

GUJARAT UNIVERSITY
5th Semester B.Sc.
ZOOLOGY SYLLABUS
(effective from June 2013)

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

Pattern of Examination :

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

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

Examination	Duration	External Marks	Internal Marks	Total Marks
Theory-Paper 301 (Ecology, Animal diversity (nonchordates))	3 hours	70	30	100
Theory-Paper 302 (Animal diversity (chordates))	3 hours	70	30	100
Theory-Paper 303 (Animal Biochemistry)	3 hours	70	30	100
Theory-Paper 304 (Cytology, Developmental Biology)	3 hours	70	30	100
Theory (Total)		280	120	400
SEC Paper 305	3 hours	70	30	100
Practical-Paper 306 (A-1) (Based on Theory Paper – 301)	5 hours	35	15	50
Practical-Paper 306 (A-2) (Based on Theory Papers – 301 & 302)	5 hours	35	15	50
Practical-Paper 306 (B-1) (Based on Theory Paper – 303 & 304)	5 hours	35	15	50
Practical-Paper 306 (B-2) (Based on Theory Paper – 304)	5 hours	35	15	50
Practicals (Total)		140	60	200

INSTRUCTIONS

- Each theory question paper comprises of FIVE QUESTIONS. All questions carry equal marks, i.e. 14 marks (hence $14 \times 5 = 70$) in the university examinations.
- The theory question papers will have to be set according to the paper-style and the pattern of marks-distribution provided on page no. 3, 5, 8, 11 & 13, as-well-as all other instructions mentioned in this syllabus.
- The practical question papers will have to be set according to the paper-style and the pattern of marks-distribution provided on page nos. 16, 21, 25 & 30, as-well-as all other instructions mentioned in this syllabus.
- In order to be qualified to appear for the University Practical Examinations, the student must submit his/her duly certified journals during the examinations.

5th Semester B.Sc.

ZOOLOGY SYLLABUS

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 (Nonchordates) – Type Study & General Topics :

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

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

B. General topics :

1. *Porifera* : Skeleton and Canal systems.
2. *Coelenterata* : Polymorphism.
3. *Annelida* : Ecology of polychaeta, Nephridia & Coelomoducts.

Unit III ANIMAL DIVERSITY (Nonchordates) – 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 :

1. *Arthropoda* : Crustacean larvae and Excretory organs.
2. *Mollusca* : Shell, Foot and Torsion & Detorsion.

Unit IV ANIMAL DIVERSITY (Nonchordates) – 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 :

1. *Echinodermata* : Larval forms.
2. *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 & Company, Delhi.

Theory Paper-style and pattern of marks-distribution**PAPER – 301****(ECOLOGY and ANIMAL DIVERSITY (nonchordates))**

<u>Q.No.</u>	<u>UNIT NO.</u>	<u>MARKS</u>
Q.1.A	Unit-I OR	07
Q.1.B	Unit-I OR Unit-I	07
Q.2.A	Unit-II OR	07
Q.2.B	Unit-II OR Unit-II	07
Q.3.A	Unit-III OR	07
Q.3.B	Unit-III OR Unit-III	07
Q.4.A	Unit-IV OR	07
Q.4.B	Unit-IV OR Unit-IV	07
Q.5	14 objective questions of 1 mark each. (3 questions from each of the four Units and remaining 2 questions from any of the four Units)	14

PAPER – 302 (Theory)
(ANIMAL DIVERSITY (chordates))

Unit I ANIMAL DIVERSITY (Chordates) – Type Study :

A. 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, Excretory System, Reproductive systems and Types of feathers.

Unit III ANIMAL DIVERSITY (Chordates) – General topics :

1. *Protochordata* : Comparison of embryonic features with those of Vertebrates.
2. *Pisces* : Differences between Chondrichthyes & Osteichthyes, Swim bladders, Accessory respiratory organs, Parental care and Migration.
3. *Dipnoi* : Habits, Habitat and peculiarities of Protopterus, Lepidosiren and Neoceratodus.
4. *Amphibia* : Neoteny and Parental care.

Unit IV ANIMAL DIVERSITY (Chordates) – General topics :

1. *Reptilia* : Dinosaurs (Brontosaurus, Triceratops, Tyrannosaurus, Dimetrodon, Stegosaurus, Pteranodon, Ichthyosaurus, Iguanodon).
2. *Aves* : Birds are glorified reptiles, Migration.
3. *Mammalia* : - Adaptations of aquatic mammals,
- Dentition (dental formulae of Human, Cow, Horse, Rat, Elephant, Dog, Cat).
4. *Comparative anatomy of* : Aortic arches, Brain.

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

1. **Textbook of Vertebrates**, R. L. Kotpal, Rastogi Publications, Meerut.
 2. **Chordate Zoology**, P. S. Dhama, and J. K. Dhama, S. Chand & Co., Delhi.
 3. **Introduction to Chordates**, T. C. Majumuria, Pradeep Publications, Jalandhar.
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Theory Paper-style and pattern of marks-distribution**PAPER – 302
(ANIMAL DIVERSITY (chordates))**

<u>Q. No.</u>	<u>UNIT NO.</u>	<u>MARKS</u>
Q.1.A	Unit-I OR Unit-I	07
Q.1.B	Unit-I OR Unit-I	07
Q.2.A	Unit-II OR Unit-II	07
Q.2.B	Unit-II OR Unit-II	07
Q.3.A	Unit-III OR Unit-III	07
Q.3.B	Unit-III OR Unit-III	07
Q.4.A	Unit-IV OR Unit-IV	07
Q.4.B	Unit-IV OR Unit-IV	07
Q.5	14 objective questions of 1 mark each. (3 questions from each of the four Units and remaining 2 questions from any of the four Units)	14

PAPER – 303 (Theory)
(ANIMAL BIOCHEMISTRY)

Unit I CARBOHYDRATES :

1. Asymmetry, Isomers, Optical isomerism and Mutarotation.
2. Introduction, definition and classification of Carbohydrates.
3. **Monosaccharides** (*No particular example should be asked as a short note or full question*) :
 - Definition, General formula.
 - Classification upto Hexoses (with structures of suitable examples).
 - Chemical properties :
 - a) Reaction involving glycosidic –OH group.
 - b) Reaction involving alcoholic –OH group (Etherification).
 - c) Reactions involving both, glycosidic as-well-as alcoholic –OH groups (Esterification).
 - d) Reactions involving both, –OH as-well-as –CHO/-C=O groups :
 - Oxidation : Sugar acids, Oxidation with metal hydroxides.
 - Reduction : Reduction with sodium amalgam,
Reduction with strong mineral acids,
Reduction with dilute alkalis.
 - Osazone test : Reaction with phenyl hydrazine.

Unit II CARBOHYDRATES :

1. **Disaccharides** :
 - Definition.
 - Flow-chart of classification, based upon the type of glycosidic linkages.
 - Occurrence, formation, structure and general properties of Maltose, Lactose, Cellobiose and Sucrose.
2. **Polysaccharides** :
 - Definition.
 - Flow-chart of classification, based upon structures and functions.
 - Occurrence, formation, structure and general properties of :
 - a) Homopolysaccharides – Starch, Glycogen, Cellulose and Chitin.
 - b) Heteropolysaccharides – Mucopolysaccharides : Hyaluronic acid, Chondroitin sulphate.
3. Biological significance of Carbohydrates.

Unit III PROTEINS :

1. Introduction and Definitions.
2. **Amino acids** :
 - General Structure
 - Classification (based upon the composition of the side chain/R group)
3. **Peptides** :
 - N- and C- terminals
 - Naming of peptide chain
4. **Protein structure** (*No particular example should be asked as a short note or full question*) :
Chemical Bonds :
 - a) Primary - Peptide bond
 - b) Secondary - Disulfide, Hydrogen, Hydrophobic and Ionic.

5. Protein Configuration (No particular example to be asked as a short note or full question) :

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

Unit IV PROTEINS :

1. Classification of proteins (No particular example to be asked as a short note or full question):

- a) Based upon shape - Globular and Fibrillar
- b) Based upon composition & solubility - Simple, Conjugated and Derived.

