and second generations.

Solution Hint : P : CC × cc 1st generation : Cc- colored

2nd generation : CC-colored Cc-Colored ; cc - albino

3. Red fruit (R) is dominant to yellow (r) and tallness (T) is dominanat over short (t) in plants. What phenotypic and genotypic ratio would result if one of the parent plants is red homozygous & tall homozygous and other is red heterozygous & tall heterozygous?

Solution Hint : P: RRTT × RrTt ; Result : Same Phenotype in all offspring, and
Genotype = RRTT, RRTt, RrTT, RrTt.

4. In the mouse the gene for colored coat (C) is dominant to the gene for albino (c) and the gene for straight whiskers (W) is dominant to the allele for bent whiskers (w). Find out the phenotypes of the following crosses.

1. Ccww × ccww 2. ccww × ccWw 3. CcWw × CcWw

Solution Hint : 1st Cross : colored & bent whiskers
2nd Cross: albino & straight whiskers ; albino & bent whiskers
3rd cross : colored & straight whiskers ; colored & bent whiskers ;
albino & straight whiskers ; albino & bent whiskers

5. In four o'clock plants, red colour of flowers (R) is incompletely dominant over white (r), the heterozygous having pink flower color. What will be the offsprings in a cross between plants of red flowers and pink flowers?

Solution Hint : P – RR × Rr Offspirngs : Red and Pink

6. A roan bull is bred to three cows. Cow A has the same genotype as the roan bull. Cow B is red and cow C is white.What proportions of roan progeny are expected from each of the above three crosses ?

Solution Hint : In all three crosses 50 % Roan cows are expected.

7. A couple preparing for marriage, a man has blood group B and woman has A. 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 Hint : - All four A, B, AB , & O types of blood groups are possible if both parents are heterozygous
- AB and A are possible if man is heterozygous and woman is homozygous.
- AB and B are possible if man is homozygous and woman is heterozygous.

8. Two white flowered varieties of pea plant when crossed produced purple flowered in F_1 progeny. Selfing of F_1 plants produced total 112 progeny of which 62 plants with purple flowers and 50 with white flowers. Find out (i) What type of interaction is involved? (ii) Give a phenotypic ratio approximated by the f2 progeny. (iii) Give the genotype of the parents.

Solution Hint : (i) Complementary gene interaction; (ii) Phenotypic ratio - 9:7 ; (iii) P : CCpp × ccPP

9. In a Plant, the gene for white fruit color (W) is epistatic to yellow (Y) which is dominant over green (y). Determine the fruit color of the offsprings of following crosses.

I. Wwyy × wwyy ; II. wwYy × wwyy ; III. WwYy × WwYy

Solution Hint : 1st Cross : White & green ; 2nd Cross : Yellow & green ;

3rd Cross : White: Yellow : green (12:3:1)

10. When dogs from a true breeding brown coat line were mated to dogs from a true breeding white coat line, all F_1 progeny were with white coat color. Mating of F_1 progeny produced F_2 offsprings having phenotypes in the ratio of 132 white: 33 black: 11 brown. Explain results.

Solution Hint : Cross : BBII × bbii Where B = Black; I=epistatic and bb= brown

Here dominant epistatic gene I inhibit the expression of associated genes.

SYLLABUS FOR CREDIT BASED SEMESTER SYSTEM

B.Sc. ZOOLOGY – JUNE - 2021

SEMESTER - II

GUJARAT UNIVERSITY
CBCS BASED PROPOSED COURSE
(Effective from June 2021)
B.Sc. SEMESTER – 2
Zoology-103 (Theory)
(Animal diversity (Chordates), Blood Physiology, Cytology and Animal biotechnology)

Unit I ANIMAL DIVERSITY (Chordates) – *Type Study*:

General structure & morphology with functional anatomy of the following animal**:**
Chondrichthyes*:** Type – **Shark – (Scoliodon sorrakowah***):** Systemic position, Habits and habitat, Ext. characters, Digestive system, Heart, Arterial system, Venous system, Respiratory system, Nervous system (Brain & Cranial nerves),Urinogenital systems.

Unit II Blood Physiology:

1. Functions of blood
2. Composition of Human blood: (Blood plasma and formed elements)
    a) RBC - Structure, Functions, Total counts.
        - Composition (Haemoglobin)
        - Effect of isotonic, hypotonic and hypertonic solutions.
        - Anaemias: - General symptoms and types (Nutritional, Pernicious, Hemorrhagic, Hemolytic, Aplastic and Sickle-cell (maxi. 5-6 sentences each)

    b) WBC – Functions, Total count.
        - Types of WBCs (brief note)
        - Brief concept of Leukemia (maxi. 5-6 sentences)

    c) Platelets - Structure, Total count, Functions.
3. Haemopoiesis
4. Blood coagulation - (Factors, Intrinsic & Extrinsic pathways)
    - Brief concepts of Thrombosis & Fibrinolysis
5. Groups and Blood Types:
    - ABO and Rh Blood Groups
    - Transfusions

Unit III: Cytology

Cytology:

Introduction

Study of eukaryotic cell organelles:

Nucleus:

- Occurrence and Position,
- Morphology
- Ultra structure-Nuclear membrane ,Nuclear pores, Origin of Nuclear membrane and Nuclear envelop, Function of Nuclear Membrane and Nuclear pores, Chromatin fibres; Nucleolus, Fine structure of Nucleolus, Chemistry of Nucleolus, Function of Nucleolus

Lysosome:

- Occurrence and Position,
- Morphology
- Ultra structure
- Functions

Microscope:

Structure, application and way of use of light (Dissecting and Compound) microscopes.

Unit –IV Animal biotechnology: (By Photographs)

1. Brief Introduction
2. Lab design and layout of small tissue culture laboratory
3. Some Lab facilities needed for setting up a tissue culture laboratory –
    - Cultural vessels (Choice of culture vessels, Multi well plates, Petri dishes, Culture flasks)
    - Laboratory Equipments (Autoclave, CO_2 Incubator, Centrifuge, Laminar Airflow)
4. Recombinant DNA Technology
    - Biological Tools (Restriction enzymes, Plasmid, Cosmid, Bacteriophase), Process and applications of Recombinant DNA Technology

Reference Books:

1. Textbook of 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.
4. Principles of Anatomy & Physiology, Tortora and Grabowski, Harper Collins College Pub
5. Animal Physiology And Related Biochem. H. R. Singh, Shobhan Lal Naginchand & Co. Edu. Pub., Jalandhar.
6. Textbook of Animal Histology. A. K. Berry, Emkay Pub, New Delhi.
7. Cytology, P. S. Verma, S. Chand & Co, Ltd., New Delhi
8. Cell Biology, C. B. Powar, Himalaya Books Pub.
9. Essentials of Cytology, C. B. Powar, Himalaya Books Pub
10. Elements of Biotechnology, P. K. Gupta. Rastogi pub, Meerut
11. Culture of Animal Cells: A Manual of Basic Technique. By R. Ian Freshney.
12. Genetic Engineering, N. Arumugam, Saras Publication

GUJARAT UNIVERSITY
CBCS BASED PROPOSED COURSE
ZOOLOGY
(Effective from June 2021)
B.Sc. SEMESTER-II
Zoology-103
SKELETAL QUESTION PAPER FOR THEORY EXAMINATION

Total-70

Que.1 Unit 1 Type study Shark (7)

Or

(A) Unit 1 Type study Shark
(B) Unit 1 Type study Shark (7)

Or

(B) Unit 1 Type study Shark

Que.2 (A) Unit 2 Blood Physiology (7)

Or

(A) Unit 2 Blood Physiology
(B) Unit 2 Blood Physiology (7)

Or

(B) Unit 2 Blood Physiology
Que. 3 (A) Unit 3 Cytology (7)

Or

(A) Unit 3 Cytology
(B) Unit 3 Cytology (7)

Or

(B) Unit 3 Cytology
Que. 4 (A) Unit 4 Animal biotechnology (7)

Or

(A) Unit 4 Animal biotechnology
(B) Unit 4 Animal biotechnology (7)

Or

(B) Unit 4 Animal biotechnology
Que.5 Short 14 questions (each of 1 mark) (14)
Que. 1 to 3- from unit 1
Que. 4 to 6- from unit 2
Que. 7 to 9- from unit 3
Que. 10 to 12- from unit 4
Que. 13 to 14- from any unit

GUJARAT UNIVERSITY
CBCS BASED PROPOSED COURSE
(Effective from June 2021)
B.Sc. SEMESTER-II
ZOOLOGY – 104 (Practical)

1. ANIMAL DIVERSITY (Chordates):

***Study of Shark*:**

1. Study of external characters.
2. Study of Digestive system, Arterial system, Venous system, Urinogenital systems, Brain.
3. Study of Placoid scales, Striated muscle fibres, Membranous Labyrinth, Ampulla of Lorenzini

2. Physiology of blood:

a) Points for drawing blood by a syringe (Chart)
b) Study of blood corpuscles by preparation of human blood smear using Leishman Stain. (Demonstration only)
c) Demonstration of determination of ABO blood grouping in humans.
d) Demonstration of determination of blood clotting time. (BT, CT)
e) Separation of plasma/serum from blood. (Chart)

3. Cytology: (Charts / Photographs)

1. Nucleus
2. Lysosome
3. Microscopes (Compound and Dissecting)

4. Animal biotechnology: (By Photographs)

1. Lab design – Layout
2. Culture vessels (Multi-well plates, Petri dishes, Culture flasks)
3. Lab Equipments (Autoclave, CO_2 Incubator, Centrifuge, Laminar Airflow)
4. Recombinant DNA Technology

GUJARAT UNIVERSITY
CBCS BASED PROPOSED COURSE
(Effective from June 2021)
B.Sc. SEMESTER-II
ZOOLOGY – 104

Marks- 70

Q.1 Sketch, lable and describe _____ system of Shark.	12
Q.2 Sketch, lable and describe temporary mounting of _____ from Shark.	08
Q.3. Explain the following experiments	
a) Blood smear / Blood groups	08
b) BT and CT / Separation of serum from blood	08
Q.4. Identify the specimens as per instructions.	21
1. Identify and describe. (Any system of Shark)	
2. Identify and describe. (ABO blood group/ Points for drawing blood by a syringe)	
3. Identify and describe. (Cytology)	
4. Identify and describe. (Cytology)	
5. Identify and describe. (Biotechnology)	
6. Identify and describe. (Biotechnology)	
7. Identify and explain. (Biotechnology)	
Q.6 Viva Voce.	08
Q.7 Journal.	05

GUJARAT UNIVERSITY

3rd Semester B.Sc.

ZOOLOGY

(Effective from June 2022)

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

Pattern of Examination:
Theory (Ext. 140 marks &Int. 60marks)
Practicals (Ext. 70 marks & Int. 30marks)

Examination	Duration	External Marks	Internal Marks	Total Marks
Theory-Paper 201 **(**Animal diversity (nonchordates) and Parasitology**)**	3 hours	70	30	100
Theory-Paper 202 **(**Animal diversity (chordates) and Genetics& Animal biotechnology**)**	3 hours	70	30	100
Theory (Total)		140	60	200
Practical-Paper 203 (A) **(** Based on Theory Paper –201**)**	3 hours	35	15	50
Practical-Paper 203 (B) **(**Based on Theory Paper –202**)**	3 hours	35	15	50
Practicals (Total)		70	30	100

INSTRUCTIONS

1. Each theory paper comprises of FOUR UNITS. Each UNIT carries equal marks, i.e.14 marks (14 x5 =70) in the university examinations.
2. The theory question papers will have to be set according to the paper-style and the pattern of marks-distribution provided on page no. 4 & 7of this syllabus.
3. The paper-style & distribution of marks for the Practicals is also provided on page no. 9&12 of this syllabus.
4. In order to be qualified to appear in the University Practical Examination, the student must submit this/her duly certified journals during the examination.

ZOOLOGY SYLLABUS

SEMESTER–3

PAPER–201(Theory)

(ANIMAL DIVERSITY (nonchordates) and PARASITOLOGY)

Unit I ***ANIMAL DIVERSITY*** **(Nonchordates) –** ***Systematics:***

Salient features and Classification of Invertebrates, starting from Kingdom upto Classes, giving reasons with examples (as per practical syllabus):

Phylum:

1. Protozoa
2. Porifera
3. Coelenterata
4. Platyhelminthes
5. Nemathelminthes
6. Annelida

(Classification as per–Textbook of invertebrates by R. L. Kotpal, Rastogi Publication, Meerut).

