GUJARAT UNIVERSITY
CBCS BASED PROPOSED COURSE
(Effective from June 2017)
B.Sc SEMESTER – I
ZOOLOGY - 101 (Theory)

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

Unit 1 Mammalian Anatomy, Histology & Physiology of the Urinary System

1. Two Kidneys, two ureters, one urinary bladder, and one urethra.

2. Anatomy and Histology of the kidneys.
   - Overview of kidney functions
   - External Anatomy of the Kidneys
   - Internal Anatomy of the Kidneys.
   - Blood and Nerve Supply of the 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 of Tubular Reabsorption and Tubular Secretion (Name of the Hormones and their function only)
   - Counter Current Mechanism
   - Micturitio

Unit 2 (A) Continuation of Excretory system (of Unit 1)

1. Characteristics of Normal Urine
2. Summary of Abnormal Constituents of Urine
3. Clinical Connection: (Brief introduction)
   - Nephroptosis (Floating Kidney)
   - Kidney Transplant
   - Proteinurea
   - Ketonurea
   - Glucosuria Stone in Kidney
   - Renal failure
   - Cystoscopy
   - Dialysis

Reference books for Mammalian Physiology & Histology and Anatomy:

1. Principles of Anatomy & Physiology, Tortora and Grabowski, Harper Collins College Pub
2. Animal Physiology And Related Biochem. H.R.Singh, Shobhan Lal Naginchand & Co. Edu. Pub., Jalandhar.
3. Textbook of Animal Histology. A.K.Berry, Emkay Pub, New Delhi.

(B) Non Chordate Animal Diversity :

Fasciola hepatica (Liver fluke) -Type study

- Systematic position
- Habits and habitat
- External features
- Body wall
- Digestive system
- Respiration
- Excretory system
- Nervous system
- Reproductive system
- Life cycle & Development
- Pathogenesis
- Parasitic Adaptations

Reference books for Animal Diversity of Nonchordates.

1.Textbook of Invertebrates, R.L. Kotpal, Rastogi publications, Meerut
2. Invertebrate Zoology, Jordan and Verma, S.Chand & Company, Delhi

Unit III Genetics and Animal Biotechnology

(A) Genetics :

1. Introduction to Gene
2. Introduction to Mendelian laws of Heredity.
3. Incomplete dominance (e.g. Mirabilis jalap a)
4. Co-dominance (e.g. Roan cattle)
5. Multiple alleles

   e.g.
   - ABO blood groups in human
   - Rh Factor-Erythroblastosisfoetalis
6. Polygenic inheritance (e.g. skin colour in humans)
7. Lethal genes (e.g. Yellow coat colour in mice, Thalesemia)

Reference Books:

1. Genetics, P.K.Gupta,Rastogi Publications, Meerut.
2. Genetics,V.B.Rastogi,Kedarnath Ramnath,Meerut

(B) Animal Biotechnology:

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, Multiwell plates, Petri dishes, Culture flasks)
    - Laboratory Equipments
      (Autoclave, CO_2 Incubator, Centrifuge,
      Laminar Airflow)

Reference Books:

1. Elements of Biotechnology, P.K.Gupta.Rastogi pub, Meerut

2. Culture of Animal Cells: A Manual of Basic Technique. By R. Ian Freshney.

Unit IV Economic Zoology

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

2 Dairy Farming - Introduction, Necessity & Scope of dairy Farming, Definition and importance of Domestication & Husbandry

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

Reference books:

1. Economic Zoology, Sarkar, kundu & Chaki, New Central Book Agency(P) Ltd. New Delhi
2. Economic Zoology (5^{th} edition), G.S Shukla, V. B. Upadhyay, Rastogi Publications, Meerut, New Delhi
3. Applied Zoology, N Arumugam, MuruganRajeswar & Prabhu, Saras Publication,Tamilnadu

GUJARAT UNIVERSITY
CBCS BASED PROPOSED COURSE
ZOOLOGY
(Effective from June 2017)
B.Sc SEMESTER-I
101

SKELETAL QUESTION PAPER FOR THEORY EXAMINATION

Total-70

Que.1 (A) Unit 1 Mammalian anatomy, Histology & Physiology of the Urinary system (7)

