Ref:- 1. Minutes of the meeting of the Board of Studies (UG) in Zoology held on 25-09-2017.

ORDER:

The Vice-Chancellor, after having considered the minutes 1st cited, has approved the III year B.Sc Zoology VI Semester syllabus under CBCS pattern for the academic year 2017-18 prepared by the Board of Studies (UG) in Zoology. The titles of the papers are mentioned below.

Semester VI

Elective paper in paper VII.

VII –A – Immunology

OR

VII –B – Cellular Metabolism & Molecular Biology

Cluster Electives in paper VIII.

VII –A : Medical Diagnostics
1. Clinical Bio chemistry
2. Hematology
3. Clinical Micro- Biology

OR

VIII –B : Aqua Culture
1. Principals of Aquaculture
2. Aquaculture Management
3. Postharvest Technology

It is ordered that the modified syllabus in paper V- Animal Bio Technology in V Semester be implemented from next academic year i.e 2018-19 onwards as per the recommendations of the BoS (UG) in Zoology.

(BY ORDER)

To
The Chairman and all members, Board of Studies (UG) in Zoology, ANU.
All the Principals of the Affiliated Colleges under ANU area.
Copy to:
The Dean, Faculty of Natural Science, ANU.
The Dean, CDC, ANU.
The Coordinator, UG (Exams), ANU
The Addl. Controller of Examinations, ANU.
The In- Charge, ANU website.
The P.A. to Vice-Chancellor/ Registrar/Rector, ANU.
ZOLOGY SYLLABUS FOR V SEMESTER FOR 2018-19
ZOLOGY - PAPER - V
ANIMAL BIOTECHNOLOGY

Periods: 60
Max. Marks: 100

Unit 1: Introduction to Bio-Technology and its applications:
- **Tools of Recombinant DNA technology - Enzymes and Vectors**
- **Restriction modification systems**: Types I, II and III. Mode of action, nomenclature, applications of Type II restriction enzymes in genetic engineering
- **Cloning Vectors**: Plasmid vectors: pBR and pUC series, Bacteriophage lambda and M13 based vectors, Cosmids, BACs, YACs,

Unit 2 Techniques of Recombinant DNA technology
- **Cloning**: gene cloning
- **Gene delivery**: Microinjection, electroporation, biolistic method (gene gun), liposome and viral-mediated delivery
- **PCR**: Basics of PCR.
- **Hybridization techniques**: Southern, Northern and Western blotting,
- **Genomic and cDNA libraries**: Preparation and uses

UNIT 3 Animal Cell Technology
- Culture; Established Cell lines (common examples such as MRC, HeLa, CHO, BHK, Vero); Organ culture; Cryopreservation of cultures.
- **Hybridoma Technology**: Cell fusion, Production of Monoclonal antibodies (mAb), Applications of mAb
- **Stem cells**: Types of stem cells, applications

Unit 4 Reproductive Technologies & Transgenic Animals
- Embryo transfer, Embryo cloning
- **Transgenic Animals**: Strategies of Gene transfer; Transgenic - sheep, - fish; applications

Unit 5 Applied Biotechnology
- **Industry**: Fermentation: Different types of Fermentation: Short notes on - Submerged & Solid state; batch, Fed batch & Continuous; Stirred tank, Air Lift, Fixed Bed and Fluidized; Downstream processing - Filtration, centrifugation, extraction, spray drying and lyophilization
- **Agriculture**: fisheries – monoculture in fishes, polyploidy in fishes.
IMMUNOLOGY

Periods: 60
Max. Marks: 100

Unit - I
1.1 Overview of Immune system
   1.1.1 Introduction to basic concepts in Immunology
   1.1.2 Innate and adaptive immunity
1.2 Cells and organs of Immune system
   1.2.1 Cells of immune system
   1.2.2 Organs of immune system

Unit - II
2.1 Antigens
   2.1.1 Basic properties of antigens
   2.1.2 Factors influencing immunogenicity

Unit - III
3.1 Antibodies
   3.1.1 Structure of antibody
   3.1.2 Classes and functions of antibodies

