B.Sc. Part III  
Semester – Vth  
Zoology

Session : 2016-17  

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Option I : Medical Zoology and Medical Laboratory Technology (Zoology)  
Option II : Economic Entomology and Pest Management (Zoology)  
Option III : Aquaculture (Zoology)  

Note : There will be one Practical paper of 3 hours pertaining to entire syllabus in each semester.

Time : 9:00 a.m. – 12:00 noon

SEMESTER - V  
Zoo.301 : Developmental Biology and Genetics

Max. Marks :50  
Pass Marks : 35%  
Internal Assessment : 20

Note : The number of lectures per week will be nine for theory and six for practical.

INSTRUCTIONS FOR PAPER SETTER

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective sections of the syllabus and will carry 7.5 marks each. Section C will consist of 10 short-answer type questions which will cover the entire syllabus uniformly and will carry 20 marks in all.

INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt two questions from each section A and B and the entire section C.

Section : A

2. Egg maturation : egg membranes, polarity of egg.
3. Fertilization; parthenogenesis, Cleavage patterns.
4. Basic concepts of organizers and inducers and their role.
5. Embryonic development: Cleavage, determination and differentiation, development upto three germ layers and their fate in *Herdmania, Amphioxus*, frog, chick and rabbit. Metamorphosis in *Herdmania* and Rana (Frog).
6. Foetal membranes, their formation and role. Mammalian placenta, its formation, types and functions.

**Section : B**

3. Multiple factors: Qualitative and quantitative characters, Inheritance of quantitative traits (skin colour in man).
6. Genetic recombination in bacteria (conjugation, transduction and transformation), Recombinant DNA –technology, Genetic cloning and its applications in medicine and agriculture, DNA finger printing.

**Practical Based on Theory Paper Zoo 301 (Zoo 351)**

1. Demonstration of Law of Segregation, Independent assortment and epistasis (use of coloured beads, capsules etc). Numericals for segregation and independent assortment.
2. Segregation demonstration in preserved material (Maize).
3. Cytoplasmic inheritance in *Mirabilis jalapa*.
4. Inheritance of other human characteristics, ability to taste. PTC, thiourea.
5. Comparison of variance in respect of pod length and number of seeds in pods.
7. Study of Polytene chromosomes of *Chironomus/Drosophila* through permanent slide.
8. Dermatographics: Palm print taking and finger tip patterns.
9. Study of the development of frog from permanent slides.
10. Study of the development of chick embryo form permanent slides upto 96 hours.
11. Study of the following prepared slides:
   a. Stages of gametogenesis, structure of egg and sperm of a mammal.
   b. Larva of Herdmania
12. Project regarding Inheritance of human characteristics, Dermatographics or developmental biology.

B.Sc. Part III
Semester – VI

Applied Zoology (Zoo.302)

Option I : Medical Zoology and Medical Laboratory Technology (Zoology)

Max. Marks : 50  Time Allowed : 3 hours
Pass Marks : 35%  Lectures to be delivered : 90
Internal Assessment : 20

Note: The number of lectures per week will be nine for theory and six for practical.

INSTRUCTIONS FOR PAPER Setter

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective sections of the syllabus and will carry 7.5 marks each. Section C will consist of 10 short-answer type questions which will cover the entire syllabus uniformly and will carry 20 marks in all.

INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt two questions from each section A and B and the entire section C.

Section – A

1. Introduction to Parasitology (pertaining to various terminologies in use).
2. Brief Introduction to pathogenic microbes. Viruses, Rickettsiae, Spirochaetes and Bacteria.
3. Brief accounts of life history, mode of infection and pathogenicity of the following pathogens with reference to man; prophylaxis and treatment:

5. Epidemic diseases such as typhoid, cholera, small pox; their occurrence and eradication programmes.

6. Brief introduction to human defence mechanisms.


8. Antigen and antibody interactions: Serodiagnostic assays.

9. Vaccines.

**Section – B**

1. Laboratory safety rules, hazards and precautions during sample collection and laboratory investigations.

2. Laboratory techniques: Colorimetry, Microscopy, Autoclaving, Centrifugation, Spectrophotometry.

3. Collection, Transportation and Preservation of different clinical samples.

4. Bacteriology: Sterilisation, (dry heat, moist heat, autoclave, filtration), Disinfection, Staining techniques (gram's stain, AFB stain, etc), Culture media (Defined & Synthetic media & routine laboratory media), Bacterial culture (aerobic and anaerobic), antibiotic sensitivity.