Or

(A) Unit 1 Mammalian anatomy, Histology & Physiology of the Urinary system

(B) Unit 1 Mammalian anatomy, Histology & Physiology of the Urinary system (7)

Or

(B) Unit 1 Mammalian anatomy, Histology & Physiology of the Urinary system

Que.2 (A) Unit 2 Continuation of Excretory system (7)

Or

(A) Unit 2 Continuation of Excretory system

(B) Unit 2 Non chordate animal diversity -Type study (*Fasciola hepatica*) (7)

Or

(B) Unit 2 Non chordate animal diversity-Type study (*Fasciola hepatica*)

Que. 3 (A) Unit 3 Genetics (7)

Or

(A) Unit 3 Genetics

(B) Unit 3 Animal Biotechnology (7)

Or

(B) Unit 3 Animal Biotechnology

Que. 4 (A) Unit 4 Economic Zoology (7)

Or

(A) Unit 4 Economic Zoology

(B) Unit 4 Economic Zoology (7)

Or

(B) Unit 4 Economic Zoology

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 2017)
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 Normal constituents of urine
Abnormal constituents of urine
Analysis of Urine:
- Physical analysis
  Color, Odour, Specific gravity (Urinometer), pH
- Chemical analysis
  Sugar, Protein, Bile Salts, Ketones, Urea, Creatinine
- Microscopies (Photographs)

3 Study of *Fasciola hepatica* : (Slides / Photographs)
Liver fluke (W.M)
Digestive system
Excretory system
Nervous system
Reproductive system
Developmental stages
(Capsules, Miracidium, Sporocyst, Redia, Cercaria, Metacercaria)

4 Genetics:
a) Study of genetics through charts (example as per theory syllabus) :
   - Monohybrid cross
   - Dihybrid cross
   - Incomplete dominance
   - Co-dominance
   - Multiple alleles
   - Polygenic inheritance
   - Lethal genes
b) Genetics problems (as per Appendix)

5 Animal biotechnology: (By Photographs)
- Lab design – Layout
- Culture vessels (Multi-well plates, Petri dishes, Culture flasks)
- Lab Equipments
  (Autoclave ,CO_2 Incubator, Centrifuge, Laminar Airflow)

6 Economic Zoology (by photographs)
- Vermiculture, Vermicomposting process, Indian Breeds of earthworm

- Dairy Farming-Common breeds (Indian -Kankrej, Hissar, Gir) (Exotic-Jersy)
- Pearl Culture-Pearl oysters (*Pinctada fucta, Pinctada margaritifera*, *Pinctada maxima*), Structures used for pearl oyster farming.

GENETIC PROBLEMS (4 b -Appendix)

1. Red fruit (R) is dominant to yellow (r) and tallness (T) is dominanat over short 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: Phenotype=All equal
   Genotype=RRTT, RRTt, RrTT,RrTt.

2. In rabbits, black skin (B) is dominated over brown skin (b) and short hair (S) is dominated over long hair (s). If homozygous black-short haired male is crossed with a homozygous brown-long haired female, what will be the genotypes and phenotypes of F_1 and F_2 offspring?
   Solution: F1=BbSs=all black-short haired
   F2=9:3:3:1

3. In four o'clock plants, red colour of flowers (R) is incompletely dominant over white (r), the heterozygous having pink flower colour. What will be the offsprings in a cross between plants of red flowers and pink flowers?
   Solution: Red: Pink = 1:1

4. 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 cows are expected in the offsprings of any one group of cows?
   Solution : Roan bull X Roan cow = 1red: 2roan: 1white
   Roan bull X Red cow = 1red: 1roan
   Roan bull X White cow = 1roan: 1white

5. A couple preparing for marriage both have blood group AB. They ask you what type of blood group their children may have. What would you tell them and how would you explain your conclusions?
   Solution: Blood group of children can be A, AB or B

6. A man has blood group A and his wife has blood group B. They have four children, all having different blood groups i.e. A, B, AB and O. Is it possible? How?
   Solution: Yes, it is possible. Heterozygous parents