2. 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)
 - Reaction with alcohols (Esterification)
- c) Reactions involving -NH₂ group :
 - Reaction with mineral acids (Salt formation)
 - Reaction with formaldehyde

3. 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.
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Theory Paper-style and pattern of marks-distribution**PAPER – 303
(ANIMAL BIOCHEMISTRY)**

<u>Q. No.</u>	<u>UNIT NO.</u>	<u>MARKS</u>
Q.1.A	Unit-I OR Unit-I	07
Q.1.B	Unit-I OR Unit-I	07
Q.2.A	Unit-II OR Unit-II	07
Q.2.B	Unit-II OR Unit-II	07
Q.3.A	Unit-III OR Unit-III	07
Q.3.B	Unit-III OR Unit-III	07
Q.4.A	Unit-IV OR Unit-IV	07
Q.4.B	Unit-IV OR Unit-IV	07
Q.5	14 objective questions of 1 mark each. (3 questions from each of the four Units and remaining 2 questions from any of the four Units)	14

PAPER – 304 (Theory)
(CYTOLOGY, DEVELOPMENTAL BIOLOGY)

Unit I CYTOLOGY (Tools and Techniques) :

1. Electron Microscopes (TEM, SEM)
2. Fluorescence microscope
3. Paper chromatography (Ascending and Descending)
4. PAGE - Tube gel electrophoresis
5. Centrifugation - Low Speed
- Ultracentrifugation (Differential, Density Gradient)
6. Karyotyping

Unit II CYTOLOGY :

1. Karyotype
2. Cell cycle
3. 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.
4. Ultrastructure & general functions of Centrioles/Basal bodies.

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. Ultrastructure & general functions of Cilia/Flagella.
4. Cell differentiation.

Reference Books for Units I, II and III :

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

Unit IV DEVELOPMENTAL BIOLOGY :

1. Types of eggs depending upon the quantity of yolk. (Microlecithal/Oligolecithal, Mesolecithal and Polylecithal/Macrolecithal/Megalecithal)
2. Types of eggs depending upon the distribution of yolk. (Homolecithal/Isolecithal, Centrolecithal and Telolecithal)

3. Patterns of cleavage - radial, spiral(dextral, sinistral), bilateral, incomplete/meroblastic and complete/holoblastic.
4. Embryology of Chick (upto 72 hours) :
 - Structure of a hen's unfertilized egg.
 - Fertilization, cleavage, blastulation, gastrulation.
 - Development of brain upto 72 hrs.
 - Development of heart upto 72 hrs.
 - Flexion & Torsion.
 - Extra-embryonic membranes.
 - Diagrams of 21 hr, 33 hr, 48 hr and 72 hr old chick embryos.
4. Types of Placentation in mammals (histological).

Reference books for Unit IV :

1. **Introduction of Embryology**, Balinsky, CBS College Publishers.
 2. **Developmental Biology**, T. Subramanayam, Narosa Publishing House.
 3. **Vertebrate Zoology**, R. L .Kotpal, Rastogi Publication, Meerut.
 4. **Developmental Biology**, V. B. Rastogi, Rastogi Publications, Meerut.
 5. **An Outline of Animal Development**, Davenport, Addition-Werley.
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Theory Paper-style and pattern of marks-distribution**PAPER – 304
(CYTOLOGY, DEVELOPMENTAL BIOLOGY)**

<u>Q. No.</u>	<u>UNIT NO.</u>	<u>MARKS</u>
Q.1.A	Unit-I OR Unit-I	07
Q.1.B	Unit-I OR Unit-I	07
Q.2.A	Unit-II OR Unit-II	07
Q.2.B	Unit-II OR Unit-II	07
Q.3.A	Unit-III OR Unit-III	07
Q.3.B	Unit-III OR Unit-III	07
Q.4.A	Unit-IV OR Unit-IV	07
Q.4.B	Unit-IV OR Unit-IV	07
Q.5	14 objective questions of 1 mark each. (3 questions from each of the four Units and remaining 2 questions from any of the four Units)	14

PAPER – 305 (Theory)
(APICULTURE, SERICULTURE)

SUBJECT ELECTIVE COURSE (SEC)

APICULTURE :

Unit-I :

1. Introduction. (*Not to be asked in the exams*)
2. Classification of *Apis*.
3. Different species of honey bees.
4. Castes in honey bees.
5. Structures and functions of each caste of honey bees.
6. A typical bee hive.
7. Communication in honey bees.

Unit-II :

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.

SERICULTURE :

Unit-III :

1. Introduction. (*Not to be asked in the exams*)
2. Classification of *Bombyx mori*.
3. Introduction to different species of silkworms used for sericulture.
4. External features and Life cycle of *Bombyx mori*.

Unit-IV :

1. Sericulture industry :
 - Requirements for sericulture.
 - Mulberry.
 - Rearing of silkworm : Grainage management.
 - Post-cocoon processing.
2. Chemistry and uses of silk.

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.
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SEC Paper-style and pattern of marks-distribution

PAPER – 305 (Theory)
(APICULTURE, SERICULTURE)

SUBJECT ELECTIVE COURSE (SEC)

<u>Q. No.</u>	<u>UNIT NO.</u>	<u>MARKS</u>
Q.1.A	Unit-I OR	07
Q.1.B	Unit-I OR Unit-I	07
Q.2.A	Unit-II OR	07
Q.2.B	Unit-II OR Unit-II	07
Q.3.A	Unit-III OR	07
Q.3.B	Unit-III OR Unit-III	07
Q.4.A	Unit-IV OR	07
Q.4.B	Unit-IV OR Unit-IV	07
Q.5	14 objective questions of 1 mark each. (3 questions from each of the four Units and remaining 2 questions from any of the four Units)	14

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

1. ANIMAL DIVERSITY (Nonchordates) :

Study of Earthworm :

1. Dissections to study the Reproductive systems.
2. Temporary mountings of Spermathecum and Ovaries.

2. ANIMAL DIVERSITY (Nonchordates) :

Study of Cuttlefish :

Dissections & Temporary mountings of :

1. Study of external characters.
2. Dissections to study the Digestive system and Nervous system.
3. Temporary mounting of Jaws .

3. ANIMAL DIVERSITY (Nonchordates) :

Study of Starfish :

Dissections & Temporary mountings of :

1. Study of external characters.
2. Dissections to study the Water-vascular system.
3. Temporary mounting of Tube feet.

4. ANIMAL DIVERSITY (Nonchordates) :

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

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

JOURNAL INDEX for PAPER-306 (A-1) (Practicals)*(based on Theory Paper 301)*

Sr. No.	PRACTICAL	Page No.	Date of Practical	Date of report	Signature of Prof.-in-charge
(A)	Study of Earthworm by dissections for :				
1.	Reproductive systems	2			
2.	Temporary mountings of : Spermathecum & Ovaries	3			
(B)	Study of Cuttlefish by dissections for_:				
1.	External characters	5			
2.	Digestive system	6			
3.	Nervous system	7			
4.	Temporary mounting of Jaws	8			
(C)	Study of Starfish by dissections for :				
1.	External characters	10			
2.	Water-vascular system	11			
3.	Temporary mounting of Tubefeet	12			
(D)	Study the peculiarities of :				
1.	Leucosolenia	14			
2.	T.S. through Leucosolenia	15			
3.	Canal systems in Porifera	16-17			
4.	Spicules	18			
5.	W.M. of Obelia	19			
6.	Medusa of Obelia	20			
7.	Porpita	21			
8.	Physalia	22			
9.	Crustacean larvae	23-24			
10.	Echinoderm larvae	25-26			
11.	Bonelia	27			
12.	Lingula	28			
13.	Phoronis	29			

GUJARAT UNIVERSITY

5th Semester - Zoology

(SKELETON QUESTION PAPER FOR PRACTICAL EXAMINATION)

PAPER-306 (A-1)

(*Based mainly on Theory Paper 301*)

Date :

Marks : 35

Time :

- Q.1.A.** Dissect the given animal _____ so as to expose the _____ system and show it to the examiner. **08**
- B.** Make a temporary mounting of _____ from the given animal and show it to the examiner. **04**
- Q.2.A.** Dissect the given animal _____ so as to expose the _____ system and show it to the examiner. **08**
- B.** Make a temporary mounting of _____ from the given animal and show it to the examiner. **04**
- Q.3** Identify specimens 1 & 4 as per instructions : **08**
- 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.
- Q.4** Journal. **03**
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GUJARAT UNIVERSITY
5th Semester - Zoology

DETAILS OF PRACTICAL EXAMINATION (Question wise)

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

- Q.1.A.** Starfish – Water-vascular system
Cuttlefish – Digestive system
B. Starfish – Tubefeet
- Q.2.A.** Cuttlefish – Nervous system
Earthworm – Reproductive systems
B. Cuttlefish – Jaws
Earthworm – Spermathecum, Ovaries
- Q.3** Sp.1 : Leucosolenia, T. S. through Leucosolenia, Canal systems in Porifera, Spicules, Porpita, Physalia, Obelia (W.M. & Medusa)
Sp.2 : Crustacean larvae (Nauplius, Zoea, Megalopa)
Sp.3 : Echinoderm larvae (Bipinnaria, Brachiolaria, Echinopluteus, Ophiopluteus, Auricularia, Doliolaria)
Sp.4 : Bonelia, Lingula, Phoronis.
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PAPER – 306 (A-2) (Practicals)
(Based on Theory Papers 301 & 302)

1. ECOLOGY :

Estimation of (*in water samples*) :

- Titrimetric - Calcium hardness (using calcium hardness tablets as indicator),
- Total Hardness (using total hardness tablets as indicator),
- Chlorinity.