Unit II ***ANIMAL DIVERSITY*** **(Nonchordates) –** ***Type study*****:**

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

Earthworm (*Pheretima posthuma*)–Systematic position, Habits & Habitat, External characters, Body wall, Digestive system, Circulatory system, Excretory system, Nervous system, Reproductive systems & reproduction

Unit III ***GENERAL TOPICS:***

1. Coelenterata **: C**oral reefs (Introduction, Formation, Types, Importance)
2. Types of Symmetry (Radial, Biradial, Bilateral, Spherical)
3. Types and significance of Coelom.
4. Types and significance of Metamerism.
5. Segmental organs in annelida - Coelomoducts and nephridia.
6. Adaptive radiation in polychaeta (Diversity according to habitat and feeding)

Unit IV ***PARASITOLOGY:***

1. General Introduction: Parasite, Host, Host-parasite relationships
2. Types of Parasites: Endoparasites (Obligate, Facultative), Exoparasite
3. Types of Hosts: Definitive, Intermediate, Reservoir
4. Morphology, Life cycle, Pathogenesis and Prophylaxis of the following human parasites:
   Protozoan Parasites: *Entamoeba histolytica, Leishmania donovani*
   Helminthes Parasites: *Taenia solium, Wuchereria bancrofti*

Theory Paper-style and pattern of marks-distribution

PAPER – 201
(ANIMAL DIVERSITY(nonchordates) and PARASITOLOGY)

Q.No.	UNITNO.	MARKS
Q.1.	Unit-I OR Unit-I	**07**
Q.1.	Unit-I OR Unit-I	**07**
Q.2.	Unit-II OR Unit-II	**07**
Q.2.	Unit-II OR Unit-II	**07**
Q.3.	Unit-III OR Unit-III	**07**
Q.3.	Unit-III OR Unit-III	**07**
Q.4.	Unit-IV OR Unit-IV	**07**
Q.4.	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–202 (Theory)

(ANIMAL DIVERSITY (chordates), GENETICS & ANIMAL BIOTECHNOLOGY)

Unit I ***ANIMAL DIVERSITY*** **(Chordates) –** ***Systematics*****:**

Salient features & Classification, starting from Kingdom upto Orders, with reasons & examples as per practical syllabus: Protochordata, Cyclostomata, Pisces & Amphibia. (Classification as per text book of vertebrates by R. L. Kotpal, Rastogi Publication, Meerut).

Unit II ***ANIMAL DIVERSITY*** **(Chordates) –** ***Type Study*****:**

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

Calotes versicolor **(Garden lizard):** Systematic position, Habits and Habitat, External characters, Digestive system, Respiratory system, Blood-vascular system (Heart, Arterial system, Venous system), Urinogenital system, Brain, Hyoid apparatus and Columella auris.

Unit III ***GENERAL TOPICS:***

1. Comparison of chordates with non-chordates.
2. Comparison of Chondrichthyes with Osteichthyes.
3. Neoteny (Types and affecting factors)
4. Identification of venomous and non-venomous snakes of India
   - Venomous**:** Russel's viper, Krait, Cobra, King cobra, Marine snake.
   - Non-venomous: Boa, Pythons, Rat snake.
5. Poison apparatus and biting mechanism of Snakes.

Unit IV ***GENETICS & ANIMAL BIOTECHNOLOGY*****:**

Genetics:

1. Pleotropism
2. Duplicate genes (15:1 ratio, e.g. Fruit shape in Shepherel's purse)
3. Multiple genes (e.g. Biochem pathway of Tryptophan in *E. coli*)
4. Mutations :
   - Definition
   - Mutable & Mutator genes
   - Reverse mutation
   - Paramutations
   - Frame-shift mutations and its types
   - Mutagens (Radiation & Chemical agents)

Tools in Animal Biotechnology:

Equipments for animal cell culture laboratory, in brief**:**

1. Water bath.
2. Dry bath
3. Magnetic stirrer
4. Vortex mixture
5. Variable volume micropipettes
6. Cryostorage containers
7. Inverted microscope (Phase contrast).

Theory Paper-style and pattern of marks-distribution

PAPER – 202
(ANIMAL DIVERSITY (chordates), ***GENETICS and ANIMAL BIOTECHNOLOGY*****)**

Q.No.	**UNIT NO.**	**MARKS**
Q.1	Unit-I **OR** Unit-I	**07**
Q.1.	Unit-I Unit-I **OR** Unit-I	**07**
Q.2	Unit-II **OR** Unit-II	**07**
Q.2	Unit-II **OR** Unit-II :	**07**
Q.3	Unit-III **OR** Unit-III	**07**
Q.3	Unit-III **OR** Unit-III	**07**
Q.4	Unit-IV **OR** Unit-IV	**07**
Q. 4	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–203 (A) (Practicals)
(Based *on Theory Paper 201)*

1. ***ANIMAL DIVERSITY*** **(Nonchordates)– *Systematics*: (a short description and habitat should also be written for each animal)**

Identification & classification of invertebrates (Kingdom to Class):

1. Protozoa: Amoeba, Paramoecium, Polystomella, Euglena,Vorticella.
2. Porifera **:** Leucosolenia, Euspongia, Grantia, Hyalonema.
3. Coelenterata **:** Hydra, Sea anemone, Physalia, Aurelia, Coral.
4. Platyhelminthes **:** Planaria, Liverfluke, Tapeworm.
5. Nemathelminthes**:** Enterobius, Ascaris, Rhabditid.
6. Annelida **:**Nereis, Aphrodite, Amphitrite, Leech.

2. *ANIMAL DIVERSITY* (Non chordates):

A) Study of Earthworm**:**
   1. Study of external characters.
   2. Study of Digestive System, Circulatory System, Nervous system and Reproductive System.

B) Permanent slides/ charts of**:**
   1. Setae, Bloodgland, Septal Nephridia, Ovary, Spermatheca
   2. T.S. passing through pharynx, T.S. passing through gizzard, T.S. passing through typhlosole.

3. *ANIMAL DIVERSITY* (Non chordates):

Study through charts/models/slides**:**

1. Coelenterata **:** Kinds of coral reefs (Fringing, Barrier, Atoll)
2. Types of symmetry (As per theory syllabus)
3. Types and significance of Metamerism.
4. Segmental organs in annelida - Coelomoducts and nephridia.
5. Adaptive radiation in polychaeta (Vanadis, Owenia, Chaetopterus, Arenicola and Terebella)

4. *PARASITOLOGY*

Study of *Entamoeba histolytica, Plasmodium, Taenia solium, Wuchereria bancrofti* and their life stages through permanent slides / specimens / photographs.

GUJARAT UNIVERSITY

Semester-3 Zoology

(SKELETON QUESTION PAPER FOR PRACTICAL EXAMINATION)

PAPER-203 (A)

(*Based on Theory Paper 201*)

Date: …….. Marks : 35 Time :……

Q: 1 Sketch, label and describe_____system of Earthworm. **06**

Q:2 Sketch, label and describe temporary mounting of Earthworm **04**

Q:3 Identify the given figure of parasite and describe its life cycle **05**

Q:4 Identify specimens 1 to 6 as per instructions**:** **12**

Sp.1 Identify and classify upto Class, giving reasons.
Sp.2 Identify and classify upto Class, giving reasons.
Sp.3 Identify and describe.
Sp.4 Identify and describe.
Sp.5 Identify and describe.
Sp.6 Identify and state its pathogenicity.

Q.5 Viva voce **04**

Q.6 Journal. **04**

DETAILS FOR PRACTICAL EXAMINATION (Question wise)
Semester-3 Zoology

PAPER-203 (A)
(*Based on Theory Paper 201*)

Q.1 Earthworm**:** Digestive system, Circulatory, Nervous system, Reproductive System.
Q.2 Charts/Permanent slides of Earthworm**:** Setae, Bloodgland, Septalnephridia Ovary, Spermatheca,
Q.3 Parasitology: *Entamoeba histolytica, Plasmodium, Taenia solium, Wuchereria bancrofti* and their life stages
Q.4 Sp.1 Protozoa, Porifera, Coelenterata
Sp.2 Platyhelminthes, Nemathelminthes, Annelida
Sp.3 Kinds of coral reefs/ Types of symmetry
Sp.4 Segmental organs in annelida/Adaptive radiation in polychaeta.
Sp.5 Study of T.S. passing through pharynx, T.S. passing through gizzard, T.S. passing through typhlosole of earthworm.
Sp.6 Study of *Entamoeba histolytica, Plasmodium, Taenia solium, Wuchereria bancrofti* and their pathogenicity through permanent slides / specimens /photographs.
Q.5 Syllabus of Theory Paper 201 and Practical Paper-203 (A) only.

PAPER–203 (B) (Practicals)
(Based *on Theory Paper 202*)

1. *ANIMAL DIVERSITY* (Chordates)– *Systematics*: (a short description and habitat should also be written for each animal)

Identification & Classification of following animals upto Orders, giving reasons**:**

1. Protochordata**:** Amphioxus, Salpa, Doliolum, Ascidian.
2. Cyclostomata : Lamprey, Hagfish.
3. Pisces: Sting ray fish, Electric ray fish, Exocetus, Sea horse, Sucker fish, Eel.
4. Amphibia**:** Icthyophis, Salamader, Hyla.

2. *IDENTIFICATION OF SNAKES*:

Study by specimens **(*only external characters*):**

- Venomous**:** Russel's viper, Krait, Cobra, King cobra, Marine snake.
- Non-venomous**:** Boa, Python, Rat snake.

3. *ANIMAL DIVERSITY* (Chordates):

***Study of Calotes*:**

1. Study of external characters. Digestive system, Arterial system, Venous system, Urinogenital systems, Brain.
2. Study of Hyoid apparatus and Columella auris.

***4. GENETICS*:**

Study of genetics through charts**:**

1. Pleotropism
2. Duplicate genes (15:1 ratio, e.g. Fruitshape in Shepherel' spurse)
3. Multiple genes (e.g. Biochem. pathway of Tryptophan in *E. coli*)
4. Mutations :Reverse mutation, Paramutations, Frame-shift mutations and its types

5. *ANIMAL BIOTECHNOLOGY*:

Study of tools in animal biotechnology through charts/specimens**:**

1. Water bath.
2. Dry bath
3. Magnetic stirrer
4. Vortex mixture
5. Variable volume micropipettes
6. Cryostorage containers
7. Inverted microscope (Phase contrast).

GUJARAT UNIVERSITY

Semester-3 Zoology

(SKELETONQUESTIONPAPERFORPRACTICALEXAMINATION)

PAPER-203(B)

(*Based on Theory Paper 202*)

Date: …….. Marks : 35 Time : ….……

Q.1	Sketch, label and describe_____system of Calotes	**08**
Q.2	Sketch, label and describe temporary mounting of Calotes	**05**
Q.3	Identify specimens 1 to 7 as per instructions: Sp.1 Identify and classify upto Order, giving reasons. Sp.2 Identify and classify upto Order, giving reasons. Sp.3 Identify and comment. Sp.4 Identify and describe. Sp.5 Identify and describe Sp.6 Identify and describe Sp.7 Identify and describe	**14**
Q.4	Viva voce.	**04**
Q.5	Journal.	**04**

DETAILSFORPRACTICALEXAMINATION(Questionwise)
Semester-3Zoology

PAPER-203(B)
(*Based on Theory Paper 202*)

Q.1 Calotes**:** Externalcharecter, Digestive system, Arterial system, Urinogenital systems, Brain.
Q.2 Calotes **:** Hyoid apperatus and Columella auris

Q.3
Sp.1 Protochordata or Cyclostomata.
Sp.2 Pisces or Amphibia.
Sp.3 Venomous snake
Sp.4 Non-venomous snake
Sp.5 Genetics
Sp.6 Genetics
Sp.7 Biotechnology

Q.4 For viva Syllabus of Theory Paper-202 and Practical Paper-203 (B) only.

Note: ***All examiners should take the viva sitting together and each examiner should give marks from 04 and then the average marks of all the examiners should be given to the candidate.***

Reference Books for 201, 202 and Practical 203 (A) and (B).

