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**PG/IVS/ZOO/403(A<sub>1</sub>,A<sub>2</sub>,B<sub>1</sub>,B<sub>2</sub>,  
C<sub>1</sub>,C<sub>2</sub>,D<sub>1</sub>,D<sub>2</sub>)/25**

**M.Sc. 4th Semester Examination, 2025**

**ZOOLOGY**

**PAPER — ZOO-403(A<sub>1</sub>,A<sub>2</sub>,B<sub>1</sub>,B<sub>2</sub>,C<sub>1</sub>,C<sub>2</sub>,D<sub>1</sub>,D<sub>2</sub>)**

*Full Marks : 50*

*Time : 2 hours*

**Answer all questions**

*The figures in the right hand margin indicate marks*

*Candidates are required to give their answers in  
their own words as far as practicable*

**Spl. Paper : Fishery**

**PAPER — ZOO-403 A.1**

*( Aquaculture and Fish Technology )*

**[ Marks : 20 ]**

**1. Answer the following questions (any two):**  
2 × 2

*( Turn Over )*

( 2 )

- (a) Mention the Key features of super intensive aquaculture.
- (b) Briefly mention the basic characteristics of a nursery pond.
- (c) State the potential innovations in integrated fish farming of rural Bengal.
- (d) Write a note on : Weed Fishes and their uses.

2. Answer the following questions (any two): 4 × 2

- (a) How many larval stages are available in prawn culture system and mention their food habits ?
- (b) What is the importance of fishery in employment generation ? Mention different marketing channels used for fish marketing in India.

( 3 )

(c) Discuss on the dietary essential nutrients in fish.

(d) Write notes on : 2 + 2

(i) Application of AI-in aquaculture.

(ii) Fish-Biproducts

3. Answer the following question (any one) :  $8 \times 1$

(a) Discuss the basic components of a modern hatchery system in India.

Write a note on sympathetic breeding of Fishes.

6 + 2

(b) Answer the following : 2 × 4

(i) Cage culture

(ii) Fish transport

(iii) Crab fattening

(iv) Parental care of fishes.

( 4 )

**PAPER – ZOO-403 A.2**

( *Limnology and Oceanography* )

[ **Marks : 20** ]

4. Answer the following questions (any two) :  $2 \times 2$
- (a) What is Estuary ? Cite two examples.
  - (b) Differentiate between 'Oligotrophic' and 'eutrophic' lakes.
  - (c) Mention the names of export products which are originate from marine resources.
  - (d) What are the major cause for marine pollution ?
5. Answer the following questions (any two) :  $4 \times 2$
- (a) Discuss the major steps for a newly developed reservior and mention the demerits of 'Reservior fisheries' ?  $2 + 2$
  - (b) State the chronological steps for RS-system and highlight its role in aquaculture.  $3 + 1$

( 5 )

(c) Estuary is a productive bed for capture fishery' – Justify. 4

(d) Why shellfish fishery is a noted site for aquaculture practice in india. 4

6. Answer the following question (any one) :  $8 \times 1$

(a) Discuss the different aspects of the origin of Lake. Write note on : Oil spillages.  $6 + 2$

(b) Write notes on (any four) :  $2 \times 4$

(i) Cryopreservation of fish milt

(ii) Potential Fishing Zone

(iii) EEZ of India

(iv) Marine Zomations

(v) Oxidative Ponds.

[ Internal Assessment – 10 Marks ]

( 6 )

**Spl. Paper : Ecology**

**PAPER – ZOO-403 B.1**

*( System Ecology )*

**[ Marks : 20 ]**

1. Answer any *two* questions from the following :

2 × 2

- (a) Distinguish between reclamation and rehabilitation in relation to ecological restoration.
- (b) How does Niche Stratification occur in a tropical rainforest ?
- (c) What is sustainability and how does it relate to Ecological Economics ?
- (d) Explain 'rescue effect' as a part of the metapopulation dynamics.

2. Answer any *two* questions from the following :

(a) Enlist the activities of an ideal ecotourist-  
specifying the do's and don'ts. Cite  
some examples of ecotourism sites in  
India. 4 × 2  
3 + 1

(b) (i) What are the necessary conditions  
for the term 'metapopulation' to be  
applicable to a system of local popula-  
tion ?

(ii) How can corridors act as useful  
conservation tools ? 2 + 2

(c) Discuss various hypotheses explaining  
why some areas have high species  
diversity as compared to others.