6. Biochemistry: Protein estimation, estimation of blood urea, sugar and cholesterol, serum creatinine and uric acid, urine analysis; estimation of protein, sugar, bile salts, bile pigments, ketone bodies; enzyme studies (serum transaminase, phosphatase, amylase and lipase), liver function test.

Practical Based on Theory Paper

ZOO 302 (ZOO 352)

1. Demonstration of safety rules in laboratory like proper handling of paints, specimens and disposal of syringes, needles etc.
2. Demonstration of the use of autoclave, centrifuge and spectrophotometer.
3. Cleaning and sterilization of glassware using hot air oven, autoclave etc.
4. Demonstration of parts of microscope, its functioning and care.
5. Processing of clinical samples for culture and identification of pathogens: blood, throat swab, sputum, pus, urine, stool, CSF and other body fluids.
7. Preparation of thick and thin film for malarial parasite.
8. Counting of WBC, RBC & DLC.
9. Examination of stool for demonstration of intestinal parasites.
10. Study of permanent slides and specimens of parasitic protozoans, helminthes, arthropods, mentioned in theory syllabus.
11. Analysis of blood group, A, B, AB, O and Rh.
12. ESR, haematocrit, bleeding time, coagulation time, prothrombin time.
14. Fixation, embedding, cutting of tissue sections and their staining (routine Haematoxyline and Eosin and special staining with Hg-BPB, PAS, SBB and Feulgen reaction.

Suggested Readings

Applied Zoology (ZOO 303)

Option II: Economic Entomology and Pest Management (Zoology)

Max. Marks : 50
Pass Marks : 35%
Internal Assessment : 20

Note: The number of lectures per week will be nine for theory and six for practicals.

INSTRUCTIONS FOR PAPER SETTER

The question paper will consist of three sections A, B and C. Section A and B will have four questions form the respective sections of the syllabus and will carry 7.5 marks each. Section C will consist of 10 short-answer type questions which will cover the entire syllabus uniformly and will carry 20 marks in all.

INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt two questions from each section A and B and the entire section C.

Section – A

A) Systematic position, habits and nature of damage of the following pests for crops and vegetables.

i) Sugarcane
   1. Sugarcane leaf hopper (*Pyrrlia perpusilla*)
   2. Sugarcane top borer (*Scirpophaga nivella*)
   3. Sugarcane stem borer (*Chilo infuscatellus*) along with life cycle and control of *Pyrrlia perpusilla* (Sugarcane leaf hopper).

ii) Cotton
   1. Pink Bollworm (*Pectinophora gossypiella*)
   2. Red cotton bug (*Dysdercus cingulatus*)
   3. Cotton grey weevil (*Myllocerus maculosus*)
   4. Surface grasshopper (*Chrotogonus trachypterus*)
   5. Cotton jassid (*Empoasca devastans*) along with life cycle and control of *Pyrrlia perpusilla* (Sugarcane leaf hopper)

iii) Paddy
   1. Rice Gundhy Bug (*Leptocorisa varicornis*)
   2. Rice Grasshopper (*Hieroglyphus banian*)
3. Rice Hispa (*Diclodispa armigera*) along with life cycle and control of Gundhy bug (*Leptocorisa varicornis*)

iv) Wheat:
1. Wheat stem borer (*Sesamia inferens*) along with life cycle and control.
2. Termites
3. Aphids, Jassids

v) Vegetables:
1. Red Pumpkin beetle (*Aulacophora foveicollis*)
2. Pumpkin fruit fly (*Dacus cucurbitae*)
3. Hadda beetle (*Epilachna vigindictopunctata*) along with life cycle and control of pumpkin/fruit fly (*Dacus cucurbitae*)

B) Pests of stored grains: Systematic position, habits and nature of damage of the following pests of stored grains:
1. Pulse Beetle (*Callosobruchus maculatus*) along with life cycle and control.
2. Rice weevil (*Sitophilus oryzae*)
3. Khapra beetle (*Trogoderma granarium*)
4. Rust red flour beetle (*Tribolium castaneum*)
5. Lesser grain borer (*Rhizopertha dominica*)
6. Rice moth (*Corcyra cephalonica*)

