GUJARAT UNIVERSITY
CBCS BASED PROPOSED COURSE
ZOOLOGY

(Effective from June 2011)

SEMESTER – 1

101 (Theory)

(Mammalian Anatomy, Histology, Physiology, Non Chordate Animal Diversity, Cell Biology, Genetics, and Animal Biotechnology (Animal Cell Culture)

Unit 1 Mammalian Anatomy, Histology & Physiology(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)
   - Production of the Concentrated Urine.
     - Counter Current Multiplication
     - Counter Current Exchange

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
   - Jaundice
   - Stone in Kidney
   - Renal failure
   - Cystoscopy
   - Dialysis

4. Urinary Bladder
5. Micturition

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 :
Ascaris lumbricoides (The Common Roundworm)-Type study

- Systematic position
- Habits and habitat
- External features
- Body wall
- Pseudocoel
- Digestive system
- Respiration
- Excretory system
- Central nervous system
- Reproductive system
- Life cycle
- Pathogenicity (effect on host)
- Parasitic adaptation

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 III Cytology :

1. Cell Biology and other Biological Sciences.
2. Diversity in Cell shape & size of Eukaryotic cell.
3. Centrifugation
   - Mechanism of Centrifugation (Cell fractionation).
   - Low speed
   - Ultracentrifugation (Differential & Density gradient)

4. 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

5. Endoplasmic Reticulum
   - Occurance
   - Morphology
   - Ultrastucture
   - Types of Endoplasmic reticulum
   - Origin of Endoplasmic reticulum
   - Functions of Endoplasmic reticulum.

6. Eukaryotic Ribosome
   - Occurance and distribution
   - Method of isolation
   - Types of Ribosome
   - Structure of Ribosome
   - Ultra structure
   - Chemical composition
   - Functions.
7. Mitochondria.
   - Distribution or localization
   - Morphology
   - Structure
   - Chemical composition
   - Functions
   - Mitochondrial DNA
   - Mitochondrial Ribosome

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 IV Genetics and Animal Biotechnology (Animal cell culture)

(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 humans,
   - Rh Factor-Erythroblastosisfoetalis)
7. Polygenic inheritance (e.g. skin colour in humans)
8. Lethal genes (e.g. Yellow coat colour in mice, Thalesemia)

Referannce Book for Genetics

1.Genetics,P.K.Gupta,Rastogi Publications, Meerut.

2 Genetics,V.B.Rastogi,Kedarnath Ramnath,Meerut

(B) Animal Biotechnology:

1. Brief Introduction & Definition.
2. Fields of Animal Biotechnology.
3. Some Lab. facilities needed for setting up a tissue culture laboratory –
   - Glass wares
   - Autoclaves
   - pHmeter.

Reference books:

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

102 (Practicals)

1. Analysis of Urine

- **Physical analysis**
  - Color,appearance,odour, deposits if any
- **Chemical analysis**
  - Sugar
  - Protein
  - Bile pigments (Bilirubin)
  - P^H
  - Specific gravity
  - Ketones
  - Urea
  - Creatinine
- **Microscopies**
  - Pus cells
  - R.B.Cs.
  - Bacteria
- **Histology of excretory system : (Charts / photograph of)**
  - Frontal section of right kidney.
  - Renal corpuscle (internal view)
  - Juxtamedullary nephron and vascular supply

2. **Study of Ascaris lumbricoides**
   - Ascaris (W.M.)
   - T.S. through pharynx and excretory pore
   - Ascaris egg (Entire egg and egg in section)
   - T.S. through mature male
   - T.S. through mature female

3. Cytology:
Charts / photographs of
   - Mitochondria.
   - Nucleus.
   - Ribosomes.
   - Endoplasmic reticulum**.**

3 **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) Solve the given genetics problems (as per Appendix)

Appendix

GENETICS PROBLEMS

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)

4 Animal biotechnology:

- Study of methods for sterilization of glassware.
- Calibration of pH meter.
- Preparing of various reagents.(Methy blue,eosin)
- Detection of pH of various sample waters.

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ZOOLOGY

(Effective from June 2011)

SEMESTER – 2
103 (Theory)

(Mammalian Anatomy, Histology, Physiology, Non Chordate Animal Diversity, Cell Biology, Genetics, and Animal Biotechnology (Animal Cell Culture)

Unit 1 Blood Physiology:

1. 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.
   - Concept of Intravascular blood clotting (Thrombosis)

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 heartfailure

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 (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
  (A) Effect on mosquito
  (B) Effect on man

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 :

Ultrastructure & general functions of Golgi body:

- Morphology: Cisternae, Tubules, Vesicles, Golgian vacuoles.
- Zones of exclusion.
- General Brief introduction.
- functions.

a) Centrioles/Basal bodies –

- Brief introduction.
- Structure
- T.S. of centriole/basal body
- Chemical composition
- Origin of Centriole and Basal body
- T.S. of centriole/basal body
- General functions

c).Cilia and Flagella-

- Brief introduction.
- Distribution of Cilia and Flagella.
- Ultrastructure of Cilia and Flagella
- T.S. of cilium/flagellum ,L.S. of cilium and flagellum
- Chemical composition of Cilia and Flagella
- Functions of Cilia and Flagella.
- Derivatives of Cilia.

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

- General functions.

Unit 4 Genetics and Animal Biotechnology

(A) 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

Referannce Book for Genetics

1.Genetics,P.K.Gupta,Rastogi Publications, Meerut.

2 Genetics,V.B.Rastogi,Kedarnath Ramnath,Meerut

(B) Animal Biotechnology (Animal cell culture)

1) Some more labs. facilities needed for setting up a tissue culture laboratory
2) Incubators
3) Centrifuges,
4) Laminar Airflows.
5) Introduction to Genetic Engineering in Zoology
6) Introduction to Nanotechnology in Zoology

Reference books:

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

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104 (Practicals)

Physiology of blood :

a) Points for drawing blood by a syringe.
b) Preparations of human blood smear.
c) Determination of ABO blood grouping in humans.
d) Determination of blood clotting time.(BT,CT,PT)
e) Separation of plasma/serum from blood.

Cardiology: (Models / Charts / Photographs)

- Study of internal structure of the Heart.
- Antirior view of frontal section (To show the conductin of the heart)
- Location of pulse points in humans
- Determination of pulse rate in humans

Plasmodium :

- Study of life cycle of Plasmodium by chart
  1) In man, 2) In mosquito
- Study of signet ring stage in human blood

Cytology: (Charts / Photographs)

- T.S. Cilium and flagellum.
- L.S. Cilium and flagellum.
- T.S. Centriol and Basal Body.
- Golgibody- Zones of exclusion**.**

Genetics

A) 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)

a. Sex-influenced inheritance :
b. Baldness in man.

B) Genetics Problem

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 offsprins.
   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 norma 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

E Animal Biotechnology : (Instrument /chart /photograph)

a) Incubators

b) Centrifuges

c) Laminar Airflows