(d) How can measurement of Alpha, Beta  
and Gamma diversity be done ?

3. Answer any *one* question from the following :

8 × 1

(a) (i) Elaborate the forms of provisioning, regulating, supporting and cultural services that constitute the ecosystem services.

(ii) Compare and contrast random, uniform, and clumped spatial distribution patterns with suitable ecological examples.

6 + 2

(b) Write short notes on any *four* of the following :

2 × 4

(i) Steps of restoration

(ii) Landscape vs. Patch

(iii) Types of metapopulations

(iv) Deterministic vs. Stochastic models

(v) Different levels of Habitat fragmentation

(vi) Benthic vs. Pelagic zone.

**PAPER – ZOO-403 B.2**

( *Human Ecology* )

[ **Marks : 20** ]

4. Answer any *two* of the following questions : 2 × 2
- (a) Outline the origin and effects of 'photochemical Smog'.
  - (b) What is Extramural transportation of BMW.
  - (c) What are the primary objectives of watershed management.
  - (d) Mention two major impacts of urbanization on biodiversity.
5. Answer any *two* of the following questions : 4 × 2
- (a) What is ozone depletion ? Explain major causes and effects of ozone depletion.

- (b) What is desertification Enumerate the causes and effects of desertification. 2 + 2
- (c) Outline the methods for restoring land that has experienced land degradation? 4
- (d) Discuss about the origin of the various agro-wastes and their key impact on the environment. 4

6. Answer any *one* of the following question :

- (a) How do you classify biomedical wastes.  $8 \times 1$   
Illustrates the colour coding system for segregating biomedical waste. 3 + 5
- (b) What is EIA ? Mention different steps in EIA. What are the criteria for the selection of plant species for creating Green Belt around industries? 2 + 3 + 3

[ Internal Assessment — 10 Marks ]

**Spl. Paper : *Genetics and Molecular Biology***

**PAPER – ZOO-403 C.1**

*( Applied Genetics and Human Diseases )*

[ Marks : 20 ]

1. Answer any *two* questions from the following :

- (a) What is the Protospacer Adjacent Motif (PAM) ? 2 × 2
- (b) How can we identify positive colonies following transformation ?
- (c) What do you mean by the melting curve in qPCR ?
- (d) What is the process for adding two distinct restriction sites to the ends of a PCR product ?

2. Answer any *two* questions from the following :

4 × 2

(a) Explain how the TaqMan probe works and highlight its differences from the SYBR Green probe.

2 + 2

(b) Why does the genomic lac Z gene interfere with the detection during T-A cloning ? In what ways is TOPO cloning different from T-A cloning ?

2 + 2

(c) What is the role of the 'Chi site' ? How can sgRNA be used in CRISPR-mediated genome editing ?

2 + 2

(d) State the function of the following components in an expression vector :

(i) HIS tags, (ii) Enterokinase site,  
(iii) RBS, (iv) Lac operator.

1 × 4

3. Answer any *one* question from the following : 8 × 1
- (a) Illustrate the solid and liquid phases of the pyrosequencing method. Write a note on Next Generation DNA sequencing. 5 + 3
- (b) Provide a schematic representation of CRISPR-Cas9-mediated immunity acquired in bacteria. How do non-homologous end joining (NHEJ) and homology-directed repair (HDR) differ ? 6 + 2

**PAPER – ZOO-403 C.2**

( *Applied Genetics* )

[ **Marks : 20** ]

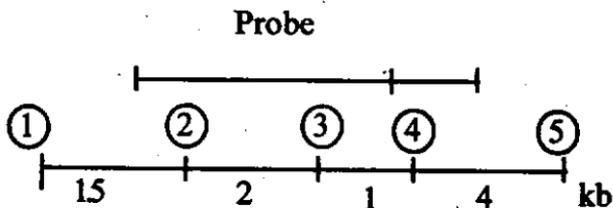
4. Answer any *two* questions from the following : 2 × 2
- (a) What is class switch recombination ?

- (b) Why a VH segment can not join directly with a JH segment in heavy chain gene rearrangement ?
- (c) Briefly explain the role of RAG-1 and RAG-2 proteins in V(D)J recombination.
- (d) What is meant by "positional cloning" in the context of the Human Genome Initiative ?