C) Systematic position, disease caused and control of the following pests of Medical and Veterinary importance:
1. Mosquitos
2. Sand fly (*Phlebotomus minutes*)
3. House fly (*Musca domestica*)
4. Horse fly (*Tabanus striatus*)
5. Blow fly (*Calliphora erythrocephala*)
6. Warble fly (*Hypoderma lineatus*)
7. Lice Poultry louse (*Menopon gallinae*)
8. Sucking louse (*Haematopirus eurysternus*)
9. Fleas
Section – B

1. Sericulture
   i) Species of silkworm
   ii) Requirements of Sericulture Industry
   iii) Grainage Management
   iv) Pre and Post-cocoon processing (Spinning & Reeling)
   v) Diseases of silkworm.

2. Apiculture
   i) Species of Honeybees
   ii) Flora for Apiculture
   iii) Methods & Appliances of Bee Keeping
   iv) Products – a) Honey b) Bee wax c) Propolis d) Pollen e) Royal Jelly f) Bee Venom
   v) Disease of Honey Bees

3. Lac Culture
   i) Species of Lac culture
   ii) Host Plants
   iii) Cultivation of Lac
   iv) Processing of Lac Industry
   v) Diseases of Lac Cultivation

Pest Management

   i) Biological Control : History : Techniques in Biological Control, Agents of Biological Control (a) Vertebrates (b) Nemathelminthes (c) Arthropods (d) Protozoan : Microbial Control with the help of Bacteria, Virus and Fungi.


   iii) Recent methods of Pest Control : (i) Sterile Insect Release Methods (ii) Behavioural control involving use of Pheromones (iii) Integrated Pest Control :
Introduction to IPM: Pre-requisites, Implementation strategy, Framework of IPM programme and Perspective in IPM.

Practical Based on Theory Paper

ZOO 303 (ZOO 353)

1. Feeding apparatus: Mouth parts of honey bee, butterfly and red cotton bug by preparing permanent mounts.

2. A study of different types of larvae and pupae of insects.


4. External morphology and identification marks of the following stored grain pests, *Sitophilus oryzae* (Rice weevil), *Tribolium castaneum* (Rusted flour beetle), *Rhizopertha dominica* (Lesser grain borer/susri), *Trogoderma granarium* (Khapra beetle), *Collosobruchus maculates* (Pulse beetle/Dhora).

5. External morphology and identification marks of the following insects of Medical/Veterinary importance-Mosquitoes (*Culex, Anopheles* and *Aedes*), house fly, blow fly, warble fly and horse fly.


7. Collection of insects representing different orders, storage and preservation of insect material.


9. Visit to apiary and godowns for study of infections.
Applied Zoology (ZOO 304)
Option III : Aquaculture (Zoology)

Max. Marks :50 Time Allowed : 3 hours
Pass Marks : 35% Lectures to be delivered : 90
Internal Assessment : 20

Note : The number of lectures per week will be nine for theory and six for practicals.

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INSTRUCTIONS FOR CANDIDATES
Candidates are required to attempt two questions from each section A and B and the entire section C.

Section – A

1. History of inland fisheries in India
2. Morphology of a typical fish (carp, cat-fish, fresh water eel, perch).
3. Structure of mouth of different fishes in relation to feeding habits.
4. Identification and classification of important fishes of Punjab, Haryana & Himachal Pradesh.
5. Bionomics of
   - Labeo rohita
   - Catla catla
   - Cirrhinus mirigala
   - Wallago attu
6. Exotic fishes : History, their introduction, morphology, their role in fish culture, impact on native fish fauna.
7. Induced Breeding
   - History
   - Technique
   - Chemicals involved induced breeding impact on fish culture
8. Pond culture
   - Construction of pond
Types of pond
Hydrobiological factors of water and soil of a fish pond
Fertilization of pond
Maintenance of pond

9. Aquatic weeds and their control both biological and chemical.

**Section – B**

10. Riverine fisheries of river Sutlej and Beas.
11. Reservoir fisheries of river Sutlej and Beas.
12. Culture systems
   - Conventional
   - Extensive
   - Intensive
   - Monoculture
   - Poly culture
13. Integrated fish farming
    - Duck-cum-poultry-cum-pig-dairy fish farming.
14. Sewage fed fisheries
15. Cold water fisheries
    - Mahseer fisheries
    - Trout fisheries
16. Fish Diseases and their control
    (i) Viral
    (ii) Bacterial
    (iii) Fungal
    (iv) Helminth
    (v) Crustacean
    (vi) Diseases due to unhygienic conditions
    (vii) Diseases during transportation.
17. Fish by-product
18. Marketing of fish
    a. Fresh fish
    b. Preservation of fish.
**Practical Based on Theory paper ZOO 304 (ZOO 354)**