1. **Textbook of Invertebrates**, R. L. Kotpal, Rastogi Publishers, Meerut.
2. **Invertebrate Zoology**, Jordan and Verma, S. Chand & Company, Delhi.
3. **Invertebrate: Structure and Function**, E. J. W. Barrington.
4. **Text book of Vertebrates**, R. L. Kotpal, Rastogi Publication, Meerut.
5. **Text book of practical zoology - Invertebrates**, S. S. Lal Rastogi Publication, Meerut.
6. **Text book of practical zoology - Vertebrates**, S. S. Lal Rastogi Publication, Meerut.
7. **Chordate Zoology**, P. S. Dhami, and J. K. Dhami, S. Chand & Co.,Delhi.
8. **A text book of Chordates,** N. Arumugam, Saras publication.
9. **Introduction to Chordates**, T. C. Majupuria, Pradeep Publication, Jalandhar.
10. **A Manual of Zoology**, E. K. Ayyer, Vol. I &II.
11. **Medical Parasitology, C. K. Jayram Paniker,** Jaypee Brothers Medical Publishers (P) Ltd., New Delhi
12. **Protozoa,** R. L. Kotpal, Rastogi Publications, Meerut.
13. **Helminthes,** R. L. Kotpal, Rastogi Publications, Meerut.
14. **An Introduction to Parasitology,** P.N.Sharma, L. S. Ratnu, S. Chand & Co. Ltd., New Delhi
15. **Text book of Genetics**, Veerbala Rastogi, Kedar Nath Ram Nath, Meerut.
16. **Genetics**, P. S. Verma & V. K. Agarwal, S. Chand & Company, Delhi.
17. **Fundamentals of Biotechnology**, P. K. Gupta, S. Chand & Company, Delhi.
18. **Culture of Animal Cells-A Manual of Basic Technique**, R. Ian Freshney, 5th Ed., A. John Wiley & Sons Inc. Pub.

GUJARATUNIVERSITY
4th SemesterB.Sc.
ZOOLOGY
(Effective from June 2022)

The syllabus has to be completed by assigning FOUR hours for each Theory Paper and a total of SIX hours for the Practicals, per week.

Pattern of Examination :
Theory (Ext. 140 marks &Int. 60marks)
Practicals (Ext. 70 marks & Int. 30marks)

Examination	Duration	External Marks	Internal Marks	Total Marks
Theory-Paper 204 (Animal diversity (nonchordates), Insect vectors, vector born diseases & Cytology)	3 hours	70	30	100
Theory-Paper 205 **(**Animal diversity (chordates),Fishery biology, Wildlife of India**)**	3 hours	70	30	100
Theory (Total)		140	60	200
Practical-Paper 206 (A) **(** Based on Theory Paper –204**)**	3 hours	35	15	50
Practical-Paper 206 (B) **(**Based on Theory Paper –205**)**	3 hours	35	15	50
Practicals (Total)		70	30	100

INSTRUCTIONS

1. Each theory paper comprisesof FIVE UNITS. Each UNITcarries equal marks, i.e.14 marks(14 x5 =70)in the universityexaminations.
2. The question paperswill haveto be set according tothepaper-styleand thepattern of marks-distribution provided on page no.17 &20of thissyllabus.
3. Thepaper-style&distributionofmarksforeachPracticalisalsoprovidedonpageno.22&25ofthissyllabus.
4. In order to bequalified toappearin the University PracticalExamination, thestudent must submithis/her duly certified journals during the examination.

ZOOLOGY SYLLABUS

SEMESTER–4
PAPER– 204 (Theory)

(ANIMAL DIVERSITY (nonchordates), INSECT VECTORS, VECTOR BORNE DISEASES & CYTOLOGY)

Unit I ***ANIMAL DIVERSITY*** **(NonChordates)–** ***Systematics*****:**

Salient features and Classification of Invertebrates, starting fromKingdom upto Classes,givingsuitableexamples(asperpracticalsyllabus)**:**

Phylum :

1. Arthropoda
2. Mollusca
3. Echinodermata
4. Hemichordata

(Classification, as per the book–Text book of invertebrates by R. L. Kotpal, Rastogi Publication, Meerut).

Unit II ***ANIMAL DIVERSITY*** **(Nonchordates)–** ***Type Study* & *General Topics*****:**

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

Arthropoda**:** Type – **Cockroach** (*Periplaneta americana*) – Classification, Habits & Habitat, Ext. characters, Digestive system, Circulatory system, Excretory system, Reproductive systems, Nervous system, and Sense organ (only compound eyes).

General topics:

1. Metamorphosis (Incomplete & Complete), Hormonal Control
2. Mouth parts of**:** Honey bee, Housefly, Butterfly, Mosquito (*Anopheles*& *Culex*-male & female) and cockroach.

Unit III ***INSECTS VECTORS AND VECTOR-BORNE DISEASES***

Introduction of Vectors (Mechanical & Biological)

Mosquitoes, Flies, Fleas, Ticks, Bugs, Lice, Mites, Cyclops, Cockroach as vectors

Study of Transmission, Symptoms, Control and Prophylactic measures of following diseases:

Mosquito-borne diseases- Malaria (Anopheles), Dengue (Aedes), Chikungunia (Aedes), Filariasis (Culex)

Sand fly-borne diseases- Visceral Leishmaniasis, Flea-borne diseases- Plague

Tick-borne Encephalitis, Crimean-Congo haemorrhagic Fever (CCHF)

Bugs/Tsetse flies-Trypanosomiasis, Black fly-River blindness

Unit IV: ***CYTOLOGY***

1. Cytoplasm (Physical nature of matrix, Chemical organization of matrix)

2. Cytoskeleton

3. Endoplasmic reticulum

4. Mitochondria

5. Mitosis

Theory Paper-style and pattern o fmarks - distribution

PAPER – 204
(ANIMAL DIVERSITY (nonchordates), INSECT VECTORS, VECTOR-BORNE DISEASES AND CYTOLOGY.)

Q.No.	UNITNO.	MARKS
Q.1.	Unit-I **OR** Unit-I	**07**
Q.1.	Unit-I **OR** Unit-I	**07**
Q.2.	Unit-II **OR** Unit-II	**07**
Q.2.	Unit-II **OR** Unit-II :	**07**
Q.3.	Unit-III **OR** Unit-III	**07**
Q.3.	Unit-III **OR** Unit-III	**07**
Q.4.	Unit-IV **OR** Unit-IV	**07**
Q.4.	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–205 (Theory)
(ANIMAL DIVERSITY (chordates), FISHERY BIOLOGY, WILDLIFE of India)

Unit I ***ANIMAL DIVERSITY*** **(Chordates) –** ***Systematics*** **:**

Salient features & Classification, starting from Kingdom upto Orders, with reasons with examples (as per practical syllabus) of Reptilia, Aves & Mammalia.

(Classification as per the book– Textbook of vertebrates by R.L. Kotpal, Rastogi Publication, Meerut).

Reference Books for **Unit I:**

1. **Textbook of 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 II ***FISHERY BIOLOGY*****:**

1. BriefintroductionandimportanceofstudyingFisheryScience.**(*nottobeaskedinexam*)**
2. Study of fishing gears and crafts**:**
   - Nets **:** Stringed Cast net, Gill net, Drag net, Trawl net.
   - Boats **:** Dugout canoe, Machhawa, Flat-bottomed boat, Trawler.
3. Scales of fishes; Types of caudal fins
4. Identification & Classification of the following fishes upto Family

   (*as per Day*):

   -Catla, Rohu, Mrigal, Hilsa, Dara, Ghol, Bombay duck and Pomfret.
5. Home Aquarium**:** Primary knowledge, Construction, General maintenance and popular aquarium fishes.

Unit III ***WILDLIFE OF INDIA:***

1. Introduction**:** National Parks, Sanctuaries, Endangered, Vulnerable, Threatened Species.
2. Elementary knowledge of**:** Marine National Park of Gujarat, Velavadar National Park, Gir National Park and Sanctuary, Wildass Sanctuary of Gujarat and Nalsarovar Bird Sanctuary, Conservation projects of Tiger, Wild Ass, Black buck, Lion.
3. Wildlife management tools**:** Compass, Binoculars, Cameras, Radio- transmitters/receivers, Spotting Scope, Tranquilizer gun/darts.
4. Some important wild fauna of India (***give scientific name*** & ***brief note on each*****):** Asiatic lion, Tiger, Leopard, Snow leopard, Black buck, Indian Bison, Indian wildass, Indian One-horned Rhino, Great Indian Bustard, Great Indian Hornbill, Peacock, Gangetic dolphin and Vultures.
5. Animal Evidences in the field: Pug marks, Hoofmarks, Scats, Nests, Antlers.

Unit IV ***ANIMAL DIVERSITY*** **(Chordates)–*General Topics*:**

Comp. anatomy of vertebrates–Aortic arches, Heart and Kidney.

Theory Paper-style and pattern of marks-distribution

PAPER – 205
(ANIMAL DIVERSITY (chordates), FISHERY BIOLOGY, WILDLIFE of India)

Q.No.	**UNITNO.**	**MARKS**
Q.1.	Unit-I **OR** Unit-I	**07**
Q.1.	Unit-I **OR** Unit-I	**07**
Q.2.	Unit-II **OR** Unit-II	**07**
Q.2.	Unit-II **OR** Unit-II :	**07**
Q.3.	Unit-III **OR** Unit-III	**07**
Q.3.	Unit-III **OR** Unit-III	**07**
Q.4.	Unit-IV **OR** Unit-IV	**07**
Q.4	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–206 (A) (Practicals)
(*Based on Theory Paper 204*)

1. ***ANIMAL DIVERSITY*** **(Non Chordates)– *Systematics*: (a short description and habitat should also be written for each animal)**
   Identification & classification of invertebrates (Kingdom to Class)**:**
   1. Arthropoda**:** Apus, Balanus, Prawn, Crab, Centipede, Butterfly, Scorpion.
   2. Mollusca **:**Chiton, Dentalium, Pila, Unio, Octopus.
   3. Echinodermata : Brittlestar, Sea urchin, Sea cucumber, Feather star, Starfish.

2. ***ANIMAL DIVERSITY*** **(Nonchordates):**
   A) Study of Cockroach by Charts / Video / Photographs **:**
      1. External characters. Study Digestive, Circulatory, Nervous systems, Reproductive system
      2. Study of V.S. of Compound eye, W.M. of Salivary gland, T.S. of Gizzard, W.M of Leg

   B) Study of mouthparts of**:**
   Honey bee, Housefly, Butter fly, Mosquito (*Anopheles* & *Culex*, male & female) and Cockroach.

3. ***INSECTS VECTORS AND VECTOR-BORNE DISEASES:***
   Study of Arthropod Vectors through permanent slides / photographs (As per theory syllabus) Study of Vector Borne Diseases (As per theory syllabus)

4. ***CYTOLOGY***
   1. Cytoplasm (Physical nature of matrix, Chemical organization of matrix)
   2. Cytoskeleton
   3. Endoplasmic reticulum
   4. Mitochondria
   5. Mitosis

GUJARAT UNIVERSITY

Semester-4 Zoology

(SKELETON QUESTION PAPER FOR PRACTICAL EXAMINATION)

PAPER-206 (A)

(*Based on Theory Paper 204*)

Date: …….. Marks : 35 Time : ….……

Q.1 Sketch, label and describe_____system of Cockroach. **06**

Q.2 Identify given figure of an arthropod vector and write brief description of its disease. **05**

Q.3 Identify & describe the given mouth parts. **04**

Q.4 Identify specimens 1 to 6 as per instructions**:** **12**

Sp.1 Identify and classify upto Class, giving reasons.
Sp.2 Identify and classify upto Class, giving reasons.
Sp.3 Identify and classify upto Class, giving reasons.
Sp.4 Identify and describe.
Sp.5 Identify and comment.
Sp.6 Identify and comment.

Q.5 Viva voce **04**

Q.6 Journal **04**

DETAILSFORPRACTICALEXAMINATION(Questionwise)
Semester-4Zoology

PAPER-206(A)
(*Based on Theory Paper 204*)

Q.1 Cockroach **:**External characters, Digestive, Circulatory, Nervous and Reproductive systems.
Q.2 Vector and Vector-borne diseases (As per theory syllabus)
Q.3 Honey bee, Housefly, Butterfly, Mosquito (*Anopheles*& *Culex*, male & female) and Cockroach.