7. In man, the difference in skin colour between whites and negroes is due to two pairs of factors, AABB is "black" and aabb is 'white'. Any three of the colour producing factors produce dark skin, any two medium and any one light colour. What will be the skin colour of the offspring from a mating of white with black and from a mating of two F_1 individuals?
   Solution:
   Parents genotype = aabb X AABB
   F1 offspring skin colour = medium
   F2=1:4:6:4:1 (black: dark: medium: light:white)

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

Marks- 70

Q.1. Analyse the following properties of urine. 15

(Physical analysis, Chemical analysis, Microscopies)

Q.2 A. Complete the nomenclature of given figure and describe about its histology / physiology. (Charts of Urinary system) 10

Q.3 Sketch, label & describe _____ system of liver-fluke. 07

(Digestive system, Excretory system, Reproductive system and Nervous system)

Q.4 Solve the given genetic problem. 06

Q.5 Identify the specimens as per instructions. 21

1. Identify, Sketch and label. (Liver-fluke larvae)
2. Identify and describe. (Genetics charts-Monohybrid cross / Dihybrid cross / Incomplete dominance / Co-dominance)
3. Identify and describe. (Genetics charts- Multiple alleles / Polygenic inheritance/ Lethal genes)
4. Identify and describe. (Animal biotechnology-Lab design / culture vessels)
5. Identify and describe. (Animal biotechnology-Lab equipments)
6. Identify and describe. (Economic zoology-Vermi culture/Dairy farming / Pearl culture)
7. Identify and describe. (Economic zoology-Vermi culture/Dairy farming / Pearl culture)

Q.6 Viva Voce. 06

Q.7 Journal. 05

GUJARAT UNIVERSITY
CBCS BASED PROPOSED COURSE
(Effective from June 2017)
B.Sc SEMESTER – 2
Zoology-103 (Theory)

(Mammalian Anatomy, Histology and Physiology of Blood, Cardiology, Non Chordate Animal Diversity, Cell Biology and Genetics)

Unit 1 Blood Physiology:

1. Functions and Composition of Human blood :
   - i Blood Plasma -Water
     - Dissolved solids: Blood proteins, Supplies for the cells, Cellular products, Cellular waste-products.
     - Dissolved gases.
   - ii Blood cells :
     - a) RBC
       - Structure, Total count, Functions.
       - Composition (Hb only)
       - Effect of isotonic, hypotonic and hypertonic solutions.
       - Development & Life history (with flow-chart of figures)
       - Factors affecting Erythropoesis.
       - Anaemias:
       - General symptoms.
       - Types: Nutritional, Pernicious, Hemorrhagic, Hemolytic,
       - Aplastic and Sickle-cell (maxi. 5-6 sentences each)
     - b) WBC
       - Structure, Total count, Functions.
       - Classification (brief note for each WBC)
       - Development & Life history (only flow-chart without figures)
       - Brief concept of Leukemia (maxi. 5-6 sentences)
     - c) Platelets
       - Structure, Total count, Functions.
       - Development (only flow-chart with figures)

2. Blood coagulation
   - Brief introduction and significance.
   - Factors involved in blood coagulation.
   - Intrinsic & Extrinsic pathways of blood coagulation.
   - Intravascular blood clotting (Thrombosis) & Fibrinolysis

3. Groups and Blood Types:
   - ABO Blood Group
   - Transfusions
   - Rh Blood Group
   - Typing and Cross-Matching Blood for Transfusion

Reference books for Mammalian Physiology & Histology and Anatomy:

1 .Principles of Anatomy & Physiology, Tortora and Grabowski, Harper Collins College Pub

2 Animal Physiology And Related Biochem. H.R.Singh, Shobhan Lal Naginchand& Co. Edu. Pub., Jalandhar.

3. Textbook of Animal Histology. A.K.Berry, Emkay Pub, New Delhi.

Unit 2

(A) Cardiac anatomy.

1. Structure of human heart.
2. Layers of the heart wall
3. Brief study of coronary circulation
4. Origin, conduction and rate of heartbeat in humans.
5. Basic concept of cardiac cycle and ECG in humans.
6. Clinical connection : (Maximum 5-7 lines for each).
   - Cardiopulmonary resuscitation
   - Myocarditis and endocarditis
   - Heart valve disorders
   - Myocardial ischemia and infarction
   - Artificial pacemakers
   - Congestive heart failure

Reference books for Mammalian Physiology & Histology and Anatomy:

1 .Principles of Anatomy & Physiology, Tortora and Grabowski, Harper Collins College Pub
2 Animal Physiology And Related Biochem. H.R.Singh, Shobhan Lal Naginchand& Co. Edu. Pub., Jalandhar.
3. Textbook of Animal Histology. A.K.Berry, Emkay Pub, New Delhi.