2. ANIMAL DIVERSITY (Chordates) :

Study of Labeo :

Dissections & Temporary mountings :

1. Study of external characters.
2. Dissections to study the Digestive System and Brain
3. Temporary mountings of scales and striated muscle fibres.

3. ANIMAL DIVERSITY (Chordates) :

Study of Pigeon by charts/models/specimens of :

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

4. ANIMAL DIVERSITY (Chordates) :

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

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

5. ANIMAL DIVERSITY (Chordates) :

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

Aquatic mammals (Dolphin, Whale, Walrus, Seal),

Dentition in mammals (dental formulae of Human, Cow, Horse, Elephant, Rat, Dog, Cat),

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

6. ANIMAL DIVERSITY (Chordates) :

Study of comparative anatomy by charts/specimens :

- Aortic arches, Brain.
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JOURNAL INDEX for PAPER-306 (A-2) (Practicals)*(Based on Theory Papers 301 & 302)*

Sr. No.	PRACTICAL	Page No.	Date of Practical	Date of report	Signature of Prof.-in-charge
(A)	<u>ECOLOGY</u>				
	<i>Estimations of :</i>				
1.	Calcium hardness	2			
2.	Total hardness	3			
3.	Chlorinity	4			
(B)	<u>Study of <i>Labeo</i> by dissections for:</u>				
1.	External characters	5			
2.	Digestive system	6			
3.	Brain	7			
4.	Temporary mountings of : Scales & Striated muscle fibres	8			
(C)	<u>Study of Pigeon by charts/models :</u>				
1.	External characters	9			
2.	Digestive system	10			
3.	Heart	11			
4.	Arterial system	12			
5.	Venous system	13			
6.	Brain	14			
7.	Excretory system	15			
8.	Male reproductive system	16			
9.	Female reproductive system	17			
10.	Types of feathers	18			
11.	Air sacs	19			
(D)	<u>Study the peculiarities of :</u>				
1.	Swim bladders	20			
2.	Accessory respiratory organs	21			
3.	Petromyzon	22			
4.	Myxine	22			
5.	Protopterus	23			
6.	Eel	23			
7.	Siren	24			
8.	Necturus	24			
9.	Axolotl larva	25			
10.	Male Hippocampus	26			
11.	Male Kurtus	26			
12.	Male Arius	27			
13.	Female Tilapia	27			

14.	Alytes	28			
15.	Pipa	28			
16.	Rhacophorus	29			
17.	Hyla	29			
18.	Rhinoderma	30			
19.	Dolphin	31			
20.	Whale	31			
21.	Walrus	32			
22.	Seal	32			
23.	Dentition in mammals	33			
24.	Brontosaurus	34			
25.	Triceratops	34			
26.	Tyrannosaurus	35			
27.	Iguanodon	35			
28.	Stegosaurus	36			
29.	Pteranodon	36			
30.	Ichthyosaurus	37			
31.	Dimetrodon	37			
(E)	<u>COMPARATIVE ANATOMY OF CHORDATES</u>				
	<i>Study by charts/specimens of :</i>				
1.	Aortic arches	38			
2.	Brain	39			

GUJARAT UNIVERSITY

5th Semester - Zoology

(SKELETON QUESTION PAPER FOR PRACTICAL EXAMINATION)

PAPER-306 (A-2)

(*Based on Theory Papers 301 & 302*)

Date :

Marks : 35

Time :

- Q.1** Estimate titrimetrically the _____ of the given water sample. **05**
Record your observations & calculations and submit to the examiner.
- Q.2** Dissect the given *Labeo* so as to expose the _____ system **08**
and show it to the examiner.
- Q.3** Make a temporary mounting of _____ from the *Labeo*. **03**
- Q.4** Identify specimens 1 to 5 as per instructions : **10**
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.
- Q.5** Viva voce. **06**
- Note :** *All examiners should take the viva sitting together and each examiner should give marks from 06 and then the average marks of all the examiners should be given to the candidate.*
- Q.6** Journal. **03**
-
-

GUJARAT UNIVERSITY

5th Semester - Zoology

DETAILS OF PRACTICAL EXAMINATION (Question wise)

PAPER-306 (A-2)

(*Based on Theory Papers 301 & 302*)

- Q.1** Calcium hardness (using calcium hardness tablets as indicator),
Total Hardness (using total hardness tablets as indicator),
Chlorinity.
- Q.2** *Labeo* : Digestive system and Brain.
- Q.3** *Labeo* : Scales and striated muscle fibres.
- Q.4** Sp.1 Pigeon : Digestive system, Heart, Arterial & Venous systems, Brain, Excretory System, Reproductive system, Types of feathers and Air-sacs.
Sp.2 & Sp.3 Swim bladder, Accessory respiratory organs in fishes, Petromyzon, Myxine, Protopterus, Eel, Neoteny (Siren, Necturus, Axolotl larva), Parental care (Male Hippocampus, Male Kurtus, Male Arius, Female Tilapia, Alytes, Pipa, Rhacophorus, Hyla, Rhinoderma).
Sp.4 Aquatic mammals(Dolphin, Whale, Walrus, Seal), Dentition in mammals (dental formulae of Human, Cow, Horse, Elephant, Rat, Dog, Cat), Dinosaurs (Brontosaurus, Triceratops, Tyrannosaurus, Iguanodon, Stegosaurus, Pteranodon, Ichthyosaur, Plesiosaur).
Sp.5 Comparative anatomy of Aortic arches and Brain.
- Q.5** Syllabus of Theory Papers 301 & 302 as-well-as Practical Papers 306 (A-1) & 306 (A-2) only.

Note : *All examiners should take the viva sitting together and each examiner should give marks from 06 and then the average marks of all the examiners should be given to the candidate.*

PAPER – 306 (B-1) (Practicals)

(Based on Theory Paper 303)

1. CARBOHYDRATES :

Detection of carbohydrates :

- Monosaccharides – Glucose and Fructose
- Disaccharides - Lactose, Maltose and Sucrose

2. PROTEINS :

Detection of Proteins – Albumin and Casein

3. COLORIMETRIC ESTIMATION OF :

- Proteins (Preparation of Std. Curve by Biuret method).
- Glucose (Nelson-Somogyi method)

4. ATOMIC MODELS OF CARBOHYDRATES :

Preparation of Atomic Models of :

- Acyclic as-well-as all cyclic structures of Ribose, Arabinose, Ribulose, Glucose, Mannose, Galactose, Psicose, Fructose and Tagatose.
- Maltose, Lactose and Sucrose.

5. ATOMIC MODELS OF PROTEINS :

Preparation of Atomic Models of :

- All amino acids except heterocyclic amino acids.
- Glycyl-Alanine, Glycyl-Valine, Ala-Ser and Glu-Lys.

Note :

- 1) *In the journal, students should **only write** the structures of the compounds. There is no need to make colour drawings of the atomic models.*
 - 2) *During examination, in case of carbohydrates, the examiners should specify the particular **acyclic/cyclic structure** of the monosaccharide, that the student has to prepare.*
 - 3) *During examination, **students are not supposed to take the colorimetry readings by themselves.***
-
-

JOURNAL INDEX for PAPER-306 (B-1) (Practicals)
(Based on Theory Paper 303)

Sr. No.	PRACTICAL	Page No.	Date of Practical	Date of report	Signature of Prof.-in-charge
(A)	<u>CARBOHYDRATES</u>				
1.	Detection of monosaccharides	2-3			
2.	Detection of disaccharides	4-6			
(B)	<u>PROTEINS</u>				
	Detection of proteins	7-8			
(C)	<u>COLORIMETRIC ESTIMATIONS</u>				
1.	Estimation of Proteins by plotting a standard curve.	9			
2.	Estimation of Glucose.	10			
(D)	<u>ATOMIC MODELS</u>				
	Preparation of atomic models of carbohydrates and proteins.	11-25			

GUJARAT UNIVERSITY
5th Semester - Zoology

(SKELETON QUESTION PAPER FOR PRACTICAL EXAMINATION)

PAPER-306 (B-1)
(*Based on Theory Papers 303 & 304*)

Date : Marks : 35 Time :

Q.1 Detect any two constituents from the given unknown solution and show your tests to the examiner. (No need to write the tests). **09**

Q.2 Estimate colorimetrically the concentration of _____ from the given unknown solution and submit your results to the examiner. **09**

Note : Students are not supposed to take the colorimetry readings by themselves.