Q.4 Sp.1 Arthropoda
Sp.2 Mollusca
Sp.3 Echinodermata & Hemichordata
Sp.4 V.S. of Compound eye, W.M. of Salivary gland, T.S. of Gizzard, W.M of Leg
Sp.5 Cytology
Sp.6 Cytology

Q.5 Syllabus of Theory Paper-204 & 205 and Practical Paper-206 (A) & (B) only.

Note: ***All examiners should take the viva sitting together and each examiner should give marks from 04 and then the average marks of all the examiners should be given to the candidate.***

PAPER–206 (B) (Practicals)
(*Based on Theory Paper 205*)

1. *ANIMAL DIVERSITY* (Chordates)– *Systematics*: (a short description and habitat should also be written for each animal)

Identification & Classification of following animals with scientific names upto Orders, giving reasons **:**

1. Reptilia **:** Giant turtle, Tuatara, Common house lizard, Horned toad, Chameleon, Rat snake, Seasnake.
2. Aves **:** Stork, Pelican, Goose, Kite, Peacock, Crane, Cuckoo, Kingfisher, Woodpecker, Parakeet, Owl, Pigeon, Crow, Lapwing, Swift.
3. Mammalia **:** Hedgehog, Flying fox, Human, Dog, Blue whale, Donkey, Blue bull, Elephant, Dugong, Squirrel, Indian hare, Pangolin.

2. *FISHERY SCIENCE*:

1. Study of fishing gears**:**
   - Nets **:** Stringed Cast net, Gill net, Dole net, Drag net, Trawl net.
   - Boats **:** Dugout canoe, Machhawa, Flat-bottomed boat, Trawler.
2. Identification & Classification of the following fishes upto Family **(*as per Dey*):**
   - Catla, Rohu, Mrigal, Hilsa, Dara, Ghol, Bombay duck and Pomfret.
3. Types of Caudal fins
4. Scales of Fishes

3. WILDLIFE OF INDIA:

1. Study by photographs of some endangered fauna of India, along with scientific names(As per theory syllabus)
2. Field Observation Tools for Wildlife **:**
   Compass, Spotting Scope, Binoculars, Cameras, Radio-transmitters/receivers, Tranquilizer gun/darts.
3. Study of Animal Evidences in the field by photographs.(As per theory syllabus)
4. National Park & Sanctuary **(*as per theory syllabus*)** spotting in map of Gujarat.

4. *CYTOLOGY:*

1. Cytoplasm (Physical nature of matrix, Chemical organization of matrix), Cytoskeleton, Endoplasmic reticulum, Mitochondria,
2. Prepare temporary mounting of mitosis from Onion root tip.

GUJARATUNIVERSITY

Semester-4Zoology

(SKELETONQUESTIONPAPERFORPRACTICALEXAMINATION)

PAPER-206 (B)
(*Based on Theory Paper 205*)

Date: …….. Marks : 35 Time : ….……

Q.1 Identify and classify, giving reasons, the given two fishes. **08**
Q.2 Prepare temporary mounting of mitosis from Onion root tip. **07**
Q.3 Identify specimens 1 to6 as per instructions**:** **12**
Sp.1. Identify and classify upto Order, giving reasons.
Sp.2. Identify and classify upto Order, giving reasons.
Sp.3. Identify and classify upto Order, giving reasons.
Sp.4. Identify and describe.
Sp.5.Identify, state its scientific name and comment on the given specimen.
Sp.6. Identify and describe
Q.4 Viva voce **04**
Q.5 Journal. **04**

DETAILS FOR PRACTICAL EXAMINATION (Question wise)
Semester-4 Zoology

PAPER-206 (B)
(*Based on Theory Paper 205*)

Q.1 Catla, Rohu, Mrigal, Hilsa, Dara, Ghol, Bombay duck and Pomfret.

Q.2 Prepare temporary mounting of mitosis from Onion root tip.

Q.3 Sp.1 Reptilia

Sp. 2 Aves

Sp. 3 Mammalia

Sp.4 Nets / Boats / Types of Scales / Types of Caudal fins

Sp.5 Asiatic lion, Tiger, Leopard, Snow leopard, Black buck, Indian Bison, Indian wildass, Indian One-horned Rhino, Great Indian Bustard, Great Indian Hornbill, Peacock, Gangetic dolphin and Vultures.

Sp. 6 Compass, Spotting Scope, Binoculars, Cameras, Radio-transmitters/receivers, Tranquilizer gun/darts, Pug marks, Hoof marks, Scats, Nests, Antlers.

Reference Books for 204, 205 and Practical 206 (A) and (B).

1. **Textbook of Invertebrates**, R. L. Kotpal, Rastogi Publishers,Meerut.
2. **Manual of Zoology**, E. K. Ayyer, Vol. I &II.
3. **Invertebrate Zoology**, Jordan and Verma, S. Chand &Company,Delhi.
4. **Textbook of Vertebrates**, R. L. Kotpal, Rastogi Publication, Meerut.
5. **Chordate Zoology**, P. S. Dhami, and J. K. Dhami, S.Chand & Co., Delhi.
6. **Introduction to Chordates**, T. C. Majupuria, Pradeep Publication, Jalandhar.
7. **Text book of practical zoology - Invertebrates**, S. S. Lal Rastogi Publication, Meerut.
8. **Text book of practical zoology - Vertebrates**, S. S. Lal Rastogi Publication, Meerut.
9. **Entomology and Pest Management**. Pedigo L. P. (2002), Prentice Hall Publication.
10. **Integrated Vector Management: Controlling Vectors of Malaria and other Insect Vector borne Diseases**. Methews, G. (2011) Wiley-Blackwell
11. **Cytology,** P. S. Verma & V. K. Agarwal, S. Chand & Company, Delhi.
12. **Cell Biology,** C. B. Power, Himalaya Publishing House.
13. **Introduction to cytology,** Veer bala Rastogi, Kedarnath Ramnath, Meerut.
14. **Fish & Fisheries of India,** V. B. Jhingran, Hindustan Pub., Meerut.
15. **Fishery Science and Indian Fisheries,**Srivastav, Kitab Mahal Pub., Delhi.
16. **Fishes,** Chandy.
17. **Day volume-I & II.**
18. **Indian Wildlife**, **Srilanka**, **Nepal**, APA Publications.
19. **Wildlife of India**, Mark E. Trisch, Harper Collins Pub.
20. **Threatened Animals of India**, B.K. Tikader, ZSI, Calcutta.

GUJARAT UNIVERSITY

B.Sc. Semester - 5

ZOOLOGY SYLLABUS

(Effective from June 2019)

The syllabus is to be completed by assigning FOUR hours for each Theory Paper 301 to 304 and THREE hours for Theory Paper 305 and a total of TWELVE hours for the Practicals, per week.

Pattern of Examination:

- Theory (Ext. 350 marks & Int. 150 marks)
- Practicals (Ext. 140 marks & Int. 60 marks)

INSTRUCTIONS:

1. Each theory paper comprises of FOUR UNITS. UNIT I & II carry 18 marks & UNIT III & IV carry 17 marks in the university examinations.
2. The theory question papers will have to be set according to the paper-style and the pattern of marks-distribution provided on last page of theory syllabus.
3. The details, paper-skeleton with marks distribution for the Practicals is provided in this syllabus.
4. In order to be qualified to appear in the Internal/External (University) Practical Examination, the student must submit his/her duly certified journals on the day of examination.

PAPER – 301 (Theory)

(ECOLOGY, ANIMAL DIVERSITY (Nonchordates))

Unit-I ECOLOGY:

A. Biotic Community:

- Concept of community
- Community stratification in terrestrial habitat
- Community periodicity

B. Ecological Succession:

- Kinds of Succession
- Process of succession
- Patterns of succession (Hydrosere, Xerosere)
- Significance of Ecological Succession.

Reference Books for Ecology:

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 ANIMAL DIVERSITY (Nonchordate)

Type Study & General Topics:

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

Arthropoda: Type – **Scorpion (*Palamnaeus*)** - Classification, Habit & Habitat, Ext. characters, Digestive system, Book-lungs, Circulation system, Excretory organs, Nervous system, Sense organs and Reproductive systems.

B. General topics:

Porifera : Skeleton and Canal systems.

Coelenterata : Polymorphism.

Annelida : Ecology of polychaeta, Nephridia & Coelomoducts.

Unit III ANIMAL DIVERSITY (Nonchordate)

Type Study & General Topics:

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

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

B. General topics:

Arthropoda : Crustacean larvae and Excretory organs.

Mollusca : Shell, Foot and Torsion - Detorsion.

Unit-IV ANIMAL DIVERSITY (Nonchordate)

Type Study & General Topics:

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:

Echinodermata : Larval forms.

Minor phyla : General characters of Phoronida, Brachiopoda and Echiuroidea.

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 & Companv, Delhi.

PAPER - 302 (Theory)

(ANIMAL DIVERSITY (Chordates))

Unit-I ANIMAL DIVERSITY (Chordates) - Type Study :

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

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

Unit-II ANIMAL DIVERSITY (Chordates) - Type study :

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

Aves : Type - Pigeon *(Columba livia)* - Classification, Habit & Habitat, External characters, Digestive system, Respiratory system, Circulatory systems, Brain, Urinogenital system, Types of feathers.

Unit-III ANIMAL DIVERSITY (Chordates) - General topics:

Pisces : Differences between Chondrichthyes & Osteichthyes, Swim bladders, Accessory respiratory organs, Parental care and Migration.

Dipnoi : Habits, Habitat and peculiarities of Protopterus, Lepidosiren and Neoceratodus.

Amphibia : Parental care.

Unit-IV ANIMAL DIVERSITY (Chordates) - General topics :

Reptilia : Temporal fossae,

Dinosaurs (Brontosaurus, Triceratops, Tyranosaurus, Dimetrodon, Stegosaurus, Pteranodon, Ichthyosaurus, Iguanodon).

Aves : Birds are glorified reptiles, Migration.

Mammalia : Adaptations of aquatic mammals,
Dentition (dental formulae of Human, Cow, Horse, Rat, Elephant, Dog, Cat).

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 - 303 (Theory)

(ANIMAL BIOCHEMISTRY)

Unit-I CARBOHYDRATES :

Introduction, definition and classification of Carbohydrates.

Asymmetry, Isomers, Optical isomerism and Mutarotation.

Formulation of Monosaccharides (Fischer and Haworth formula)

Monosaccharides :

- Definition, General formula.
- Classification upto Hexoses (with structures of suitable examples).
- Chemical properties :
  a) Reaction involving glycosidic -OH group.
  b) Reactions involving both, -OH as-well-as -CHO/-C=O groups :
     - Oxidation : Sugar acids, Oxidation with metal hydroxides.
     - Reduction : Reduction with sodium amalgam, Reduction with strong mineral acids, Reduction with dilute alkalis.
     - Osazone test: Reaction with phenyl hydrazine.

Unit-II CARBOHYDRATES :

Disaccharides :

- Definition.
- Flow-chart of classification based upon the type of glycosidic linkages.
- Occurrence, formation, structure, properties and hydrolysis of Sucrose, Lactose, Maltose and Cellobiose.

Polysaccharides :

- Definition.
- Flow-chart of classification, based upon structures and functions.
- Occurrence, formation, structure, properties and hydrolysis of :
  a) Homopolysaccharides - Starch, Glycogen, Inulin, Cellulose and Chitin.
  b) Heteropolysaccharides - Mucopolysaccharides : Hyaluronic acid, Chondroitin Sulphates, Heparin.
- Biological significance of Carbohydrates.

Unit III PROTEINS :

Introduction and Definitions.

Amino Acids :

General Structure

- Classification

  (based upon the composition of the side chain/R group)

  (based upon the number of amino and carboxylic groups)
- Nonprotein amino acids

Peptides :

- Formation of Peptide Bond, N- and C- terminals
- Naming of peptide chain

Protein Structure:

Chemical Bonds: a) Primary - Peptide bond
b) Secondary - Disulfide, Hydrogen, Hydrophobic and Ionic.