Unit - IV
4.1 Working of Immune system
   4.1.1 Structure and functions of major histocompatibility complexes
   4.1.2 Basic properties and functions of cytokines

Unit - V
5.1 Immune system in health and disease
   5.1.1 Classification and brief description of various types of hyper sensitivities

5.2 Vaccines
   5.2.1 General introduction to vaccines
   5.2.2 Types of vaccines
ZOOTOLOGY PRACTICAL SYLLABUS FOR VI SEMESTER

ZOOTOLOGY - ELECTIVE PAPER – VII-(A)

IMMUNOLOGY

**Periods: 24**  
**Max. Marks: 50**

1. Demonstration of lymphoid organs (as per UGC guidelines)
2. Histological study of spleen, thymus and lymph nodes (through prepared slides)
3. Blood group determination
4. Demonstration of
   a. ELISA
   b. Immunoelectrophoresis
I. Answer any FIVE of the following:  
Draw labeled diagrams wherever necessary  
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II. Answer any FIVE of the following:  
Draw labeled diagrams wherever necessary  
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OR

OR

OR
AP STATE COUNCIL OF HIGHER EDUCATION

ZOOGOLOGY SYLLABUS FOR VI SEMESTER

ZOOGOLOGY - ELECTIVE PAPER: VII-(B)

CELLULAR METABOLISM AND MOLECULAR BIOLOGY

<table>
<thead>
<tr>
<th>Periods: 60</th>
<th>Max. Marks: 100</th>
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**Unit I: Biomolecules**
1.1 Carbohydrates - Classification of carbohydrates. Structure of glucose
1.2 Proteins - Classification of proteins. General properties of amino acids
1.3 Lipids - Classification of lipids

**Unit II: Enzymes and Cellular Metabolism**
2.1. Introduction to biocatalysis, Enzymes and their classification, Enzyme kinetics. Mechanism of action. Inhibition and Regulation
2.2 Carbohydrate Metabolism - Gluconeogenesis,
2.3 Glycogen metabolism,

**Unit III: Cellular Metabolism and Cell Physiology**
3.1 Lipid Metabolism - Biosynthesis and β oxidation of palmitic acid
3.2 Protein metabolism - Transamination, Deamination and Urea Cycle
3.3 Cell junctions – Tight junctions, desmosomes, gap junctions

**Unit V: Gene Expression**
3.1 Gene Expression in prokaryotes (Lac Operon)
3.2 Gene Expression in eukaryotes.
3.3 Transcription and Translation.
ZOOLOGY PRACTICAL SYLLABUS FOR VI SEMESTER

ZOOLOGY - ELECTIVE PAPER: VII-(B)

CELLULAR METABOLISM AND MOLECULAR BIOLOGY

Periods: 24  Max. Marks: 50

1. Qualitative tests to identify functional groups of carbohydrates in given solutions (Glucose, Fructose, Sucrose, Lactose)
2. Estimation of total protein in given solutions by Lowry’s method.
3. Study of activity of salivary amylase under optimum conditions
4. Preparation of permanent slide to show the presence of Barr body in Human female blood cells or cheek cells
5. Mounting of salivary gland chromosomes of Chiranoaomous

SUGGESTED READINGS

I. Answer any FIVE of the following: 
   Draw labeled diagrams wherever necessary
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II. Answer any FIVE of the following: 
   Draw labeled diagrams wherever necessary
   9. OR
   10. OR
   11. OR
   12. OR
   13. OR
PRACTICAL – 1 CLINICAL BIOCHEMISTRY
- Collection of blood specimen and serum preparation.
- Blood glucose and urine glucose estimation.
- LFT, Kidney Function and Cardiac Profile tests.
- Determination of serum proteins, SGOT, SGPT, S.ALP, S.ACP
- Determination of sodium, potassium and chlorides

PRACTICAL – 2 HAEMATOLOGY & CLINICAL MICROBIOLOGY
- Routine haematological tests – Blood smear preparation, TC, DC, ESR, Platelet count.
- Determination of Haemoglobin.
- Determination of PCV.
- Determination of bleeding time.
- Determination of blood clotting time.
- Blood Grouping.
- Preparation of nutrient agar, culture plates and isolation of bacteria on nutrient agar plate.
- Study of permanent slides of Candida albicans, Enterobacter sps, Pseudomonas, Salmonella sps, Shigella sps, Staphylococcus aureus, Streptococcus pyogenes and Vibrio cholera.
- Staining methods – Albert’s and Gram’s staining methods.
- Hepatitis test and Pregnancy test using ELISA
- VDRL qualitative and quantitative test.
- WIDAL slide agglutination and tube agglutination test.