Q.3 Prepare the atomic model of _____ and show it to the examiner. **08**

Note :

- 1) *In case of carbohydrates, the examiners should specify the particular **acyclic/cyclic structure** of the monosaccharide, that the student has to prepare.*
- 2) *Examiners should make the students **only write** the structure of the compound (like in theory exam) **and not make them draw** the atomic model.*

Q.4 Viva voce. **06**

Note : All examiners should take the viva sitting together and each examiner should give marks from 06 and then the average marks of all the examiners should be given to the candidate.

Q.5 Journal. **03**

GUJARAT UNIVERSITY

5th Semester - Zoology

DETAILS OF PRACTICAL EXAMINATION (Question wise)

PAPER-306 (B-1)

(*Based on Theory Papers 303 & 304*)

- 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)

Note : *Students are not supposed to take the colorimetry readings by themselves.*

- Q.3** Atomic models of :
a) Acyclic as-well-as all cyclic structures of Ribose, Arabinose, Ribulose, Glucose, Mannose, Galactose, Psicose, Fructose and Tagatose.
b) Maltose, Lactose and Sucrose.
c) All amino acids except heterocyclic amino acids.
d) Glycyl-Alanine, Glycyl-Valine, Ala-Ser and Glu-Lys.

Note : *In case of carbohydrates, the examiners should specify the particular **acyclic/cyclic structure** of the monosaccharide, the student has to prepare. Examiners should make the students **only write** the structure of the compound (like in theory exam) **and not make them draw** the atomic model.*

- Q.4** Syllabus of Theory Papers 303 & 304 as-well-as Practical Papers 306 (B-1) & 306 (B-2) only.

Note : *All examiners should take the viva sitting together and each examiner should give marks from 06 and then the average marks of all the examiners should be given to the candidate.*

PAPER – 306 (B-2) (Practicals)

(Based on Theory Paper 304)

1. CYTOLOGY :

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

1. Electron Microscopes (TEM, SEM)
2. Centrifuge

2. CYTOLOGY :

Study by charts/models of :

1. Fluid Mosaic model of Plasma membrane.
2. Specialized structures of plasma membrane :
 - a) Specialization due to outpushings/evaginations.
 - b) Specialization due to inpushings/invaginations.
 - c) Specializations due to contact :
Desmosomes, Hemi-desmosomes, Septate desmosomes, Tight junctions, Gap junctions, Terminal bars and Interdigitation.
3. Ultrastructure of Polytene chromosome and Lampbrush chromosome.

3. CYTOLOGY :

Study by charts/models of :

1. Cell cycle.
2. Transmission & Scanning electron micrographs of a metaphase chromosome.
3. Nucleosome.
4. Ultrastructure of a Primary constriction.
5. Hammerling's experiment on *Acetabularia*.
6. Bantook's experiment on zygote of *Mayetiola destructor*.
7. Spemann's experiment on eggs of newt.
8. Somatic hybridization.

4. CYTOLOGY :

Techniques :

1. Preparation of temporary slides of :
 - a) Mitosis - Onion root tip.
 - b) Barr-body in cheek cells / hair follicle cells.
 - c) Polytene chromosomes - Salivary glands of *Drosophila* larva.
2. Human Karyotyping (preparation of chart only)
3. Ascending Paper Chromatography.
4. Separation of plasma from given blood sample.

5. DEVELOPMENTAL BIOLOGY :

Study by charts of :

1. Types of eggs depending upon the amount of yolk (as per theory syllabus).
2. Types of eggs depending upon the distribution of yolk (as per theory syllabus).
3. Patterns of cleavage (as per theory syllabus).
4. Types of placenta in mammals (histological).

6. CHICK EMBRYOLOGY :

1. Study by charts of :
 - Blastula stage of chick embryo.
 - Gastrula stage of chick embryo.
2. Study of permanent slides of W.M. of 21, 33, 48 & 72 hrs. old chick embryos.
3. Permanent slide preparation of W.M. of 21-72 hrs. old chick embryos.

INDEX FOR PAPER-306 (B-2) (Practicals)

(Based on Theory Paper 304)

Sr. No.	PRACTICAL	Page No.	Date of Practical	Date of report	Signature of Prof.-in-charge
	<u>CYTOLOGY</u>				
(A)	<u>Study by charts/models of :</u>				
1.	Transmission Electron Microscope	2			
2.	Scanning Electron Microscope	3			
3.	Centrifuge	4			
(B)	<u>Study by charts/models of :</u>				
1.	Fluid Mosaic model of PM	5			
2.	Evaginations/Microvilli in PM	6			
3.	Invaginations in PM	6			
4.	Desmosomes	7			
5.	Hemidesmosomes	7			
6.	Septate desmosomes	7			
7.	Tight junctions	8			
8.	Gap junctions	8			
9.	Terminal bars	9			
10.	Interdigitations	9			
11.	Ultrastructure of Polytene chromosome	10			
12.	Ultrastructure of Lampbrush chromosome	11			
(C)	<u>Study by charts/models of :</u>				
1.	Cell cycle	12			
2.	Transmission & Scanning Electron Micrographs of a metaphase chromosome	13			
3.	Nucleosome	14			
4.	Ultrastructure of a primary constriction	15			
5.	Hammerling's expt. on <i>Acetabularia</i>	16			
6.	Bantock's expt. on zygote of <i>Mytilus destructor</i>	17			
7.	Spemann's expt. on eggs of newt	18			
8.	Somatic hybridization	19			
(D)	<u>Techniques :</u>				
1.	Preparation of a slide to study Mitosis	20			
2.	Preparation of a slide to study Barr bodies.	21			
3.	Preparation of a slide to study Polytene chromosomes	22			
4.	Preparation of a human karyotype	23			
5.	Ascending paper chromatography	24-25			
6.	Separation of plasma from blood sample	26			

	<u>DEVELOPMENTAL BIOLOGY</u>				
	<u>Study by charts :</u>				
1.	Types of eggs depending upon the amount of yolk.	27			
2.	Types of eggs depending upon the distribution of yolk.	28			
3.	Patterns of cleavage	29-30			
4.	Types of placenta in mammals	31-32			
	<u>CHICK EMBRYOLOGY</u>				
1.	Study by charts :				
	- Blastula stage of chick embryo	33			
	- Gastrula stage of chick embryo	34			
2.	Study of permanent slides of W.M. of 21-72 hrs. old chick embryos.	35-38			

GUJARAT UNIVERSITY
5th Semester - Zoology

(SKELETON QUESTION PAPER FOR PRACTICAL EXAMINATION)

PAPER-306 (B-2)
(*Based 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 and submit your result to the examiner. **08**
OR
Find out the R_f value, identify the unknown amino acid and submit your results to the examiner.
- Q.3** Make a permanent stained mounting of the chick embryo and show it to the examiner. **08**
- Q.4** Identify specimens 1 to 4 as per instructions : **08**
Sp. 1 Identify and state its uses.
Sp. 2 Identify and describe in brief.
Sp. 3 Identify and comment.
Sp. 4 Identify and describe.
OR
Identify, sketch and label.
- Q.5** Journal. **03**
-

DETAILS OF PRACTICAL EXAMINATION (Question wise)

PAPER-306 (B-2)

(Based on Theory Papers 304)

- Q.1** a) Slide of Mitosis – Onion root tip.
b) Slide of Barr body – Cheek cells / hair follicle.
c) Slide of Polytene chromosomes - Salivary glands of Drosophila larva..
- Q.2** Normal man, Normal woman, Down syndrome, Klinefelter syndrome, Turner syndrome.
OR
Any of the 20 amino acids.
- Q.3** W.M. preparation of chick embryo from fertilized eggs incubated for 21-72 hrs.
- Q.4** Sp. 1 a) TEM, SEM, Centrifuge.
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.
c) Ultrastructure of Polytene chromosome and Lampbrush chromosome.
- Sp. 3 a) Cell cycle.
b) Transmission & Scanning electron micrographs of a metaphase chromosome.
c) Nucleosome.
d) Ultrastructure of a Primary constriction.
e) Hammerling's experiment on *Acetabularia*.
f) Bantook's experiment on zygote of *Mayetiola destructor*.
g) Spemann's experiment on eggs of newt.
h) Somatic hybridization.
- Sp. 4 a) Types of eggs depending upon the amount of yolk.
b) Types of eggs depending upon the amount of yolk.
c) Patterns of cleavage (as per theory syllabus)
d) Types of placenta in mammals (histological).
e) Blastula stage of chick embryo.
f) Gastrula stage of chick embryo.

OR

Permanant slides of W.M. of 21, 33, 48 & 72 hrs. old chick embryos.