Protein Configuration:

a) Primary structure (Amino acid sequence)
b) Secondary structure (α-helix formation, β-Pleated Sheet)
c) Tertiary structure (Folding of the peptide chain)
d) Quaternary structure (Protein-protein interactions)

Unit-IV PROTEINS:

Classification of proteins:

a) Based upon shape - Globular and Fibrillar.

b) Based upon composition & solubility - Simple, Conjugated and Derived.

Properties :

Physical - Colour & Taste, Shape & Size, Molecular weight, Colloidal nature, Denaturation, Amphoteric nature and Solubility.

Chemical -

a) Hydrolysis

b) Reactions involving -COOH group :

- Reaction with alkalies (Salt formation)

c) Reactions involving -NH_2 group :

- Reaction with mineral acids (Salt formation)
- Reaction with formaldehyde

d) Reaction involving R group (Biuret test)

■ Biological significance of proteins

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 - 304 (Theory)

(CYTOLOGY AND CANCER BIOLOGY)

Unit-I CYTOLOGY (Tools and Techniques) :

1. Electron Microscopes (TEM, SEM)
2. Fluorescence microscope
3. Confocal Microscope
4. Paper chromatography (Ascending and Descending)
5. PAGE - Slab gel electrophoresis

Unit-II CYTOLOGY :

1. Karyotyping and Karyotype
2. Ultrastructure and functions of Plasma membrane:
   a) Brief introduction of chemical composition.
   b) Ultrastructure – 'Fluid Mosaic model' only.
   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.

Unit-III CYTOLOGY :

1. Classification of chromosomes based upon :
   - the location of their centromeres
   - their functions (i.e. somatic & sex chromosomes)
2. Ultrastructure & general functions of :
   A) Metaphase Chromosome - (Chromatin, Chromatids, Nucleosome, Centromere, Kinetochore, Telomere, Secondary constriction,

Euchromatin, Heterochromatin)

B) Giant chromosomes - Polytene chromosome and Lampbrush chromosome.

3. Cell differentiation
   - Hammerling's experiment on Acetabularia,
   - Bantook's experiment on zygote of Mayetiola destructor,
   - Spemann's experiment on eggs of newt and Somatic hybridization
4. Ultrastructure & general functions of Cilia/Flagella.
5. Ultrastructure & general functions of Centrioles/Basal bodies.
6. Cell cycle

Unit-IV CANCER BIOLOGY:

1. What is cancer?
2. Types of cancer.
3. Characteristics of cancer cells.
4. Possible causes of carcinogenesis :
   a) Mutation theory
   b) Metabolic theory.
   c) Hormonal disturbance theory.
   e) Irritation theory.
5. Chemical carcinogens.
6. Mechanism by which carcinogens induce cancer.
7. Oncogenic viruses.
8. Retroviruses.

Reference Books :

1. Cytology, P. S. Verma & V. K. Agarwal, S. Chand & Company, Delhi.
2. Cell Biology, C. B. Power, Himalaya Publishing House.
3. Cellular and Molecular Biology, De Robertis and De Robertis, Saunders Pub.
4. Essential Cell Biology, Bruce Alberts, et. al., Garland Pub.

SUBJECT ELECTIVE COURSE (SEC)

PAPER - 305 (Theory)

(POLLUTION, CYTOLOGICAL/ HISTOTECHNOLOGY TECHNIQUES)

Unit-I POLLUTION :

Various pollutants & their effects on living organisms

- **Air Pollutants :**
  a) Gaseous - CO, SO_2, NO_2
  b) Particulate - Dust, Lead, Aerosol.

  Effects of air pollution on living organisms

  Effects of ozone depletion on human health
- **Water Pollutants :**

  Biological organisms (bacteria & protozoan), acids, alkalies, dyes, hydrogen sulphide, pesticides, fertilizers, toxic metals (Fluoride, Mercury, Arsenic), faeces, domestic wastes, and suspended matters.

  Effects of water pollution on living organisms
- **Noise pollution** and its effects on physical health

Unit-II POLLUTION :

- **Soil/Land Pollutants** and their effects**:**
  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.
- **Radioactive Pollutants** and their effects.
- Biological Treatment of Effluents:
  1. Trickling filters system
  2. Stabilization Ponds.
  3. Aerated lagoons.
- Role of an individual in the prevention of pollution.

Unit-III CYTOLOGICAL TECHNIQUES :

- Introduction.
- Types of slide preparations - W.M., smears, squashes, sections.
- 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 HISTOTECHNOLOGY TECHNIQUES:

- Fixation by Freezing :
  a) Freeze-Drying method.
  b) Freezing-Substitution method.
  c) Freeze-Etching method.
- Dehydration.
- Embedding.
- Sectioning by Rotatory microtome, Cryotome, Ultramicrotome.
- Staining & Stains for light microscopy and electron microscopy.

  Importance of Histotechnology

Reference Books:

1. Environmental Pollution (Popular Science), N. Manivasakan, National Book Trust, New Delhi.
2. Ecology and Environment, P. D. Sharma, Rastogi Publications, Meerut
3. Handbook of Basic Microtechnique, Peter Gray, McGraw-Hill Book Company.

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B.Sc. Semester-5 Zoology

Theory Paper-style and Pattern of marks-distribution

(PAPER 301 to 305)

Q.1A	1)	Unit-I	07
	2)	Unit-I	07
		OR	
	1)	Unit-I	07
	2)	Unit-I	07
Q.1B	Answer in brief: (Any four)		04
	06 Objective questions of 01 mark each (Unit-I)		
Q.2A	1)	Unit-II	07
	2)	Unit-II	07
		OR	
	1)	Unit-II	07
	2)	Unit-II	07
Q.2B	Answer in brief: (Any four)		04
	06 Objective questions of 01 mark each (Unit-II)		
Q.3A	1)	Unit-III	07
	2)	Unit-III	07
		OR	
	1)	Unit-III	07
	2)	Unit-III	07
Q.3B	Answer in brief: (Any three)		03
	05 Objective questions of 01 mark each (Unit-III)		
Q.4A	1)	Unit-IV	07
	2)	Unit-IV	07

OR

	1)	Unit-IV	07
	2)	Unit-IV	07
Q.4B	Answer in brief: (Any three)		03
	05 Objective questions of 01 mark each (Unit-IV).		

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PAPER-306 (A-1) (Practicals)
(Based mainly on Theory Paper-301)

1. ANIMAL DIVERSITY (Nonchordates):
   Study of Scorpion:
   1. External characters,
   2. Digestive system,
   3. Circulatory system,
   4. Excretory system,
   5. Nervous,
   6. Reproductive system

2. ANIMAL DIVERSITY (Nonchordates):
   Study of Cuttlefish:
   1. External characters,
   2. Digestive system,
   3. Circulatory system,
   4. Excretory system,
   5. Nervous,
   6. Reproductive system

3. ANIMAL DIVERSITY (Nonchordates):
   Study of Starfish:
   1. External characters,
   2. Digestive system,
   3. Water vascular system

4. ANIMAL DIVERSITY (Nonchordates):
   Study by charts/models/specimens to study peculiarities of:
   Leucosolenia, T. S. through Leucosolenia, Spicules, Porpita, Physalia, Obelia (W.M. & Medusa), Canal systems in Porifera, Crustacean larvae (Nauplius, Zoea, Megalopa), Shell (chiton, dentalium, mytilus, cypraea) and foot (Aplysia, Solen, Pearl oyster, octopus) Echinoderm larvae (Bipinnaria, Brachiolaria, Echinopluteus, Ophiopluteus, Auricularia, Doliolaria), Bonelia, Lingula, Phoronis.

5. Submission of permanent slides (03 wm & 03 Histological)

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B.Sc. Semester-5 Zoology

(SKELETON QUESTION PAPER FOR PRACTICAL EXAMINATION)

PAPER-306 (A-1)

(Based mainly on Theory Paper 301 & 305)

Date : ..... Marks : 35 Time: .....

Q.I.	Sketch a labeled diagram of the_____system of Scorpion and show it to the examiner.	06
Q.2	Sketch a labeled diagram of the_____system of _____and show it to the examiner.	06
Q.3.	Identify specimens 1 to 6 as per instructions: Sp.1 Identify and comment on its peculiarities. Sp.2 Identify and comment on its peculiarities. Sp.3 Identify and comment on its peculiarities. Sp.4 Identify and comment on its peculiarities. Sp.5 Identify and comment on its peculiarities	10
Q.4	Submission	10
Q.5	Journal	03

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B.Sc. Semester-5 Zoology

DETAILS OF PRACTICAL EXAMINATION (Question wise)

PAPER-306 (A-1)

(Based mainly on Theory Paper 301 & 305)

Q.1 Scorpion- Ext Characters, Digestive, Circulatory, Excretory, Nervous, Reproductive system

Q.2 Cuttlefish - Ext Characters, Digestive, Circulatory, Excretory, Nervous, Reproductive system

Starfish – Ext Characters, Digestive, Water Vascular system

Q.3. Sp.1 : Leucosolenia, T. S. through Leucosolenia, Spicules, Porpita, Physalia, Obelia (W.M. & Medusa)

Sp.2 : Canal systems in Porifera,

Sp.3 : Crustacean larvae (Nauplius, Zoea, Megalopa)

Sp.4 : Echinoderm larvae (Bipinnaria, Brachiolaria, Echinopluteus, Ophiopluteus, Auricularia, Doliolaria)

Sp.5 : Shell(chiton, dentalium, mytilus, cypraea) and foot (Aplysia, Solen, Pearl oyster, octopus) Bonelia, Lingula, Phoronis.

Q.4 Submission of 06 permanent slides (03 Histology and 03 W.M)

Q.5 Journal

PAPER-306 (A-2) (Practicals)
(Based mainly on Theory Paper-302 & 305)

1. Ecology:
   Estimation of (in water samples):
   Titrimetric- (Acidity, Alkalinity, Calcium hardness (using Murexide indicator), Total Hardness (using Eriochrome Black T indicator), Ca^{++} & Mg^{++}.

2. ANIMAL DIVERSITY (Chordates):
   Study of Labeo:
   1. External characters,
   2. Digestive system,
   3. Respiratory system,
   4. Arterial system,
   5. Venous system,
   6. Brain
   7. Urogenital system.

3. ANIMAL DIVERSITY (Chordates):
   Study of Pigeon:
   1. External characters,
   2. Digestive system,
   3. Arterial systems,
   4. Venous systems,
   5. Brain,
   6. Urogenital System.

4. ANIMAL DIVERSITY (Chordates):
   Study by charts/models/specimens to study peculiarities of:

   Types of feathers and Air-sacs in Pigeon, Swim bladder, Accessory respiratory organs in fishes, Petromyzon, Myxine, Protopterus, Eel, Parental care (Male Hippocampus, Male Kurtus, Male Arius, Female Tilapia, Alytes, Pipa, Rhacophorus, Hyla, Rhinoderma).

5. ANIMAL DIVERSITY(Chordates):
   Study by charts/models/specimens to study peculiarities of:

   Temporal fossae, Dinosaurs (Brontosaurus, Triceratops, Tyrannosaurus, Iguanodon, Stegosaurus, Pteranodon, Ichthyosaur, Plesiosaur). Aquatic mammals (Dolphin, Whale, Walrus, Seal), Dentition in mammals (dental formulae of Human, Cow, Horse, Elephant, Rat, Dog, Cat).

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B.Sc. Semester-5 Zoology

(SKELETON QUESTION PAPER FOR PRACTICAL EXAMINATION)

PAPER-306 (A-2)

(Based mainly on Theory Paper 302 & 305)

Date : ..... Marks : 35 Time: .....

Q.1	Estimate titrimetrically the .....of the given water sample Record your observations & calculations and submit to the examiner.	08
Q.2	Sketch a labeled diagram of the_____system of _____Labeo / Pigeon and show it to the examiner.	08
Q.3	Identify specimens 1 to 5 as per instructions: Sp.1 Identify and describe. Sp.2 Identify and comment on its peculiarities. Sp.3 Identify and comment on its peculiarities. Sp.4 Identify and comment on its peculiarities. Sp.5 Identify and comment.	10
Q.4	Viva voce.	06
Q.5	Journal	03

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B.Sc. Semester-5 Zoology

DETAILS OF PRACTICAL EXAMINATION (Question wise)

PAPER-306 (A-2)

(Based mainly on Theory Paper 302 & 305)

Q.1 Acidity, Alkalinity, Calcium hardness (using Murexide indicator),

Total Hardness (using Eriochrome Black T indicator), Ca++ and Mg++.