(B) Non Chordate Animal Diversity :

Plasmodium vivex (The Malarial Parasite)

- Systematic position
- Habits and habitat
- Life cycle of Plasmodium vivex
  (A) Asexual cycle of P.vivex in man
  (B) Sexual cycle of P.vivex in mosquito
- Pathogenicity

Reference books for Animal Diversity of Nonchordates.

1 Textbook of Invertebrates, R.L. Kotpal, Rastogi publications, Meerut
2 Manual of Zoology, E.K.Ayer, Vol 1 & 2
3 Invertebrate Zoology, Jordan and Verma, S.Chand & Company, Delhi.

Unit 3 : 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,Chemisty of Nucleolus, Function of Nucleolus

Endoplasmic Reticulum

- Occurance
- Morphology
- Ultrastucture
- Types of Endoplasmic reticulum
- Origin of Endoplasmic reticulum
- Functions of Endoplasmic reticulu

Mitochondria.

- Distribution or localization
- Morphology
- Structure
- Chemical composition
- Functions
- Mitochondrial DNA
- Mitochondrial Ribosome

Golgi body

- Ultrastructure and general functions
- Morphology: Cisternae, Tubules, Vesicles, Golgian vacuoles.
- Zones of exclusion.

Reference Books for Cell Biology:

1. Cytology, P.S.Verma, S.Chand & Co, Ltd., New Delhi
2. Cell Biology, C.B.Powar, Himalaya Books Pub.
3. Essentials of Cytology, C.B.Powar, Himalaya Books Pub

Unit 4: Genetics

1. Complementary genes (e.g. Pea plant - Purple & White flowers)
2. Epistasis - Dominant (e.g. Dog), Recessive (e.g. Mice)
3. Sex-linked inheritance :
   - X-linked (e.g. colour blindness in man, eye-colour in *Drosophila*)
   - Y-linked (Holandric genes)
4. Sex-influenced inheritance :
   - Baldness in man
5. Sex limited genes
6. Extrachromsomal Inheritance
   - Cytoplasmic Inheritance eg. Snail , Paramecium
7. Human Pedigree Analysis

Reference Books for Genetics

1.Genetics,P.K.Gupta,Rastogi Publications, Meerut.
2.Genetics,V.B.Rastogi,Kedarnath Ramnath,Meerut
3.Advance Practical Zoology-Sinha,Chatterjee,Chattopadyay

GUJARAT UNIVERSITY
CBCS BASED PROPOSED COURSE
(Effective from June 2017)
B.Sc SEMESTER-II
ZOOLOGY - 103

SKELETAL QUESTION PAPER FOR THEORY EXAMINATION

Total-70

Que.1 (A) Unit 1 Blood Physiology (7)

Or

(A) Unit 1 Blood Physiology

(B) Unit 1 Blood Physiology (7)

Or

(B) Unit 1 Blood Physiology

Que.2 (A) Unit 2 Cardiac anatomy (7)

Or

(A) Unit 2 Cardiac anatomy

(B) Unit 2 Non chordate animal diversity (*Plasmodium*) (7)

Or

(B) Unit 2 Non chordate animal diversity (*Plasmodium*)

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 Genetics (7)

Or

(A) Unit 4 Genetics

(B) Unit 4 Genetics (7)

Or

(B) Unit 4 Genetics

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 2017)
B.Sc SEMESTER-II
ZOOLOGY – 104 (Practical)

1 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)

2 Cardiology: (Models / Charts / Photographs)

a) Study of internal structure of Heart.
b) Study of conduction system of Heart
c) Location of pulse points in humans
d) Determination of pulse rate in humans

3 Plasmodium :

a) Study of life cycle of Plasmodium by chart
   1) In man,
   2) In mosquito
b) Study of various stages in human blood (Slides / Photographs)

4 Cytology: (Charts / Photographs)

Nucleus
Endoplasmic reticulum
Mitochondria
Golgi body

5 Genetics

Study of Genetics through charts (e.g. as per theory syllabus):