PRACTICAL - III: PROJECT WORK
Associated with a Clinical Diagnostic Laboratory.

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AP STATE COUNCIL OF HIGHER EDUCATION

ZOOLOGY SYLLABUS FOR CLUSTER ELECTIVE VIII-A: VI SEMESTER

MEDICAL DIAGNOSTICS

Cluster Elective Paper: VIII-A-1

CLINICAL BIOCHEMISTRY

Hours 60 Marks 100

UNIT – I: Basic Medical Laboratory Principles and Procedures: 10 Hours

UNIT – II: Clinical Biochemistry of Carbohydrates, Proteins & Lipids: 20 Hours

UNIT – III: Clinical Biochemistry of Enzymes: 10 Hours

UNIT- IV: Water & Mineral Metabolism and Acid-Base Balance: 10 Hours
UNIT - V: Function Tests: 10 Hours


SUGGESTED READINGS

- Park, K. (2007), Preventive and Social Medicine, B.B. Publishers
- Cheesbrough M., A Laboratory Manual for Rural Tropical Hospitals, A Basis for Training Courses
- Prakash, G. (2012), Lab Manual on Blood Analysis and Medical Diagnostics, S. Chand and Co. Ltd.
I. Answer any FIVE of the following:

1. Draw labeled diagrams wherever necessary
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Max. Marks: 75

II. Answer any FIVE of the following:

9. Draw labeled diagrams wherever necessary

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OR
HAEMATOLOGY

Hours 60
Marks 100

UNIT – I: Laboratory Preparation in Haematology: 10 Hours

UNIT – II: Routine Haematology: 15 Hours

UNIT – III: Haemostasis and Haematological Diseases: 15 Hours

UNIT- IV: Automation in Haematology: 10 Hours

UNIT - V: Immunohaematology and Blood banking: 10 Hours
SUGGESTED READINGS

- Park, K. (2007), Preventive and Social Medicine, B.B. Publishers
- Cheesbrough M., A Laboratory Manual for Rural Tropical Hospitals, A Basis for Training Courses
- Prakash, G. (2012), Lab Manual on Blood Analysis and Medical Diagnostics, S. Chand and Co. Ltd.
I. Answer any FIVE of the following:  
   Draw labeled diagrams wherever necessary  
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II. Answer any FIVE of the following:  
   Draw labeled diagrams wherever necessary  
   9. OR  
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   13. OR  

Max. Marks: 75

Time: 3 hrs
CLINICAL MICROBIOLOGY

Hours 60  Marks 100

UNIT – I: Introduction to Clinical Microbiology:  10 Hours

UNIT – II: Clinical Bacteriology Laboratory & Staining methods:  15 Hours

UNIT – III: Culturing of Microorganisms and Identification of Bacteria:  15 Hours

UNIT- IV: Clinical Mycology and Virology:  10 Hours
Basic morphological classification of clinically important fungi. Parasitic fungi – Superficial Mycoses and Dermatophytes, Subcutaneous Mycoses, Classification based on symptomatology. Some important viruses and related diseases (Measles viruses, Influenza viruses, Rotaviruses, PoliovirusesHerpes viruses, Rabies viruses, Hepatitis viruses. General transmission routes for viruses.
UNIT - V: Diagnostic Serology:  
10 Hours  
Autoimmune diseases. Principles of Serodiagnostic tests - Flocculation test, Agglutination test, Slide agglutination test, Tube agglutination test, Complement test, Micro titration test, Precipitin test and ELISA.