Q.2 Labeo- External characters, Digestive. Respiratory, Arterial, Venous, Brain, Urogenital

Pigeon - External characters, Digestive system, Arterial & Venous systems, Brain, Urogenital System.

Q.3 Sp.1 Pigeon : Types of feathers and Air-sacs.

Sp.2 & Sp.3 Swim bladder, Accessory respiratory organs in fishes, Petromyzon, Myxine, Protopterus, Eel, Parental care (Male Hippocampus, Male Kurtus, Male Arius, Female Tilapia, Alytes, Pipa, Rhacophorus, Hyla, Rhinoderma).

Sp.4 Temporal fossae, Dinosaurs (Brontosaurus, Triceratops, Tyrannosaurus, Iguanodon, Stegosaurus, Pteranodon, Ichthyosaur, Plesiosaur).

Sp.5 Aquatic mammals (Dolphin, Whale, Walrus, Seal), Dentition in mammals (dental formulae of Human, Cow, Horse, Elephant, Rat, Dog, Cat).

Q.4 Viva (Syllabus of Theory Papers 301, 302 & 305 as-well-as Practical Papers 306 (A-1) & 306 (A-2) only.)

Q.5 Journal

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B.Sc. Semester-5 Zoology

(SKELETON QUESTION PAPER FOR PRACTICAL EXAMINATION)

PAPER-306 (B-1)

(Based mainly on Theory Paper 303)

Date : ..... Marks : 35 Time: .....

Q.1	Detect any one constituent from the given unknown solution and show your tests to the examiner.	10
Q.2	Estimate calorimetrically the concentration of____ from the given unknown solution and submit your results to the examiner. (Note : Students are not supposed to take the colorimetry readings by themselves.)	10
Q.3	Prepare the atomic model and show it to the examiner. A. Carbohydrate B. Amino Acid / Dipeptide	12
Q.4	Journal	03

PAPER-306 (B-1) (Practicals)
(Based mainly on Theory Paper-303)

1. Detection of carbohydrates & proteins:
   Monosaccharides - Glucose and Fructose
   Disaccharides - Lactose, Maltose and Sucrose
   Proteins - Albumin and Casein

2. COLORIMETRIC ESTIMATION OF:
   Proteins (Preparation of Std. Curve by Biuret method).
   Glucose (Nelson-Somogyi method)

3. ATOMIC MODELS OF CARBOHYDRATES:
   Preparation of atomic models of:
   Acyclic as-well-as cyclic structures of
   -Ribose, Arabinose, Ribulose, Glucose, Mannose, Galactose, Psicose, Fructose and Tagatose.
   -Maltose, Lactose and Sucrose

4. ATOMIC MODELS OF PROTEINS:
   Preparation of atomic models of:
   -All amino acids except heterocyclic amino acids.
   - Dipeptides (Glysyl-Alanine, Glysyl-Valine, Ala-Ser & Glu-Lys.)

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B.Sc. Semester-5 Zoology

DETAILS OF PRACTICAL EXAMINATION (Question wise)

PAPER-306 (B-1)

(Based mainly on Theory Paper 303)

Q.1 a) Monosaccharides - Glucose and Fructose

b) Disaccharides - Lactose, Maltose and Sucrose

c) Proteins - Albumin and Casein

Q.2 a) Estimation of Proteins (Preparation of Std. Curve by Biuret method).

b) Estimation of Glucose (Nelson-Somogyi method)

Q.3 Atomic models of :

a) Acyclic as-well-as cyclic structures of

- Ribose, Arabinose, Ribulose, Glucose, Mannose, Galactose, Psicose, Fructose and Tagatose.
- Maltose, Lactose and Sucrose

b) All amino acids except heterocyclic amino acids.

Dipeptides (Glysyl-Alanine, Glysyl-Valine, Ala-Ser & Glu-Lys.)

Q.4 Journal

PAPER-306 (B-2) (Practicals)
(Based mainly on Theory Paper-304)

1. CYTOLOGY:
   -Temporary mounting of mitosis from Onion root tip.
   -Temporary mounting of Barr body from Cheek cells / hair follicle.
   -Slide of Polytene chromosomes - Salivary glands of Drosophila larva.

2. Study of karyotype of -Normal man, Normal woman, Down syndrome, Klinefelter syndrome, Turner syndrome

3. Ascending Paper Chromatography (Any of the 20 amino acids)

4. Study by charts/photographs
   TEM, SEM, Confocal, Fluorescent microscope
   Fluid Mosaic model of Plasma membrane,
   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),
   Ultrastructure of Polytene chromosome and Lampbrush chromosome. Cell cycle, Transmission & Scanning electron micrographs of a metaphase chromosome, Nucleosome, Ultrastructure of a Primary constriction, Somatic hybridization. Hammerling's experiment on Acetabularia, Bantook's experiment on zygote of Mayetiola destructor, Spemann's experiment on eggs of newt.
   Cancer biology (Structure of retrovirus & DNA virus, Difference between normal & cancerous cell, Difference between benign & malignant tumor)

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B.Sc. Semester-5 Zoology

(SKELETON QUESTION PAPER FOR PRACTICAL EXAMINATION)

PAPER-306 (B-2)

(Based mainly on Theory Paper 304)

Date : ..... Marks : 35 Time: .....

Q.1 Make a temporary preparation of .....from the given material and show it to the examiner. 08

Q.2 Make a temporary preparation of .....from the given material submit your result to the examiner. 08

OR

Find out the Rf value, identify the unknown amino acid and submit your results to the examiner.

Q.3 Identify specimens 1 to 4 as per instructions: 10

Sp. 1 Identify and state its uses.

Sp. 2 Identify and describe in brief.

Sp. 3 Identify and comment.

Sp. 4 Identify and describe.

Sp.5 Identify and describe.

Q.4 Viva voce 06

Q.5 Journal 03

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B.Sc. Semester-5 Zoology

DETAILS OF PRACTICAL EXAMINATION (Question wise)

PAPER-306 (B-2)

(Based mainly on Theory Paper 304)

Q.1 Temporary mounting of mitosis from Onion root tip.

Temporary mounting of Barr body from Cheek cells / hair follicle.

Slide of Polytene chromosomes - Salivary glands of Drosophila larva.

Q.2 Study of karyotype of -Normal man, Normal woman, Down syndrome, Klinefelter syndrome, Turner syndrome **OR**

Any of the 20 amino acids.

Q.3 Sp. 1 TEM, SEM, Confocal, Fluorescent microscope

Sp. 2 a) Fluid Mosaic model of Plasma membrane.

b) 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.

Sp.3 Ultrastructure of Polytene chromosome and Lampbrush chromosome.

Cancer biology (Structure of retrovirus & DNA virus, Difference between normal & cancerous cell, Difference between benign & malignant tumor)

Sp.4 Cell cycle, Transmission & Scanning electron micrographs of a metaphase chromosome, Nucleosome, Ultrastructure of a Primary constriction, Somatic hybridization.

Sp.5 Hammerling's experiment on Acetabularia, Bantook's experiment on zygote of Mayetiola destructor, Spemann's experiment on eggs of newt.

Q.4 Viva voce

Q.5 Journal

NOTE:

1. The list of the reference books provided here in the syllabus is not an exhaustive list. Professors and students may use any other suitable & authentic reference source.
2. Besides using chalk & duster, professors are strongly encouraged to make use of additional methods of teaching, to complete the syllabus.
3. It is strongly advisable to take students for an excursion tour or educational visit to any coastal area, NP or sanctuary, in order to study the biodiversity in its natural habitat. However, collection of any fauna from its habitat should be avoided so as to help in maintaining the ecosystem.

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B.Sc. Semester - 6

ZOOLOGY SYLLABUS

(Effective from June 2019)

The syllabus is to be completed by assigning FOUR hours for each Theory Paper 307 to 310 and THREE hours for Theory Paper 311 and a total of TWELVE hours for the Practicals, per week.

Pattern of Examination:

- Theory (Ext. 350 marks & Int. 150 marks)
- Practicals (Ext. 140 marks & Int. 60 marks)

INSTRUCTIONS:

1. Each theory paper comprises of FOUR UNITS. UNIT I & II carry 18 marks & UNIT III & IV carry 17 marks in the university examinations.
2. The theory question papers will have to be set according to the paper-style and the pattern of marks-distribution provided on last page of theory syllabus.
3. The details, paper-skeleton with marks distribution for the Practicals is provided in this syllabus.
4. In order to be qualified to appear in the Internal/External (University) Practical Examination, the student must submit his/her duly certified journals on the day of examination.

PAPER- 307 (Theory)

(POULTRY, FISHERIES, ANIMAL DIVERSITY (chordates), MOLECULAR BIOLOGY & GENETICS)

Unit I POULTRY SCIENCE

1. Introduction, Importance
2. Poultry birds, Poultry Housing,
3. Poultry Equipment's (Incubators, Brooders, Feeders, Waterers)
4. Care of egg laying hen, Brooding, Rearing,
5. Structure of unfertilized egg, Gradation of Eggs, Preservation of Eggs
6. Poultry Diseases (Pulorum, Ranikhet, Bird flue, Coccidiosis)

Unit II FISHERIES

1. Induced Breeding
2. Fish Preservation (Icing, salting, Canning, Freezing, Smoking)
3. Age determination in Fishes (By scale reading)
4. Marine prawn culture

Reference Books for Unit I & II

1. Poultry Vighyan, M I Dhasura, Granth nirman board
2. Essentials of Poultry Science , Mihir Suthar,
3. Fish & Fisheries of India, V. B. Jhingran, Hindustan Pub., Meerut.
4. Fishes, Mary Chandy. National Book Trust, India.
5. Fishery Science and Indian Fisheries, Srivastav, Kitab Mahal Pub., Delhi.

UNIT III ANIMAL DIVERSITY*(Chordates)*

Type Study *&* General topics*:*

General structure and morphology with functional anatomy of the following animal:

A) i) **Rat *(Rattus rattus)*** - External characters, Internal anatomy, Digestive system, Respiratory system, Heart, Arterial & Venous systems, Brain, Excretory and Reproductive system

ii) **Shark *(Scoliodon sorrakowah)*** : Cranial nerves, Membranous labyrinth

B) General topics :

Types of beaks and feet in birds, V.S. of mammalian skin

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 and GENETICS :

A) Molecular Biology :

1) Types of DNA Replication **:** Semiconservative, Conservative and Dispersive.
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) Linkage and Crossing over (Linkage map, Single cross, Recombination)
6) Protein synthesis (in details)
7) Southern Blotting Technique
8) Northern Blotting Technique
9) Polymerase Chain Reaction (PCR)
10) DNA Fingerprinting

B) Genetics of Human Behavior *:*

1) First explain how to study Behavior Genetics.
2) (in brief) **:** Charcot-Marie-Tooth Disorder, Fridreich Ataxia, Huntington Disease, Menkes Kinky-hair Disorder, Aggressive behavior, Schizophrenia, Alcoholism and Alzheimer Disease.
3) Gene therapy
4) Human Genome Project-brief account

Reference Books for Molecular Biology & Genetics:

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.

5. Principles of Genetics (2nd Ed), Peter Snustad, M. J. Simmons, John Wiley & Sons
6. Basic Genetics, R. F. Weaver and P. W. Hedrick, WCB Publishers.
7. Concepts Of Genetics, W. S. Klug and M. R. Cummings, Pearson Education Pvt. Ltd.
8. Essential Genetics, D. L. Hartl and E. W. Jones, Jones & Barlett Publishers.
9. Genetics, P. S. Verma and V. R. Agarwal, S. Chand & Company, Delhi.