- Complementary genes (e.g. Pea plant - Purple & White flowers)
- Epistasis - Dominant (e.g. Dog), Recessive (e.g. Mice)
- Sex-linked inheritance :
- X-linked (e.g. Colour blindness in man, Haemophilia in man)
- Y-linked (Holandric genes)
- Sex-influenced inheritance- Baldness in man.
- Sex limited genes
- Cytoplasmic Inheritance in Snail & Paramoecium
- Human Pedigree Analysis

Genetics Problems

1. Two white flowered varities of pea plant when crossed produced purple flowered F_1 plants. Selfing of F_1 plants produced 112 progeny, 62 plants with purple flower and 50 with white flowers.
   a) What type of interaction is involved?
   b) Give a phenotype ratio approximated by the F_2 progeny.

   Solution- a) Complementary gene action
   b) 9:7 ratio

2. When dogs from a true breeding brown coatline were mated to dogs from a true breeding white coatline, all the F_1 progeny were white coat colour.
   Male and female mating of F_1 progeny produced F_2 progeny in the ratio of 130 white :35 black :11 brown. Explain these results

   Solution – 130:35: 11=12:3:1, Dominant epistasis.

3. Mating between two agouti Guinea pigs of the same genotype produced offsprings in the ratio of 45 agouti :15 black :19 albino.
   a) Give the approximate phenotype ratio of these offsprings.
   b) Give the type of interaction between the non-allelic genes responsible for the ratio calculated in (1).
   c) Give the genotype of the parents and offspring.

   Solution- a) 9:3:4
   b) Supplementary gene interaction, recessive epistasis,
   c) CcAa, CcAa

4. From a marriage, all the daughters are normal sighted whereas all the sons are colourblind.
   a) Give the genotype of the parents.
   b) If both the parents were colourblind, hildren. they give rise to normal children?

   Solution- a) Genotype of parents:Mother-XcXc-colourblind ,Father-XY-Normal
   b) If both are colourblind, they cannot give rise to normal children

5. In man, haemophilia is sex-linked and recessive. What offspring phenotype ratio would be expected from a marriage between :
   a) A haemophilic man and carrier woman, and
   b) A normal man and a carrier woman ?

   Solution-a) Ratio in woman = Haemophilic : Carrier is 1 :1;
   Ratio in man = Haemophilic : Normal is 1:1;
   b) Ratio in woman = Carrier : Normal is 1 : 1;
   Ratio in man= Haemophilic : Normal is 1: 1

6. Early baldness in man is due to an autosomal gene and is dominant in males.The homozygous recessive results in late baldness or non-baldness.The heterozygous persons marry and beget children.
   a) What are the phenotype of the male and female children?
   b) What will be the phenotypic ratio among the male children ?
   c) What will be the phenotypic ratio among the female children ?
   Solution- a) Bb Bb
   b) Male children=Bald: Normal is 3: 1;
   c) Female children = Bald: Normal is 1:3

GUJARAT UNIVERSITY
CBCS BASED PROPOSED COURSE
(Effective from June 2017)
B.Sc SEMESTER – II
ZOOLOGY Practicals-104

Marks- 70

Q.1. Explain the following experiments.

a) Blood smear / Blood groups 06
b) BT and CT / Separation of serum from blood 06

Q.2 Sketch label and describe 10

(Internal anatomy of heart / Conduction system of heart)

Q.3. Describe the _____life cycle of *Plasmodium vivex*. 10

Q.4. Solve the given genetic problem. 06

Q.5. Identify the specimens as per instructions. 21

1. Identify and describe. (Cardiology- Points for drawing blood by a syringe/ Determination of pulse rate in humans)
2. Identify and describe. (Stages of asexual cycle of *P.vivex* (photographs)
3. Identify and describe. (Cytology-Nucleus, ER, Mitochondria, Golgi)
4. Identify and describe. (Cytology-Nucleus, ER, Mitochondria, Golgi)
5. Identify and describe. (Genetics chart)
6. Identify and describe. (Genetics chart)
7. Identify and explain. (Human pedigree analysis)

Q.6 Viva Voce. 06

Q.7 Journal. 05