5. Answer any *two* questions from the following :

- (a) What is CpG suppression ? Why CpG island is significant to find out the genetic disease from genome ?  $4 \times 2$
- (b) Narrate the process of K light chain receptor editing with suitable diagram.
- (c) Describe the multigene organization of immunoglobulin (Ig) genes. How does this organization contribute to antibody diversity ?  $2 + 2$

(d) Here is the physical map of a region of DNA you are mapping by RFLP analysis



The distance between Pst I sites given. 5 restriction sites found. You cut DNA from different individuals with Pst I, electrophorese the fragments, blot them to a membrane and hybridize the blot to the labelled probe

Haplo type	Polymorphic site 3	Polymorphic site 4
A	Present	Present
B	Present	Absent
C	Absent	Present
D	Absent	Absent

Draw a picture of what the block will look like when DNA comes from individual homozygous for haplotypes.

6. Answer any *one* question from the following :

(a) (i) Write briefly on three useful markers to human genome mappers.  $8 \times 1$  4

(ii) Discuss two significant challenges encountered or insights gained from studying and comparing genomic sequences as part of the Human Genome Initiative. 2 + 2

(b) Give details of differential expression of secreted and membrane bound forms of immunoglobulin  $\mu$  chain of TCR regulated by alternative RNA processing. 8

**[ Internal Assessment – 10 Marks ]**

**Sp. Paper : Parasitology**

**PAPER — ZOO-403 D.1**

*( Vector Biology and Vector Borne Parasites )*

**[ Marks : 20 ]**

1. Answer any *two* questions from the following :

2 × 2

(a) (i) Write the scientific name of American cattle tick and Tropical fowl mite.

(ii) What is hypostome ?

1 + 1

(b) Illustrate the differences between Plumose and Pilose type of antennae in insects.

(c) Citing suitable examples, explain the Hemimetabolous and Holometabolous metamorphosis.

(d) What is Papatasi fever ?

2. Answer any *two* questions from the following :  $4 \times 2$

(a) Elaborate the gonotrophic cycle of a female mosquito ? Comment on the factors that influences the gonotrophic cycle.  $2 + 2$

(b) Distinguish between Hard tick and soft tick with examples and medical importance.

(c) What is myiasis ? Provide an outline of varied types of myiasis.  $1 + 3$

(d) (i) Discuss about the impact of climate change on mosquito Borne Diseases.

(ii) Comment on Pernicious malaria.  $2 + 2$

3. Answer any *one* question from the following :  $8 \times 1$

(a) Describe the life cycle, clinical features and prophylaxis of *Leishmania* sp.  $5 + 2 + 1$

(b) Write notes on any *two* of the following :  $4 \times 2$

(i) Maggot Debridement Therapy (MDT)

(ii) Trench fever

(iii) Jumping mechanism of flea

(iv) Pathogenicity of lymphatic filariasis.

**PAPER – ZOO-403 D.2**

*(Molecular Diagnosis and Clinical Parasitology)*

[ Marks : 20 ]

4. Answer any *two* questions from the following :

2 × 2

(a) Name the substrates used for alkaline phosphatase and horse radish peroxidase in ELISA.

(b) Which specific information about antigen can be obtained by ELISA and immunofluorescence assay (IFA) ?

(c) What are trachyzoites and bradyzoites ?

(d) Name the enzymes used for 3' and 5' end labeling of DNA.

5. Answer any *two* questions from the following :

4 × 2

(a) Discuss briefly about the anatomical and physiological adaptations of trematodes. 4

(b) What is counter current immune electrophoresis and how it is performed to analyze antigen-antibody interaction ? 1 + 3

(c) How DNA is labelled radioactively by random priming method ? How unincorporated nucleotides are removed from the reaction mixture at the end of DNA labelling. 3 + 1

(d) What is complement ? How complement fixation assay is performed to detect presence of antibody in blood against a parasite antigen. 1 + 3

6. Answer any *one* questions from the following :

(a) (i) Draw and label a typical configuration of lateral flow immunoassay strip and explain how it is used to detect antigen in a test sample.  $8 \times 1$

(ii) How biotinylated and digoxigenin labelled DNA probe are detected ?

(b) Describe the life cycle, pathogenicity and prophylaxis of *Hymenolepis nana*.  $4 + 4$

$5 + 2 + 1$

**[ Internal Assessment – 10 Marks ]**

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