PAPER - 308 (Theory)

(HUMAN PHYSIOLOGY)

Unit I HUMAN PHYSIOLOGY - LYMPHATIC SYSTEM *:*

1. Brief introduction.
2. Functions of the Lymphatic system
3. Lymphatic vessels and Lymph circulation **(**Route, Thoracic duct, Right Lymphatic duct, Maintenance)
4. Lymphoid organs: (Primary and secondary)
   - Thymus, Bone Marrow, Lymph nodes, Spleen, Lymphatic nodules
5. Non-Specific Resistance to Disease **:**
   First line of defense: Skin & Mucous Membranes
   (Mechanical factors, Chemical factors)
   Second line of defense: Antimicrobial substances
   (Interferon, Complement, Antimicrobial proteins)
6. Mechanism of Phagocytosis, Inflammation, Fever

Unit II HUMAN PHYSIOLOGY - IMMUNITY*:*

1. Brief introduction, Innate and Adaptive immunity
2. Cells of the Immune system
3. Immunity (Specific Resistance to Disease)
   - Antigens/Immunogens :
     Definition, Characteristics, Chemical nature,
     Antigen processing (Exogenous and Endogenous)
   - Antibodies/Immunoglobulins **:**
     Definition, Structure, Classes, Characteristics and Functions
     Adaptive immunity-Cellular & Humoral Immunity
     Formation of T cells & B cells
     T cells & Cellular Immunity
     B cells & Humoral Immunity
   - Monoclonal antibodies
3. Disorders, Homeostatic Imbalances :
   - AIDS
   - Hypersensitivity (Allergy)
   - Autoimmune diseases
   - Tissue rejection

Unit III HUMAN PHYSIOLOGY - RESPIRATION :

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

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

Reproduction *:*

1. Role of male sex hormones in men.
2. Role of female sex hormones in women.
3. Menstrual cycle.
4. Menopause.

Muscle contraction *:*

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

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

1. Immunology, Kuby, Goldsby, Osborne and Thomas, W.H. Freeman and Company, 6th edition
2. Principles of Anatomy and Physiology**,** Tortora and Anagnostakos, HarperCollins College Publishers, 4th Edition.
3. Animal Physiology and Related Biochemistry, H. R. Singh, Shobhan Lal Naginchand & Co. Edu. Pub., Jalandhar.
4. Textbook of Animal Physiology, A. K. Berry, Emkay Pub., New Delhi

PAPER - 309 (Theory)

(ANIMAL BIOCHEMISTRY & METABOLISM)

UNIT I LIPIDS AND ENZYMES :

A. Lipids :

1. Introduction and definition.
2. **Components :**
   Alcohols,
   Fatty acids:
   Types of Fatty Acids :
   a) *Saturated acids* **:** Butyric, Palmitic, Stearic and Arachidic.
   b) *Unsaturated acids* **:** Monoethenoid, Diethenoid, Triethenoid and Tetraethenoid.
3. **Classification of Lipids :**
   a) *Simple* **:** Triglycerides (Fats), Waxes (Formulae not required)
   b) *Compound* **:** Phospholipids **:** Phosphoglycerides **:** Lecithins, Cephalins, Plasmalogens
   c) *Derived Lipids* **:** Steroids (Basic steroid nucleus and Cholesterol only).
4. **Properties :**
   a) *Physical* **-** Colour, odour, taste, solubility, melting point, specific gravity, insulation and emulsification.
   b) *Chemical* **-**
      a) Reactions involving -COOH group
         (Hydrolysis, Saponification and Hydrolytic rancidity)
      b) Reactions involving double bonds
         (Hydrogenation, Halogenation and Oxidative rancidity)
5. Biological significance of Lipids.

B. Enzymes :

1. Introduction, Definition**,** Chemical nature
2. Nomenclature & Classification
3. Factors affecting enzyme activity/enzyme catalyzed reaction **:**
   Temperature, pH, Enzyme concentration, Substrate concentration, Activators, radiation, Inhibitors (Reversible, Irreversible, Allosteric Inhibition)
4. Mechanism of enzyme action

Unit II METABOLISM OF CARBOHYDRATE :

1. Glycogenesis (structures required).
2. Glycogenolysis (structures required).
3. Glycolysis (EM Pathway) (structures required).
4. Krebs Cycle (structures required).

Unit III METABOLISM OF CARBOHYDRATE :

1. Electron Transport System
2. HMP Shunt Pathway (structures required).
3. Glucogenesis (structures required).
4. Gluconeogenesis (structures not required).

Unit IV METABOLISM OF PROTEIN AND LIPID *:*

A. Metabolism of Protein *:*

1. Deamination (structures required).
2. Transamination (structures required).
3. Decarboxylation (structures not required).
4. Urea synthesis (structures required).

B. Metabolism of Lipid *:*

1. Glycerol metabolism (structures required).
2. Fatty acid metabolism **:-** Oxidation of saturated fatty acids (structures required).
3. Biosynthesis of saturated fatty acids (structures required)

Reference Books for Units I, II, III and IV :

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

PAPER - 310 (Theory)

(TOXICOLOGY, ANIMAL BIOTECHNOLOGY, ANIMAL BEHAVIOR, DEVELOPMENTAL BIOLOGY)

Unit I TOXICOLOGY:

1. Brief Introduction.
2. Definitions of Toxicology, Toxicity, Toxicants and Xenobiotics.
3. Areas of Toxicology **:** Mechanistic, Regulatory, Forensic, Clinical, Environmental.
4. Classification of Toxicants **:** Corrosives, Irritants, Neurotics and Cardiac poisons.
5. Types of toxicity **:** Acute, Subacute, Chronic.
6. Toxicity rating chart
7. 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.
8. 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. Brief history of biotechnology.
2. Advantages and disadvantages of animal Tissue Culture
3. Substrates on which cells grow and Gas phase for Tissue Culture - in brief.
4. Some important requirements for cell & tissue culture**:** pH, CO_2 and Bicarbonate, Buffer, O_2, Temperature, Balanced Salt Solution (BSS), Antibiotics, Serum
5. Tissue Culture techniques.
6. Organ Culture techniques.
7 Whole Embryo Culture technique.

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
2. Learning **:** Definition.
   Types of Learning **:** (a) Imprinting
   (b) Habituation
   (c) Classical conditioning (E.g. Pavlov's expt.)
   (d) 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 behaviour, Herring gull.
   - False information - e.g. Scorpion fly *(Hylobittacus apicalis)*
4. Communication in/between bats and moths.
5. Social organization in baboons.
6. Pheromones

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 DEVELOPMENTAL BIOLOGY:

1. Types of eggs depending upon the quantity of yolk.
   (Microlecithal/Oligolecithal, Mesolecithal and Polylecithal/Macrolecithal/Megalecithal)
   Types of eggs depending upon the distribution of yolk.
   (Homolecithal/Isolecithal, Centrolecithal and Telolecithal)
2. Patterns of cleavage **-** radial, spiral (dextral, sinistral), bilateral, incomplete/meroblastic and complete/holoblastic.
3. Embryology of Chick (upto 72 hours) **:**
   - Fertilization, cleavage, blastulation,
   - Gastrulation (Primitive streak , Mesogenesis, Somite Formation)
   - Development of brain.
   - Development of heart.
   - Flexion & Torsion.
   - Extra-embryonic membranes.
   - Diagrams of 24 hr, 33 hr, 48 hr and 72 hr old chick embryo
4. Types of Placentation in mammals (histological).

Reference books for Developmental Biology :

1. Introduction of Embryology, Balinsky, CBS College Publishers.
2. Developmental Biology, T. Subramanayam, Narosa Publishing House.
3. Developmental Biology, V. B. Rastogi, Rastogi Publications, Meerut.
4. An Outline of Animal Development, Davenport, Addition-Werley.

SUBJECT ELECTIVE COURSE (SEC)

PAPER – 311_(Theory)

(APICULTURE , SERICULTURE)

Unit-I : APICULTURE:

Introduction.

1. Classification of *Apis.*
2. Different species of honey bees.
3. Castes in honey bees.
4. Structures and functions of each caste of honey bees.
5. A typical bee hive.
6. Communication in honey bees.

Unit-II : APICULTURE:

1. Life history of honey bee.
2. Apiculture - choice of flora.
   - choice of bees.
3. Apiculture methods **:** Old and Modern methods.
4. Honey.
5. Beeswax.

Unit-III SERICULTURE:

Introduction.

1. Classification of *Bombyx mori.*
2. Habits and Habitat, External features and Life cycle of *Bombyx mori.*
3. Introduction to different species of silkworms used for sericulture.

Unit-IV : SERICULTURE:

1. Sericulture industry **:**
   - Requirements and appliances
   - Rearing of silkworm **:** Grainage management
   - Stiffling, Reeling and spinning
   - Diseases of silkworm
2. Chemistry and uses of silk.
3. Sericulture in India

Reference books ***:***

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.

GUJARAT UNIVERSITY

B.Sc. Semester-6 Zoology

Theory Paper-style and Pattern of marks-distribution

(PAPER 307 to 311)

Q.1A	1)	Unit-I	07
	2)	Unit-I	07
		OR	
	1)	Unit-I	07
	2)	Unit-I	07
Q.1B	Answer in brief: (Any four)		04
	06 Objective questions of 01 mark each (Unit- I)		
Q.2A	1)	Unit-II	07
	2)	Unit-II	07
		OR	
	1)	Unit-II	07
	2)	Unit-II	07
Q.2B	Answer in brief: (Any four)		04
	06 Objective questions of 01 mark each (Unit -II)		
Q.3A	1)	Unit-III	07
	2)	Unit-III	07
		OR	
	1)	Unit-III	07
	2)	Unit-III	07
Q.3B	Answer in brief: (Any three)		03
	05 Objective questions of 01 mark each (Unit-III)		
Q.4A	1)	Unit-IV	07
	2)	Unit-IV	07

OR

	1)	Unit-IV	07
	2)	Unit-IV	07
Q.4B	Answer in brief: (Any three)		03

05 Objective questions of 01 mark each (Unit-IV).

****

PAPER-312 (A-1) (Practicals)

(Based mainly on Theory Paper-307)

1. ANIMAL DIVERSITY (Chordates):

   Study of Rat:

   1. Digestive system,
   2. Arterial system,
   3. Venous system,
   4. Reproductive system,
   5. Brain.

2. ANIMAL DIVERSITY (Chordates):
   Study of Shark:
   1. V, VII, IX, X Cranial nerves,
   2. Membranous labyrinth

3. Genetic problems 1 to 4 as per appendix

4. ANIMAL DIVERSITY (Chordates):
   Study by charts/models/specimens of :
   A) Poultry – Poultry birds, Roofs of poultry house, Poultry Equipments, Structure of unfertilized egg, Gradation of Eggs (Based on air space).
   B) Fisheries - Induced Breeding, Fish Preservation (Icing, salting, Canning, Freezing, Smoking), Age determination in Fishes (By scale reading),Marine prawn culture
   C) Types of beaks and feet in birds, V.S. of mammalian skin. Derivatives of mammalian skin (Claw, Nail, Hoof, Horn and Hair), Striated muscle fibres and medullated nerve fibres.

5. MOLECULAR BIOLOGY AND GENETICS:
   A) Study by charts of :
   DNA replication type, DNA synthesis in vitro, Types of DNA and RNA, Protein synthesis, (Central dogma, Transcription, Translation).
   B) Southern blotting, Thermocycler, DNA fingerprinting

GUJARAT UNIVERSITY

B.Sc. Semester-6 Zoology

(SKELETON QUESTION PAPER FOR PRACTICAL EXAMINATION)

PAPER-312 (A-1)

(*Based mainly on Theory Paper 307)*

Date : ..... Marks : 35 Time : .....

Q.1 Sketch a labeled diagram of the_____system of rat and show it to the examiner. 08

Q.2 Sketch a labeled diagram of the_____of shark and show it to the examiner. 07

Q.3 Solve the given genetic problem. 05

Q.4 Identify specimens 1 to 6 as per instructions: 12

Sp.1 Identify and describe.

Sp.2 Identify and describe

Sp.3 Identify and describe

Sp.4 Identify and describe

Sp.5 Identify and describe

Sp.6 Identify and describe

Q.5 Journal 03

GUJARAT UNIVERSITY

B.Sc. Semester-6 Zoology

DETAILS OF PRACTICAL EXAMINATION (Question wise)

PAPER-312 (A-1)

(*Based mainly on Theory Paper 307*)

Q.1 Rat - Digestive, Arterial, Venous, Reproductive system, Brain.