NOTE :

1. *The list of the reference books provided herein 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.*
4. *Prof.-in-charge of such tours should not compel the students to collect specimens for any type of submission work.*

GUJARAT UNIVERSITY
6th Semester B.Sc.
ZOOLOGY SYLLABUS
(effective from June 2013)

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

Pattern of Examination :

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

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

Examination	Duration	External Marks	Internal Marks	Total Marks
Theory-Paper 307 (Ecology, Pollution, Animal diversity (chordates), Mol. Biol. & Genetics)	3 hours	70	30	100
Theory-Paper 308 (Human Physiology)	3 hours	70	30	100
Theory-Paper 309 (Animal Biochemistry & Metabolism)	3 hours	70	30	100
Theory-Paper 310 (Toxicology, Animal Biotechnology, Animal Behavior, Mammalian Histology)	3 hours	70	30	100
Theory (Total)		280	120	400
SEC Paper 311	3 hours	70	30	100
Practical-Paper 312 (A-1) (Based on Theory Paper – 307)	5 hours	35	15	50
Practical-Paper 312 (A-2) (Based on Theory Paper – 307 & 308)	5 hours	35	15	50
Practical-Paper 312 (B-1) (Based on Theory Paper – 309)	5 hours	35	15	50
Practical-Paper 312 (B-2) (Based on Theory Paper – 309 & 310)	5 hours	35	15	50
Practicals (Total)		140	60	200

INSTRUCTIONS

1. Each theory question paper comprises of FIVE QUESTIONS. All questions carry equal marks, i.e. 14 marks (hence $14 \times 5 = 70$) 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. 36, 39, 42, 45 & 47, as-well-as all other instructions mentioned in this syllabus.
3. The practical question papers will have to be set according to the paper-style and the pattern of marks-distribution provided on page nos. 53, 57, 61 & 65, as-well-as all other instructions mentioned in this syllabus.
4. In order to be qualified to appear for the University Practical Examinations, the student must submit his/her duly certified journals during the examinations.

6th Semester B.Sc.

ZOOLOGY SYLLABUS

PAPER – 307 (Theory)

(ECOLOGY, POLLUTION, ANIMAL DIVERSITY (chordates), MOLECULAR BIOLOGY & GENETICS)

Unit I ECOLOGY :

A) Adaptations :

Arboreal, Cursorial, Volant, Desert and Deep-sea.

B) Marine Ecosystem :

1. Physico-chemical aspects of Marine Environment : Light, Temperature, Pressure, Salinity, Currents and Tides.
2. Zonations in Marine Environment/Sea.
3. Rocky shore, Sandy shore.

C) Fresh water ecosystem :

- a) Characteristics : Salinity, pH, Water current, Transparency, O₂, CO₂, Pressure, Density, Light, Temperature and Thermal stratification (Summer & Winter stratifications).
- b) Lentic system - Ponds : Characteristics, Types, Zonations, Flora and Fauna.
Lakes : Characteristics, Types.
- c) Lotic system - Rivers : Characteristics (Current, Land-water interchange, O₂)
Zonations (Flowing-water, Rapid/Riffle, Pool zones)
Types of river-beds (Eroding, Depositing, Sandy).

D) Terrestrial ecosystems (Biomes) : Tundra, Savanna, Grassland, Desert and Tropical Rain Forest.

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 POLLUTION :

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

1. Air pollutants :
 - a) Gaseous - CO, SO₂, NO₂.
 - b) Particulate - Dust, Lead, Aerosol.
2. Water pollutants :

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

B) Biological Treatment of Effluents :

1. Trickling filters system
2. Stabilization Ponds.
3. Aerated lagoons.

Reference Book for Pollution :

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

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

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

Mammalia : Type - **Rat** (*Rattus rattus*) - External characters, Digestive system, Respiratory system, Heart, Arterial & Venous systems, Brain, Excretory System and Reproductive systems.

B) General topics :

- 1) Types of beaks and feet in birds.
- 2) V.S. of mammalian skin
- 3) 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. Dhama, and J. K. Dhama, S. Chand & Co., Delhi.
3. **Introduction to Chordates**, T. C. Majupuria, Pradeep Publication, Jalandhar.

UNIT IV MOLECULAR BIOLOGY and GENETICS :

A) Molecular Biology :

- 1) Modes 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

Reference Books for Molecular Biology :

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.

B) *Genetics of Human Behavior* :

- 1) First explain how to study Behavior Genetics. (*not to be asked in exam*)
- 2) (in brief) : Charcot-Marie-Tooth Disorder, Friedreich Ataxia, Huntington Disease, Menkes Kinky-hair Disorder, Aggressive behavior, Schizophrenia, Alcoholism and Alzheimer Disease.

(*Reference Book* : **Human Heredity - Principles and Issues** (2nd Ed.), M. R. Cummings, West Publishing Co.)

- 3) Gene therapy
- 4) Human Genome Project

***Further readings for Mol. Biol. & Genetics* :**

1. **Principles of Genetics** (2nd Ed), Peter Snustad, M. J. Simmons, John Wiley & Sons
 2. **Basic Genetics**, R. F. Weaver and P. W. Hedrick, WCB Publishers.
 3. **Concepts Of Genetics**, W. S. Klug and M. R. Cummings, Pearson Education Pvt. Ltd.
 4. **Essential Genetics**, D. L. Hartl and E. W. Jones, Jones & Barlett Publishers.
 5. **Genetics**, P. S. Verma and V. R. Agarwal, S. Chand & Company, Delhi.
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Theory Paper-style and pattern of marks-distribution**PAPER – 307****(ECOLOGY, POLLUTION, ANIMAL DIVERSITY (chordates), MOLECULAR BIOLOGY, GENETICS)**

<u>Q. No.</u>	<u>UNIT NO.</u>	<u>MARKS</u>
Q.1.A	Unit-I OR Unit-I	07
Q.1.B	Unit-I OR Unit-I	07
Q.2.A	Unit-II OR Unit-II	07
Q.2.B	Unit-II OR Unit-II	07
Q.3.A	Unit-III OR Unit-III	07
Q.3.B	Unit-III OR Unit-III	07
Q.4.A	Unit-IV OR Unit-IV	07
Q.4.B	Unit-IV OR Unit-IV	07
Q.5	14 objective questions of 1 mark each. (3 questions from each of the four Units and remaining 2 questions from any of the four Units)	14

PAPER – 308 (Theory)
(HUMAN PHYSIOLOGY)

Unit I HUMAN PHYSIOLOGY – LYMPHATIC SYSTEM :

1. Brief introduction. (*can be asked only as objective questions in Q. 5 only*)
2. Lymphatic vessels.
3. Structure of lymph node.
4. Lymph circulation :
 - Route, Thoracic duct, Right Lymphatic duct, Maintenance.
5. Lymphatic organs :
 - Tonsils, Spleen, Thymus gland.
6. Non-Specific Resistance to Disease :
 - Skin & Mucous Membranes :
 - Mechanical factors
 - Chemical factors
 - Antimicrobial substances :
 - Interferon
 - Complement
 - Properdin
 - Phagocytosis
 - Kinds of phagocytes
 - Mechanism
 - Inflammation
 - Fever
7. Functions of the Lymphatic system.

Unit II HUMAN PHYSIOLOGY – IMMUNITY :

1. Brief introduction. (*can be asked only as objective questions in Q. 5 only*)
2. Immunity (Specific Resistance to Disease)
 - Antigens/Immunogens :
 - Definition
 - Characteristics
 - Antibodies/Immunoglobulins :
 - Definition
 - Structure
 - Cellular & Humoral Immunity :
 - Formation of T cells & B cells
 - T cells & Cellular Immunity
 - B cells & Humoral Immunity
 - Monoclonal antibodies
3. Disorders, Homeostatic Imbalances :
 - Hypersensitivity (Allergy)
 - Tissue rejection
 - Autoimmune diseases
 - AIDS
4. Functions of Immunity.

Unit III HUMAN PHYSIOLOGY – RESPIRATION :

1. Exchange of respiratory gases
2. Transport of respiratory gases :
 - a) Oxygen
 - b) Carbon dioxide
3. Carbon monoxide poisoning
4. Control of respiration :
 - a) Nervous control - Respiratory centre : Medullary rhythmicity 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 :

A. Reproduction :

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

B. 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. **Principles of Anatomy and Physiology**, Tortora and Anagnostakos, HarperCollins College Publishers, 4th Edition.
 2. **Animal Physiology and Related Biochemistry**, H. R. Singh, Shobhan Lal Naginchand & Co. Edu. Pub., Jalandhar.
 3. **Textbook of Animal Physiology**, A. K. Berry, Emkay Pub., New Delhi.
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Theory Paper-style and pattern of marks-distribution**PAPER – 308
(HUMAN PHYSIOLOGY)**

<u>Q. No.</u>	<u>UNIT NO.</u>	<u>MARKS</u>
Q.1.A	Unit-I OR Unit-I	07
Q.1.B	Unit-I OR Unit-I	07
Q.2.A	Unit-II OR Unit-II	07
Q.2.B	Unit-II OR Unit-II	07
Q.3.A	Unit-III OR Unit-III	07
Q.3.B	Unit-III OR Unit-III	07
Q.4.A	Unit-IV OR Unit-IV	07
Q.4.B	Unit-IV OR Unit-IV	07
Q.5	14 objective questions of 1 mark each. (3 questions from each of the four Units and remaining 2 questions from any of the four Units)	14

PAPER – 309 (Theory)
(ANIMAL BIOCHEMISTRY & METABOLISM)

UNIT I LIPIDS and ENZYMES :

A. Lipids :

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

B. Enzymes :

1. Nomenclature & Classification.
2. Factors affecting enzyme activity/enzyme catalyzed reaction :
 - a) Temperature
 - b) pH
 - c) Inhibitors
 - d) Enzyme concentration
 - e) Substrate concentration

Unit II METABOLISM of CARBOHYDRATES :

1. Glycogenesis (structures not required).
2. Glycogenolysis (structures not required).
3. Glycolysis (EM Pathway) (structures required).
4. HMP Shunt Pathway (structures required).