1. Morphology of a carp, cat fish and perch.
2. Morphometric and meristic characters of a typical fish.
3. Identification of the following fishers using key:
   For the identification of the fishes, the students can use already prepared keys or can prepare their own keys.
4. Determination of food and feeding habits of locally available fishes on the basis of stomach analysis adopting the following methods.
   a. Frequency occurrence method
   b. Feeding intensity
   c. Point method
5. Determination of maturity stages (both male and female) of any commercial fish (preserved specimens).
6. Preparation of permanent slides of Phytoplanktons and Zooplanktons which constitute the food of commercial fishes. Their identification and study of important characters.
7. Identification of aquatic weeds of a fish pond.
8. Estimation of following chemical parameters of the water of a fish pond:
   a. Temperature
   b. pH
   c. Dissolved oxygen
   d. Phosphate
   e. Total Dissolved solids
   f. Nitrates
   g. Hardness
   h. Chlorids
9. Examination of diseased fishes.
10. Visits of various fish ponds and fish market.
## Suggested Readings

1. **Fish and Fisheries of India**: V.G. Jhingran
   Hindustan Publishing Corporation of India, Delhi, 1991.

2. **Fish of India Vol. I & II**: F-day. Reprinted Edition


4. **Fishery Development**: S.C. Agarwal & M.S. Johal, Narendra


6. **Freshwater Fishery Biology**: Karl F. Legler Wm. C-Brown
   Company Publ., Dubuque, IOWA, USA, 1969.

7. **Fisheries Techniques**: Brain R. Murphy & David W.
   Willis (Ed.) American Fisheries Society Bethesda Maryland, USA, 1996.
1. Demonstrate the law of independent assortment/segregation/epistasis from the material provided. Identify the characters involved showing the dominance/recessiveness of characters.  

2. Calculate the gene frequency from a known sample of characteristics using Hardy-Weinberg Law.  

   or  

   Make a dermatographic print of your finger tips or palm pattern and classify the various visible pattern with the help of diagrams and demonstrate it to the examiner.  

3. Make a permanent/temporary preparation and identify the material provided. Write a brief note on it.  

4. Identify the slides A to C giving two reasons for each identification.  

5. Practical Note Book  

6. Viva-voce  

7. Project Work  

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**Option – I (ZOO 352)**  

1. To make a permanent stained preparation of blood smear showing different stages of Plasmodium/rectal ciliate of frog/bacteria in sputum. Write briefly about your observation under the microscope. Draw a labeled sketch.  

2. To test the given sample of urine/stool under the microscope for its pathology. Write the procedure adopted.  

3. To identify the specimens A, B & C. Write the disease caused by each and two reasons for their identification.  

4. To find out the blood groups, erythrocyte sedimentation rate/bleeding time/coagulation time/prothromobin time of the given sample and write the procedure adopted.  

5. To identify the slides D, E and write diagnostic features.  

6. Practical Note-book  

7. Viva- voce  

8. Project Work
Option II (ZOO 353)

1. To make a permanent preparation of the mouth parts of the given specimen. Make a labeled sketch of the same.

2. To identify specimens A, B & C belonging to crop pests, stored grain pests and insects of medical importance respectively. Give one outstanding morphological character and one identification mark of each. Mention their scientific names and economic importance also.

3. To mention the type of larval and pupal stages of life history of silk worm and honeybee. Write a note on its external morphology.

4. To name the apparatus provided and explain its structure and working.

5. Insect collection.

6. Practical Note-book

7. Viva-voce

Option III (ZOO 354)

1. To identify the given sample A and write the morphometic and meristics characters. Make labeled sketch of given samples.

2. Identify and write morpho–ecological note on specimens B and C.

3. To identify slides D and E. write two identifying characters of each.

4. Estimation of chemical parameters of water from a fish pond.

5. Practical Note-book

6. Viva-voce

7. Project Work Report