SUGGESTED READINGS
- Park, K. (2007), Preventive and Social Medicine, B.B. Publishers
- Cheesbrough M., A Laboratory Manual for Rural Tropical Hospitals, A Basis for Training Courses
- Prakash, G. (2012), Lab Manual on Blood Analysis and Medical Diagnostics, S. Chand and Co. Ltd.
ZOOLOGY MODEL PAPER FOR VI SEMESTER

ZOOLOGY - PAPER - VIII


CLINICAL MICROBIOLOGY

Time: 3 hrs

Max. Marks: 75

I. Answer any FIVE of the following:
   Draw labeled diagrams wherever necessary

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II. Answer any FIVE of the following:
   Draw labeled diagrams wherever necessary

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OR

5x5=25

5x10=50

Max. Marks: 75
Cluster Elective Paper: VIII-B-1
PRINCIPLES OF AQUACULTURE

Periods: 60
Max. Marks: 100

Unit – I

1.1 Introduction / Basics of Aquaculture

1.1.1 Definition, Significance and History of Aquaculture

1.1.2 Present status of Aquaculture – Global and National scenario

1.1.3 Major cultivable species for aquaculture: freshwater, brackish water and marine.

Unit – II

2.1 Types of Aquaculture

2.1.1 Freshwater, Brackishwater and Marine

2.1.2 Concept of Monoculture, Polyculture, Composite culture, Monosex culture and Integrated fish farming

2.2 Culture systems

2.2.1 Ponds, Raceways, Cages, Pens, Rafts and water recirculating systems

2.3 Culture practices
3.1 Design and construction of aquafarms

3.1.1 Criteria for the selection of site for freshwater and brackish water pond farms

3.1.2 Design and construction of fish and shrimp farms

3.2 Seed resources

3.2.1 Natural seed resources and procurement of seed for stocking: Carp and shrimp

3.3 Nutrition and feeds

4.1 Management of carp culture ponds

4.1.1 Culture of Indian major carps: Pre-stocking management – Dewatering, drying, ploughing/desilting; Predators, weeds and algal blooms and their control, Liming and fertilization; Stocking management – Stocking density and stocking; Post-stocking management – Feeding, water quality, growth and health care; and Harvesting of ponds

5.1 Culture of shrimp (Penaeus monodon or Litopenaeus vannamei)

5.2 Culture of pearl oysters

5.3 Culture of ornamental fishes – Setting up and maintenance of aquarium; and breeding.

REFERENCES BOOKS

6. ICAR. 2006. Hand Book of Fisheries and Aquaculture. ICAR.
12. MPEDA: Handbooks on culture of carp, shrimp, etc.
I. Answer any FIVE of the following:

Draw labeled diagrams wherever necessary

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II. Answer any FIVE of the following:

Draw labeled diagrams wherever necessary

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Cluster Elective Paper: VIII-B-2
AQUACULTURE MANAGEMENT

Periods: 60                                        Max. Marks: 100

Unit – I

1.1 Breeding and Hatchery Management
1.1.1 Bundh Breeding and Induced breeding of carp by Hypophysation; and
use of synthetic hormones
1.1.2 Types of fish hatcheries; Hatchery management of Indian major carps
1.1.3 Breeding and Hatchery management of Penaeus monodon/Litopenaeus vannamei

Unit – II

2.1 Water quality Management
2.1.1 Water quality and soil characteristics suitable for fish and shrimp culture
2.1.2 Identification of oxygen depletion problems and control mechanisms in culture ponds
2.1.4 Liming materials, Organic manures and Inorganic fertilizers commonly used and
their implications in fish ponds

Unit – III

3.1 Feed Management
3.1.1 Live Foods and their role in shrimp larval nutrition.
3.1.2 Supplementary feeds: Principal foods in artificial diets; Types of feeds; Feed
additives and Preservatives; role of probiotics.
3.1.3 Feed formulation and manufacturing; Feed storage

Unit – IV

4.1 Disease Management
4.1.1 Principles of disease diagnosis and health management;
4.1.2 Prophylaxis, Hygiene and Therapy of fish diseases
4.1.3 Etiology, Symptoms, prophylaxis and therapy of common fish diseases in fish ponds
Unit - V

5.1 Economics and Marketing
5.1.1 Principles of aquaculture economics – Capital costs, variable costs, cost-benefit analysis

5.2 Fisheries Extension
5.1.2 Fisheries Training and Education in India; Role of extension in community development.

5.3 Fish Genetics
5.1.3 Gynogenesis, Androgenesis, Polyploidy, Transgenic fish, Cryopreservation of gametes, Production of monosex and sterile fishes and their significance in aquaculture.