Unit III METABOLISM of CARBOHYDRATES :

1. Krebs Cycle (structures required).
2. Electron Transport System (structures not required).
3. Glucogenesis (structures required).
4. Gluconeogenesis (structures not required).

Unit IV METABOLISM of PROTEINS and LIPIDS :

A. Metabolism of Proteins :

1. Deamination
2. Transamination
3. Decarboxylation
4. Urea synthesis (structures required).

B. Metabolism of Lipids :

1. Glycerol metabolism
2. Fatty acid metabolism :
 - β -oxidation 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.
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Theory Paper-style and pattern of marks-distribution**PAPER – 309
(ANIMAL BIOCHEMISTRY & METABOLISM)**

<u>Q. No.</u>	<u>UNIT NO.</u>	<u>MARKS</u>
Q.1.A	Unit-I OR Unit-I	07
Q.1.B	Unit-I OR Unit-I	07
Q.2.A	Unit-II OR Unit-II	07
Q.2.B	Unit-II OR Unit-II	07
Q.3.A	Unit-III OR Unit-III	07
Q.3.B	Unit-III OR Unit-III	07
Q.4.A	Unit-IV OR Unit-IV	07
Q.4.B	Unit-IV OR Unit-IV	07
Q.5	14 objective questions of 1 mark each. (3 questions from each of the four Units and remaining 2 questions from any of the four Units)	14

PAPER – 310 (Theory)
**(TOXICOLOGY, ANIMAL BIOTECHNOLOGY, ANIMAL BEHAVIOR, MAMMALIAN
HISTOLOGY)**

Unit I TOXICOLOGY :

1. Brief Introduction. (*can be asked only as objective questions in Q. 5 only*)
2. Definitions of Toxicology, Toxicity, Toxicants and Xenobiotics. (*only for Q. 5*)
3. 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 (*for information only, not to be asked in the exam*).
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. (*not to be asked in the exam*)
2. Advantages and disadvantages of Tissue Culture
3. Substrates on which cells grow and Gas phase for Tissue Culture - in brief.
4. Some important requirements for cell & tissue culture (*maxi. 5-7 sentences each*) :
 - a) pH
 - b) CO₂ and Bicarbonate
 - c) Buffer
 - e) O₂
 - f) Temperature
 - g) Balanced Salt Solution (BSS)
 - h) Antibiotics
 - i) Serum
4. Tissue Culture techniques.
5. Organ Culture techniques.
6. 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. (*not to be asked in the exam*)
2. Learning :
 - Definition.
 - Types of Learning : (a) Imprinting
(b) Habituation
(c) Classical conditioning (E.g. Pavlov's expt.)
(d) Instrumental conditioning :
 - Discrete trials procedures
 - Active avoidance learning
 - Escape learning
 - Passive avoidance learning
3. Reproductive behavior patterns :
 - Courtship : Introduction, Need of courtship.
 - Courtship signals – e.g. Balloon Fly (*Hilara sartor*)
 - Persuasion & Appeasement – e.g. ♂ Stickleback's zigzag dance, Herring gull.
 - False information – e.g. Scorpion fly (*Hylobittacus apicalis*)
4. Communication in/between bats and moths.
5. Social organization in baboons.

Reference Books for Animal Behaviour :

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

Unit IV MAMMALIAN HISTOLOGY :

Histology and endocrinological functions of the following glands :
Pituitary, Testis, Ovary, Thyroid, Adrenal.

Reference Books for Histology :

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

PAPER – 310
(TOXICOLOGY, ANIMAL BIOTECHNOLOGY, ANIMAL BEHAVIOR, MAMMALIAN HISTOLOGY)

<u>Q. No.</u>	<u>UNIT NO.</u>	<u>MARKS</u>
Q.1.A	Unit-I OR Unit-I	07
Q.1.B	Unit-I OR Unit-I	07
Q.2.A	Unit-II OR Unit-II	07
Q.2.B	Unit-II OR Unit-II	07
Q.3.A	Unit-III OR Unit-III	07
Q.3.B	Unit-III OR Unit-III	07
Q.4.A	Unit-IV OR Unit-IV	07
Q.4.B	Unit-IV OR Unit-IV	07
Q.5	14 objective questions of 1 mark each. (3 questions from each of the four Units and remaining 2 questions from any of the four Units)	14

PAPER – 311 (Theory)
(CANCER BIOLOGY, CYTOLOGICAL TECHNIQUES)

SUBJECT ELECTIVE COURSE (SEC)

CANCER BIOLOGY :

Unit I

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

Unit II

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

CYTOLOGICAL TECHNIQUES (Cytological study of dead cells) :

Unit III

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

Unit IV

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

Reference books :

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

SEC Paper-style and pattern of marks-distribution**PAPER – 311 (Theory)**
(CANCER BIOLOGY, CYTOLOGICAL TECHNIQUES)**SUBJECT ELECTIVE COURSE (SEC)**

<u>Q. No.</u>	<u>UNIT NO.</u>	<u>MARKS</u>
Q.1.A	Unit-I OR	07
Q.1.B	Unit-I Unit-I OR Unit-I	07
Q.2.A	Unit-II OR	07
Q.2.B	Unit-II Unit-II OR Unit-II	07
Q.3.A	Unit-III OR	07
Q.3.B	Unit-III Unit-III OR Unit-III	07
Q.4.A	Unit-IV OR	07
Q.4.B	Unit-IV 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 – 312 (A-1) (Practicals)
(Based mainly on Theory Paper 307)

1. ECOLOGY :

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

<u>Adaptations</u>	<u>Animals</u>
Sedentary & Fixed Animals	: Sponges, Gorgonia.
Tubeworms	: Arenicola, Sabella.
Planktons	: Daphnia, Cyclops.
Nectons	: Fish, Prawn.
Benthic	: Solefish, Sting rayfish, Electric rayfish.
Arboreal	: Hyla, Squirrel.
Burrowing	: Snake, Hedgehog.
Flying	: Bird, Bat.

B) Study by charts of :

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

2. POLLUTION :

Estimation of (*in water samples*) :

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

3. ANIMAL DIVERSITY (Chordates) :

Study by charts/specimens/models of :

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

4. ANIMAL DIVERSITY (Chordates) :

A) Study of shark by dissections for :

1. The V, VII, IX, X cranial nerves.
2. Membranous labyrinth.
3. Temporary mountings of : Striated muscle fibres and Medullated nerve fibres.

B) Study of rat by dissections for :

1. External characters.
2. Digestive, Arterial, Venous & Reproductive systems and Brain.
3. Temporary mountings of : Striated muscle fibres and Medullated nerve fibres.

5. MOLECULAR BIOLOGY & GENETICS :

A) Study by charts of :

- Modes of DNA replication
- DNA synthesis (*in vitro*)
- Types of DNA
- Types of RNA
- Protein synthesis
- Southern blotting
- Thermocycler
- Recombinant DNA
- DNA fingerprinting

B) Genetic Problems 1 to 5 (see APPENDIX)

APPENDIX for Paper – 312 (A-1) (Practicals)

GENETICS PROBLEMS

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

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

Explain these results.

Solution :

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

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

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

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

Solution :

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

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

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

Spotted short	-	48
Spotted long	-	05
Solid short	-	07
Solid long	-	40

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

Solution :

These two genes are 12 units apart on the chromosome.