Q.2 Shark - V, VII, IX, X Cranial nerves, Membranous labyrinth

Q.3 Genetic Problems 1 to 4 (See APPENDIX)

Q.4 Identify specimens 1 to 6 as per instructions:

Sp. 1 Poultry - Poultry birds, Roofs of Poultry House

Sp. 2 Poultry - Poultry Equipments, Structure of Unfertilized egg,

Gradation of Eggs (Based on air space)

Sp. 3 Fisheries - Induced Breeding,

Fish Preservation (Icing, salting, Canning, Freezing, Smoking)

Age determination in Fishes (By scale reading)

Marine prawn culture

Sp. 4 Chordates - Types of beaks and feet in birds,

V.S. of mammalian skin. Derivatives of mammalian skin

(Claw, Nail, Hoof, Horn and Hair),

Striated muscle fibres and medullated nerve fibres.

Sp.5 Molecular biology and Genetics **:**

DNA replication type

DNA synthesis in vitro

Types of DNA and RNA

Protein synthesis

(Central dogma, Transcription, Translation)

Sp.6 Molecular biology and Genetics **:**

Southern blotting, Thermocycler, DNA fingerprinting

APPENDIX for Paper - 312 (A-1) (Practical)

GENETICS PROBLEMS

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

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

Explain these results.

Solution :

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

2. Assume that an individual homozygous for ++ is crossed with one homozygous for ab and that F2 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.

3. 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.

4. 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-312 (A-2) (Practicals)

(Based mainly on Theory Paper-308)

1. HUMAN PHYSIOLOGY-BLOOD
    1. Total RBC count in your own blood.
    2. Total WBC count in your own blood.
    3. Preparation of your own blood smear, stained by Geimsa stain, to identify the different WBCs.
    4. Estimation of Hb in your own blood
    5. Preparation of Haemin crystals from your own blood
    6. Determination of bleeding time and Blood clotting time of your own blood

2. HUMAN PHYSIOLOGY-IMMUNITY
   Study by charts/slides of:
   Lymphatic circulatory system in humans, T.S. through a lymph node , T.S. through spleen, T.S. through thymus, Structure of an antibody.

3. HUMAN PHYSIOLOGY-RESPIRATION
   Study by charts of:
   Respiratory muscles, Alveolar-capillary (respiratory) membrane, Exchange of the respiratory gases, Oxygen-haemoglobin dissociation curve

4. HUMAN PHYSIOLOGY-REPRODUCTION
   Study by charts of:
   Menstrual cycle, T. S. of uterus, Mol. structures of Testosterone, Estrogen and Progesterone

5. HUMAN PHYSIOLOGY-MUSCLE
   Study by charts of:
   T. S. of striated muscle, Ultrastructure of sarcomere, Neuro-muscular junction

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B.Sc. Semester-6 Zoology

(SKELETON QUESTION PAPER FOR PRACTICAL EXAMINATION)

PAPER-312 (A-2)

(*Based mainly on Theory Paper 308)*

Date : ..... Marks : 35 Time : .....

Q.1 Perform the given physiological experiment_____ **.** 09

Record your observations & calculations if necessary, and submit to the examiner.

Q.2 Estimate the concentration of _____in your own blood. 09

OR

Make a temporary preparation of_____from your own blood.

OR

Determine the _____of your own blood.

Q.3 Identify the specimens 1 to 4 as per instructions **:** 08

Sp.1 Identify and describe.
Sp.2 Identify and comment.
Sp.3 Identify and describe.
Sp.4 Identify and describe.

Q.4 Viva voce. 06

Q.5 Journal. 03

GUJARAT UNIVERSITY
B.Sc. Semester-6 Zoology
DETAILS OF PRACTICAL EXAMINATION (Question wise)
PAPER-312 (A-2)
(*Based mainly on Theory Paper 308*)

Q.1 Total RBC count in your own blood.
Total WBC count in your own blood.
Preparation of your own blood smear, stained by Geimsa stain, to identify the different WBCs.

Q.2 Hb OR Haemin crystals OR Bleeding time & Blood clotting time

Q3 Sp.1 Immunity **:** Lymphatic circulatory system in humans
T.S. through a lymph node , T.S. through spleen
T.S. through thymus, Structure of an antibody
Sp.2 Respiration **:** Respiratory muscles
Alveolar-capillary (respiratory) membrane
Exchange of the respiratory gases,
Oxygen-haemoglobin dissociation curve
Sp.3 Reproduction: Menstrual cycle, T. S. of uterus
Mol. structures of Testosterone, Estrogen and Progesterone
Sp.4 Physiology of Muscle **:** T. S. of striated muscle.
Ultrastructure of sarcomere.
Neuro-muscular junction

Q.4 Syllabus of Theory Papers 307 & 308 as-well-as Practical Papers 312 (A-1) and 312 (A-2) only.

PAPER-312 (B-1) (Practicals)

(Based mainly on Theory Paper-309)

1. Colorimetric estimation of :
    1. Cholesterol in Serum (Ferric chloride method)
    2. Creatinine in urine
       (Note; Students are not supposed to take the colorimetric readings by themselves)
    3. Effect of temp / pH on the activity of salivary amylase

2. LIPIDS:
    1. Study by charts of:
       Basic steroid nucleus, Cholesterol
    2. Preparation of Atomic models of:
       Glycerol, Butyric acid, Crotonic acid, Tributyrin, Lecithins, Cephalins and Plasmalogens

3. ENZYMES:
   Study by charts of:
    1. Factors affecting enzyme activity :
    2. Temperature
    3. pH
    4. Graph showing effect of [S] on the velocity of an enzyme catalyzed reaction.

4. METABOLOSM:
   Study by charts of:
    1. Glycogenesis (structures required).
    2. Glycogenolysis (structures required).
    3. Glycolysis (EM Pathway) (structures required)
    4. Krebs cycle (structures required).
    5. HMP Shunt pathway (structures required).
    6. Glucogenesis (structures required).
    7. Gluconeogenesis (structures not required).
    8. Deamination (structures required).
    9. Transamination, Urea synthesis (structures required).
    10. β-oxidation of saturated fatty acids (structures required).
    11. Synthesis of fatty acids (structures required).

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B.Sc. Semester-6 Zoology

(SKELETON QUESTION PAPER FOR PRACTICAL EXAMINATION)

PAPER-312 (B-1)

(*Based mainly on Theory Paper 309)*

Date : ..... Marks : 35 Time :……

Q.1 Estimate colorimetrically the concentration of _____ 10
from the given unknown solution and submit your results to the examiner.

OR

Effect of temp / pH on the activity of salivary amylase.

Q.2 Prepare the atomic model of following and show it to the examiner. 12

a) Components of Lipid /Simple lipids.
b) Compound lipids.

Q.3 Identify the specimens 1 to 5 as per instructions **:** 10

Sp.1 Identify and comment.
Sp.2 Identify and describe.
Sp.3 Identify and complete the chart.
Sp.4 Identify and comment.
Sp.5 Identify and comment.

Q.4 Journal 03

GUJARAT UNIVERSITY
B.Sc. Semester-6 Zoology
DETAILS OF PRACTICAL EXAMINATION (Question wise)
PAPER-312 (B-1)
(*Based mainly on Theory Paper 309*)

Q.1 Cholesterol in Serum (Ferric chloride method).
Creatinine in urine.

OR

Effect of temp / pH on the activity of salivary amylase.

Q.2 a) Glycerol, Butyric acid, Crotonic acid, Tributyrin

b) Lecithins, Cephalins and Plasmalogens.

Q.3 Sp.1 Glycerol, Butyric acid, Crotonic acid,

Tributyrin, Lecithins, Cephalins, Plasmalogens

Basic steroid nucleus, Cholesterol,

Sp.2 Factors affecting enzyme activity **:**

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

Sp.3 Glycogenesis (structures required).
Glycogenolysis (structures required).
Glycolysis (EM Pathway) (structures required)
Krebs cycle (structures required).

Sp.4 ETS
HMP Shunt pathway (structures required).
Glucogenesis (structures required).
Gluconeogenesis (structures not required).

Sp.5 Deamination (structures required).
Transamination, Urea synthesis (structures required).
β-oxidation of saturated fatty acids (structures required).
Synthesis of fatty acids (structures required).

PAPER-312 (B-2) (Practicals)

(Based mainly on Theory Paper-310 & 311)

1. TOXICOLOGY:
   Study by charts of: LD_{50} and LC_{50}

2. BIOTECHNOLOGY:
   Study by charts of:
   Trowel's type II culture chamber,
   Tissue / Organ / Whole embryo culture techniques

3. ANIMAL BEHAVIOUR:
   Study by charts of:
   Communication in/between bats & moths,
   Social organization in Baboons.
   Courtship signals - e.g. Balloon Fly *(Hilara sartor)*
   Persuasion & Appeasement-e.g. 3 Stickleback's zigzag dance,
   Herring gull.
   False information - e.g. Scorpion fly *(Hylobittacus apicalis)*

4. APICULTURE:
   Study by charts of:
   Different species of honey bees, Life history of honey bee, Bee hive, Communication in honey bees, Apiculture method

5. SERICULTURE:
   Study by charts of:
   Different species of silkworms, Life cycle of Bombyx mori, Sericulture industry (Rearing, Stifling, Reeling, Spinning)

6. DEVELOPMENTAL BIOLOGY:
   Study by charts of following stages:
   Cleavage / Blastula / Gastrula/ Placenta / Extraembryonic membranes

7. CHICK EMBRYOLOGY:
   Study of permanent slides of W.M of 24, 33, 48, & 72 hrs chick embryo

GUJARAT UNIVERSITY

B.Sc. Semester-6 Zoology
(SKELETON QUESTION PAPER FOR PRACTICAL EXAMINATION)
PAPER-312 (B-2)
(*Based mainly on Theory Paper 310 & 311)*

Date : ..... Marks : 35 Time :……

Q.1 Identify the specimens 1 to 6 as per instructions **:** 14

Sp.1 Identify and describe
Sp.2 Identify and describe
Sp.3 Identify and comment
Sp.4 Identify and comment the reproductive behaviour pattern.
Sp.5 Identify and describe
Sp.6 Identify and describe
Sp.7 Identify and describe

Q.2 Identify the given slide, sketch and label the figure of chick embryo. 07

Q.3 Study Tour report 05

Q.4 Viva voce. 06

Q.5 Journal 03

GUJARAT UNIVERSITY

6th Semester - Zoology

DETAILS OF PRACTICAL EXAMINATION (Question wise)

PAPER-312 (B-2)

(Based on Theory Papers 310 & 311)

Q.1 Sp.1. Toxicology: LD_{50} & LC_{50}
Biotechnology by chart: Trowel's type II culture chamber.

Sp.2 Biotechnology by chart :
Tissue / Organ / Whole embryo culture techniques

Sp.3 Animal behaviour **:**
Communication in/between bats & moths,
Social organization in Baboons.

Sp.4 Animal behaviour **:**
Courtship signals **-** e.g. Balloon Fly *(Hilara sartor)*
Persuasion & Appeasement-e.g. 3 Stickleback's zigzag dance,
Herring gull.
False information - e.g. Scorpion fly *(Hylobittacus apicalis)*

Sp.5 Apiculture: Different species of honey bees, Life history of honey bee
Bee hive, Communication in honey bees, Apiculture method

Sp.6 Sericulture: Different species of silkworms, Life cycle of Bombyx mori,
Sericulture industry(Rearing, Stiffling, Reeling, Spinning)

Sp.7 Cleavage / Blastulation / Gastrulation / Placentation /
Extraembryonic membranes

Q.2 Chick Embryology : 24, 33, 48, & 72 hrs chick embryo

Q.3 Study tour report

Q.4 Syllabus of Theory Papers 309, 310 & 311 as-well-as
Practical Papers 312 (B-1) & 312 (B-2) only.

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NOTE:

1. The list of the reference books provided here in the syllabus is not an exhaustive list. Professors and students may use any other suitable & authentic reference source.
2. Besides using chalk & duster, professors are strongly encouraged to make use of additional methods of teaching, to complete the syllabus.
3. It is strongly advisable to take students for an excursion tour or educational visit to any coastal area, NP or sanctuary, in order to study the biodiversity in its natural habitat. However, collection of any fauna from its habitat should be avoided so as to help in maintaining the ecosystem.