REFERENCE BOOKS
7. ICAR. 2006. Handbook of Fisheries and Aquaculture. ICAR.

Daya Publ.
I. Answer any FIVE of the following:

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Draw labeled diagrams wherever necessary

Max. Marks : 25

II. Answer any FIVE of the following:

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Unit – I

1.1 Handling and Principles of fish Preservation

1.1.1 Handling of fresh fish, storage and transport of fresh fish, post mortem changes (rigor mortis and spoilage), spoilage in marine fish and freshwater fish.

1.1.2 Principles of preservation – cleaning, lowering of temperature, rising of temperature, Denudation.

Unit – II

2.1 Methods of fish Preservation

2.1.1 Traditional methods - sun drying, salt curing, pickling and smoking.

2.1.2 Advanced methods – chilling or icing, refrigerated sea water, freezing, canning,

Unit – III

3.1 Processing and preservation of fish and fish by-products

3.1.1 Fish products – fish minced meat, fish meal, fish oil, fish liquid (ensilage), fish protein concentrate, fish chowder, fish cake, fish sauce, fish salads, fish powder, pet food from trash fish, fish manure.

3.1.2 Fish by-products – fish glue, ising glass, chitosan, pearl essence, shark fins, fish leather and fish maws.

Unit – IV

4.1 Sanitation and Quality control

4.2.1 Sanitation in processing plants - Environmental hygiene and Personal hygiene in processing plants.

4.2.2 Quality Control of fish and fishery products – pre-processing control, control during processing and control after processing.
Unit – V

5.1 Quality Assurance, Management and Certification

5.1.1 Seafood Quality Assurance and Systems: Good Manufacturing Practices (GMPs); Good Laboratory Practices (GLPs); Standard Operating Procedures (SOPs); Concept of Hazard Analysis and Critical Control Points (HACCP) in seafood safety.

REFERENCE BOOKS

I. Answer any FIVE of the following:

Draw labeled diagrams wherever necessary

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II. Answer any FIVE of the following:

Draw labeled diagrams wherever necessary

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ZOOLOGY PRACTICALS
SYLLABUS CLUSTER ELECTIVE PAPER: VIII-B
VI SEMESTER
AQUACULTURE

PRACTICAL: I

Periods : 24

Max. Marks : 50

Cultivable fishes
1. Identification and study of important cultivable and edible fishes - Any ten
2. Identification and study of important cultivable and edible crustaceans - Any five
3. Identification and study of common aquarium fishes – Any five
4. General description and recording biometric data of a given fish.

Diseases
1. Identification and study of fish and shrimp diseases - Using specimens / pictures
2. External examination of the diseased fish – diagnostic features and procedure.
3. Autopsy of fish – Examination of the internal organs.
4. Determination of dosages of chemicals and drugs for treating common diseases.

Pond Management
1. Water Quality - Determination of temperature, pH, salinity in the pond water sample;
   Estimation of dissolved oxygen, free carbondioxide, total alkalinity, total hardness, phosphates and nitrates.
3. Identification and study of common zooplankton, aquatic insects and aquatic weeds – Each 5

PRACTICAL - II

Periods : 24

Max. Marks : 50

Nutrition
1. Identification and study of Live food organisms – Any five
2. Formulation and preparation of a balanced fish feed
4. Gut content analysis to study artificial and natural food intake.

Post harvest Technology
1. Evaluation of fish/ fishery products for organoleptic, chemical and microbial quality.
3. Preparation of isinglass, collagen and chitosan from shrimp and crab shell.

PRACTICAL - III

Project Work
Visit to a fish breeding centre / fish farms and submit a project report
or
Visit to a feed manufacturing unit and submit a project report
or
Visit to a shrimp hatchery / shrimp farms and submit a project report
or
Visit to a shrimp processing unit and submit a project report