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

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

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

Solution :

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

JOURNAL INDEX for PAPER-312 (A-1) (Practicals)*(Based mainly on Theory Paper 307)*

Sr. No.	PRACTICAL	Page No.	Date of Practical	Date of report	Signature of Prof.-in-charge
(A)	<u>ECOLOGY</u>				
	<i>Ecological adaptations :</i>				
1.	Sedentary & Fixed	2			
2.	Tubeworms	3			
3.	Planktons	4			
4.	Nectons	5			
5.	Benthic	6-7			
6.	Arboreal	8			
7.	Burrowing	9			
8.	Flying	10			
	<i>Study by charts of :</i>				
1.	Biomes	11-13			
2.	Summer thermal stratification in fresh water ecosystem.	14			
3.	Winter thermal stratification in fresh water ecosystem.	15			
(B)	<u>POLLUTION</u>				
	<i>Titrimetric estimations of :</i>				
1.	Acidity	16			
2.	Alkalinity	17			
3.	Calcium hardness (using Murexide)	18			
4.	Total hardness (using Eriochrome Black T)	19			
5.	Ca ⁺⁺ and Mg ⁺⁺	20			
	<i>Colorimetric estimations of :</i>				
1.	Phosphate	21			
2.	Sulphate	22			
(C)	<u>ANIMAL DIVERSITY</u>				
	<i>Study of Shark by dissections for :</i>				
1.	V, VII, IX and X cranial nerves	23			
2.	Membranous labyrinth,	24			
3.	Temporary mountings of : Striated muscle fibres, Medullated nerve fibres	25			
	<i>Study of Rat by dissections for :</i>				
1.	External characters	26			
2.	Digestive system	27			
3.	Arterial system	28			

4.	Venous system	29			
5.	Male Reproductive System & Female Reproductive System	30			
6.	Brain	31			
7.	Temporary mountings of : Striated muscle fibres, Medullated nerve fibres	32			
	<i>Study by charts/specimens :</i>				
1.	Sympathetic nervous system of frog	33			
2.	V.S. of mammalian skin	34			
3.	Derivatives of mammalian skin	35			
(D)	<u>MOLECULAR BIOLOGY</u>				
	<i>Study by charts of :</i>				
1.	Modes of DNA replication	36			
2.	DNA synthesis (<i>in vitro</i>)	37			
3.	Types of DNA	38			
4.	Types of RNA	39			
5.	Protein synthesis	40-41			
6.	Southern blotting	42			
7.	Thermocycler	43			
8.	Recombinant DNA	44			
9.	DNA fingerprinting	45			
(E)	<u>GENETICS</u>				
	Study of genetics problems.	46-50			

GUJARAT UNIVERSITY
6th Semester - Zoology

(SKELETON QUESTION PAPER FOR PRACTICAL EXAMINATION)

PAPER-312 (A-1)
(*Based on Theory Paper 307*)

Date : Marks : 35 Time :

- | | | |
|------------|--|-----------|
| Q.1 | Estimate the _____ from the given sample water. | 08 |
| Q.2 | Dissect the given shark/rat so as to expose the _____ and show it to the examiner. | 08 |
| Q.3 | Make a temporary mounting of _____ from the given shark/rat. | 04 |
| Q.4 | Solve the given genetic problem. | 04 |
| Q.5 | Identify specimens 1 to 4 as per instructions :
Sp.1 Identify and comment on its ecological adaptations.
Sp.2 Identify and comment.
Sp.3 Identify and describe.
Sp.4 Identify and explain. | 08 |
| Q.6 | Journal. | 03 |
-
-

DETAILS OF PRACTICAL EXAMINATION (Question wise)
6th Semester - Zoology

PAPER-312 (A-1)
(*Based on Theory Paper 307*)

- Q.1** Titrimetric – Acidity, Alkalinity,
Calcium hardness (using Murexide indicator),
Total Hardness (using Eriochrome Black T indicator),
Ca⁺⁺ and Mg⁺⁺.
Colorimetric – Phosphate and Sulphate.
- Q.2** Shark - V, VII, IX, X cranial nerves and Membranous labyrinth.
Rat - Digestive, Arterial, Venous and Reproductive systems and Brain.
- Q.3** Shark/Rat - Striated muscle fibres, medullated nerve fibres.
- Q.4** Genetics problems 1-5 [APPENDIX for Practical Paper – 312 (A-1)]
- Q.5** Sp.1 Sedentary & Fixed Animals : Sponges, Gorgonia.
Tubeworms : Arenicola, Sabella.
Planktons : Daphnia, Cyclops.
Nectons : Fish, Prawn.
Benthic : Solefish, Sting rayfish, Electric rayfish.
Arboreal : Hyla, Squirrel.
Burrowing : Snake, Hedgehog.
Flying : Bird, Bat.
- Sp.2 Biomes (Tundra, Savanna, Grassland, Desert and Tropical Rain Forest)
Summer & Winter Thermal stratifications in Fresh water ecosystem.
- Sp.3 Sympathetic nervous system of frog.
V.S. of mammalian skin.
Derivatives of mammalian skin (Claw, Nail, Hoof, Horn and Hair)
Rat - Digestive, Arterial, Venous and Reproductive systems and Brain.
- Striated muscle fibres and medullated nerve fibres.
- Sp.4 Molecular biology & Genetics :
- DNA replication modes
- DNA synthesis in vitro
- Types of DNA and RNA
- Protein synthesis
- Southern blotting
- Thermocycler
- Recombinant DNA
- DNA fingerprinting
-

PAPER – 312 (A-2) (Practicals)

(Based on Theory Paper 308)

1. HUMAN PHYSIOLOGY – Immunity :

Study by charts/slides of :

1. Lymphatic circulatory system in humans.
2. T.S. through a lymph node.
3. T.S. through spleen.
4. T.S. through thymus.
5. Structure of a antibody.

2. HUMAN PHYSIOLOGY – Blood :

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

3. HUMAN PHYSIOLOGY - Respiration :

Study by charts of :

1. Respiratory muscles.
2. Alveolar-capillary (respiratory) membrane.
3. Exchange of the respiratory gases.
4. Oxygen-haemoglobin dissociation curve

4. HUMAN PHYSIOLOGY – Reproduction :

Study by charts of :

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

5. HUMAN PHYSIOLOGY – Muscle contraction :

Study by charts of :

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

JOURNAL INDEX for PAPER-312 (A-2) (Practicals)*(Based on Theory Paper 308)*

Sr. No.	PRACTICAL	Page No.	Date of Practical	Date of report	Signature of Prof.-in-charge
	<u>HUMAN PHYSIOLOGY</u>				
(A)	<u>IMMUNITY</u>				
	<i>Study by charts/slides of :</i>				
1.	Lymphatic circulatory system in humans	2			
2.	T.S. through a lymph node	3			
3.	T.S. through spleen	4			
4.	T.S. through thymus	5			
5.	Structure of a antibody	6			
(B)	<u>BLOOD</u>				
1.	Estimation of Hb.	7			
2.	Preparation of haemin crystals.	8			
3.	Preparation of blood smear.	9			
4.	Total RBC count.	10-11			
5.	Total WBC count.	12-13			
6.	Determination of bleeding time.	14			
7.	Determination of clotting time.	15			
(C)	<u>RESPIRATION</u>				
	<i>Study by charts :</i>				
1.	Respiratory muscles	16			
2.	Alveolar-capillary membrane	17			
3.	Exchange of respiratory gases	18			
4.	Oxygen-haemoglobin dissociation curve	19			
(D)	<u>REPRODUCTION</u>				
	<i>Study by charts :</i>				
1.	T.S. of uterus	20			
2.	Menstrual cycle	21			
3.	Mol. structures of :	22			
	Testosterone, Estrogen, Progesterone				
(E)	<u>MUSCLE CONTRACTION</u>				
	<i>Study by charts :</i>				
1.	T.S. of a muscle	23			
2.	Ultrastructure of a sarcomere	24			
3.	Ultrastructure of Neuro-muscular junction	25			

GUJARAT UNIVERSITY

6th Semester - Zoology

(SKELETON QUESTION PAPER FOR PRACTICAL EXAMINATION)

PAPER-312 (A-2)

(*Based on Theory Papers 307 & 308*)

Date :

Marks : 35

Time :

- Q.1** Perform the given physiological experiment _____. Record your observations & calculations if necessary, and submit to the examiner. **09**
- Q.2** (a) Estimate the concentration of _____ in your own blood. **09**
OR
(b) Make a temporary preparation of _____ from your own blood.
OR
(c) 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**
- Note :** *All examiners should take the viva sitting together and each examiner should give marks from 06 and then the average marks of all the examiners should be given to the candidate.*
- Q.5** Journal. **03**
-
-

DETAILS OF PRACTICAL EXAMINATION (Question wise)
6th Semester - Zoology

PAPER-312 (A-2)
(*Based on Theory Papers 307 & 308*)

- Q.1** a) Total RBC count in your own blood.
b) Total WBC count in your own blood.
d) Preparation of your own blood smear, stained by Geimsa stain, to identify the different WBCs.
- Q.2** a) Hb
OR
b) Haemin crystals
OR
c) Bleeding time & Blood clotting time (*Both to be asked together as one single question*)
- 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 a antibody
Sp.2 Respiration : Respiratory muscles
Alveolar-capillary (respiratory) membrane
Exchange of the respiratory gases
Oxygen-haemoglobin dissociation curve
Reproduction: Mol. structures of Testosterone, Estrogen and Progesterone
Sp.3 Reproduction: Menstrual cycle
T. S. of uterus
Sp.4 Muscle contraction : T. S. of 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.

Note : *All examiners should take the viva sitting together and each examiner should give marks from 06 and then the average marks of all the examiners should be given to the candidate.*

PAPER – 312 (B-1) (Practicals)

(*Based on Theory Paper 309*)

1. LIPIDS :

Colorimetric estimation of :

1. Cholesterol in Serum/Plasma (Ferric chloride method).
2. Creatinine in urine.

(**Note :** *Students are not supposed to take the colorimetric readings by themselves.*)

2. LIPIDS :

1. Study by charts of :

Basic steroid nucleus and Cholesterol.

2. Preparation of Atomic Models of :

Glycerol, Butyric acid, Crotonic acid, Tributyrin, Lecithins, Cephalins and Plasmalogens.

(**Note :** *In the journal, students should **only write** the structures of the compounds. There is no need to make colour drawings of the atomic models.*)

3. ENZYMES :

Study by charts of :

Factors affecting enzyme activity :

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

4. METABOLISM :

Study by charts of :

1. Glycogenesis (structures not required).
2. Glycogenolysis (structures not required).
3. Glucogenesis (structures required).
4. Gluconeogenesis (structures not required).
5. Glycolysis (EM Pathway) (structures required)
6. Krebs Cycle (structures required).
7. ETS.
8. HMP Shunt Pathway (structures required).
9. Urea synthesis (structures required).
10. β -oxidation of saturated fatty acids (structures required).

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JOURNAL INDEX for PAPER-312 (B-1) (Practicals)

(Based on Theory Paper 309)

Sr. No.	PRACTICAL	Page No.	Date of Practical	Date of report	Signature of Prof.-in-charge
(A)	<u>LIPIDS</u>				
	<i>Colorimetric estimations of :</i>				
1.	Cholesterol in serum/plasma.	2			
2.	Creatinine in urine.	3			
	<i>Study by charts of :</i>				
1.	Basic steroid nucleus	4			
2.	Cholesterol	5			
	Preparation of atomic models.	6-8			
(B)	<u>ENZYMES</u>				
	<i>Study by charts of factors affecting enzyme activity :</i>				
1.	Temperature	9			
2.	pH	10			
3.	Substrate concentration	11			
(C)	<u>METABOLISM</u>				
	<i>Study by charts of :</i>				
1.	Glycogenesis	12			
2.	Glycogenolysis	13			
3.	Glucogenesis	14			
4.	Gluconeogenesis	15			
5.	Glycolysis	16			
6.	Krebs cycle	17			
7.	ETS	18			
8.	HMP Shunt pathway	19-20			
9.	Urea synthesis	21			
10.	β -oxidation of saturated fatty acids	22			

GUJARAT UNIVERSITY
6th Semester – Zoology

(SKELETON QUESTION PAPER FOR PRACTICAL EXAMINATION)

PAPER-312 (B-1)
(*Based on Theory Papers 309*)

Date : Marks : 35 Time :

Q.1 Estimate colorimetrically the concentration of _____ **08**
from the given unknown solution and submit upir results to the examiner.

Note : *Students are not supposed to take the colorimetric readings by themselves.*

Q.2 Make a permanent stained mounting of the chick embryo and show it **08**
to the examiner.

Q.3 Prepare the atomic model of _____ and show it to the examiner. **08**

Note : *Examiners should make the students **only write** the structure of the compound (like in theory exam) **and not make them draw** the atomic model.*

Q.4 Identify the specimens 1 to 4 as per instructions : **08**
Sp.1 Identify and comment.
Sp.2 Identify and describe.
Sp.3 Identify and complete the chart.
Sp.4 Identify and comment.

Q.5 Journal. **03**

DETAILS OF PRACTICAL EXAMINATION (Question wise)
6th Semester – Zoology

PAPER-312 (B-1)
(*Based on Theory Papers 309*)

- Q.1** a) Cholesterol in Serum/Plasma (Ferric chloride method).
b) Creatinine in urine.

Note : **Students are not supposed** to take the colorimetry readings by themselves.

- Q.3** Glycerol, Butyric acid, Crotonic acid, Tributyrin, Lecithins, Cephalins and Plasmalogens.

Note : *Examiners should make the students **only write** the structure of the compound (like in theory exam) **and not make them draw** the atomic model.*

- Q.4** Sp.1 Basic steroid nucleus
Cholesterol
Structures of :
- Glycerol, Butyric acid, Crotonic acid, Tributyrin, Lecithins, Cephalins and Plasmalogens.
- 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 not required).
Glycolysis (EM Pathway) (structures required)
Urea synthesis (structures required).
- Sp.4 Glucogenesis (structures required).
Krebs Cycle (structures required).
ETS.
HMP Shunt Pathway (structures required).
 β -oxidation of saturated fatty acids (structures required).
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PAPER – 312 (B-2) (Practicals)
(*Based on Theory Paper 310*)

1. HISTOTECHNOLOGY :

1. Procuring & Processing of tissues.
2. Preparations of wax blocks.
3. Sectioning by microtome.
4. Preparation & submission of permanent slides (*Maxi. 10 slides, of which 5 slides should be of histology and 5 should be W.M.)*

2. MAMMALIAN HISTOLOGY :

Identification & histological study of the following organs by permanent slides of :
T.S. of Pituitary, Testis, Ovary, Thyroid, Adrenal.

3. TOXICOLOGY :

Study by charts of :
LD₅₀ test.

4. ANIMAL BIOTECHNOLOGY :

Study by charts of :

1. Classical organ culture technique
2. Trowel's type II culture chamber
3. Balanced Salt Solution (BSS)
4. Antibiotics
5. Serum

5. ANIMAL BEHAVIOUR (Ethology) :

Study by charts of :

2. Communication in/between bats & moths.
3. Social organization in Baboons.
4. Reproductive behavior patterns :
 - Courtship signals – e.g. Balloon Fly (*Hilara sartor*)
 - Persuasion & Appeasement – e.g. ♂ Stickleback's zigzag dance, Herring gull.
 - False information – e.g. Scorpion fly (*Hylobittacus apicalis*)

GUJARAT UNIVERSITY

6th Semester – Zoology

(SKELETON QUESTION PAPER FOR PRACTICAL EXAMINATION)

PAPER-312 (B-2)

(*Based on Theory Papers 309 & 310*)

Date :

Marks : 35

Time :

- Q.1** Identify the specimens 1 to 6 as per instructions : **12**
Sp.1 Identify and describe.
Sp.2 Identify and state its endocrinological functions.
Sp.3 Identify, sketch and label.
Sp.4 Identify and state its uses.
Sp.5 Identify and comment.
Sp.6 Identify and describe the reproductive behaviour pattern.
- Q.2** Submission of 10 permanent slides (5 histology and 5 W.M.). **14**
- Q.3** Viva voce. **06**
- Note :** *All examiners should take the viva sitting together and each examiner should give marks from 06 and then the average marks of all the examiners should be given to the candidate.*
- Q.4** Journal. **03**
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DETAILS OF PRACTICAL EXAMINATION (Question wise)
6th Semester – Zoology

PAPER-312 (B-2)
(*Based on Theory Papers 309 & 310*)

- Q.1** Sp.1. Mammalian histology by permanent slides :
T.S. of Pituitary, Testis, Ovary, Thyroid, Adrenal.
- Sp.2 Mammalian histology by permanent slides :
T.S. of Pituitary, Testis, Ovary, Thyroid, Adrenal.
- Sp.3 Mammalian histology by permanent slides :
T.S. of Pituitary, Testis, Ovary, Thyroid, Adrenal.
- Sp.4 Histotechnology :
Microtome
Toxicology by chart :
LD₅₀ test
Animal Biotechnology by chart :
- Classical organ culture technique.
- Trowel's type II culture chamber.
- Sp.5 Animal behaviour :
Communication in/between bats & moths.
Social organization in Baboons.
- Sp.6 Animal behaviour :
Courtship signals – e.g. Balloon Fly (*Hilara sartor*)
Persuasion & Appeasement–e.g. ♂ Stickleback's zigzag dance, Herring gull.
False information – e.g. Scorpion fly (*Hylobittacus apicalis*)
- Q.3** Syllabus of Theory Papers 309 & 310 as-well-as Practical Papers 312 (B-1) & 312 (B-2) only.

Note : *All examiners should sit together to take the viva and each examiner should give marks from 06 and then the average marks of all the examiners should be given to the candidate.*

NOTE :

- 1. The list of the reference books provided herein 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.***