

**JHARGRAM RAJ COLLEGE**  
**M.Sc. Semester-I Examination, 2021**  
**ZOOLOGY**  
Paper-ZOO 101

Time- 2 hours

**Use Separate Scripts for Each Group**

Full Marks- 40

*Each question carries EQUAL mark*  
*Candidates are required to give their answers in their own words as far as practicable*

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**ZOO 101.1**

**(Non chordate)**

Answer **any two** questions

1. Give an account of characteristic features, biology & ecological role of Foraminifera. 4+3+3
2. What is lorica in rotifera? Give an account of reproduction in rotifera with special reference to amictic & mictic forms. What is cyclomorphosis? 2+6+2
3. How many feeding guilds are there in free-living nematodes? Comment on the role of free-living nematodes in freshwater ecology. 2+8
4. Distinguish between phylactolaemata & gymnolaemata with example. State the functional importance of ascus. Comment on the phylogenetic relation of bryozoa stating its affinity to phoronida & brachiopoda. 3+3+4
5. Give a brief structural account of trochophore larva of annelida with labelled sketches. Write a note on monophyletic & polyphyletic origin of metazoa. 6+4

**ZOO 101.2**

**(Chordate)**

Answer **any two** questions

6. Describe the structure of endostyle of any protochordate studied by you with necessary diagram and comment on its functional significance. 5+3+2
7. Discuss the theories of origin of craniates from deuterostome non chordates & lower chordates. Comment on the idea that more than one hominid species existed at the same time developed. 8+2
8. State the importance of combined Bohr and Root effect along with counter-current mechanism in the effective functioning of swim bladder. Schematically describe the phylogeny of lung. 5+5
9. Diagrammatically describe different steps of the double pumping mechanism of bony fish respiration. How do pathways in the auditory system give rise to neurons that are sensitive to pulse-echo delays? 4+6
10. Why moustached bat also produces an FM sound at the end of the CF component? Write notes on Archinephros and Mesonephros. 6+4

**JHARGRAM RAJ COLLEGE**  
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Paper-ZOO 102

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Full Marks- 40

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**ZOO 102.1**

**(Histochemistry)**

Answer **any two** questions

1. Classify fixatives based on chemical nature with one example and its chemical composition. Describe different factors which can affect the tissue fixation procedure. 5+5
2. Write notes on clearing and impregnation in respect to tissue processing for microtomy. How can you rapidly process small biopsy sample for urgent work? 4+4+2
3. Describe polychromasia with proper example. Define mordant, accentuator and accelerator. 4+6
4. What are the four main types of histochemical reactions used in EHC? Describe with proper diagram. Where can you use EHC for diagnostic purpose in modern days? 8+2
5. Why do samples need to be treated with hydrogen peroxide prior to staining with horseradish peroxidase? What are the types of enzyme-based detection systems of IHC? Which one is best and why? 4+3+3

**ZOO 102.2**

**(Animal Physiology)**

Answer **any two** questions

6. What is haemodynamic compromise? Distinguish between myogenic and neurogenic heart with example. 'Very slight changes in diameter of a vessel can change its- conductance' establish the statement with proper explanation. 3+2+5
7. State the significance of Oxygen- Haemoglobin dissociation curve. Briefly discuss the steps of Haemostasis. What is Respiratory Burst? Write a note on the physiological source of free radicals. 2+3+2+3
8. Why arterial repolarization is not seen in normal ECG? Describe the ionic basis of the action potentials of Atria with proper diagram. Discuss briefly the effect of autonomic nervous system on heart rate. 1+(3.5+1.5) +(2+2)
9. Define: Torpor. What is Bergman's rule? State the role of rete mirabile in thermoregulation. Show the consequence of thermoregulation on metabolism in light of the concept of Thermal Neutral Zone. 1+2+3+4
10. Define: Enantiostasis. Write a note on the factors of the internal environment that can be regulated by homeostasis. Draw the general components of a negative feedback control system in sequential manner and elaborate with a suitable example. 2+3+5

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**M.Sc. Semester-I Examination, 2021**  
**ZOOLOGY**  
Paper-ZOO 103

Time- 2 hours

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Full Marks- 40

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**ZOO 103.1**

**(Immunology)**

Answer **any two** questions

1. With suitable diagram briefly describe the alternative pathway of complement activation. What are the functions of complement system? 7+3
2. What is Antibody-dependent cellular cytotoxicity. How opsonization induced phagocytosis neutralize microbial toxins? 4+6
3. Describe the mechanism of antigen processing and presentation by a virally-infected cell to a CD8+ cytotoxic T cell. Use suitable diagram to illustrate your answer. 10
4. Describe the detailed mechanism of differentiation and function of cytotoxic T- lymphocytes. 5+5
5. Write a short note on mucosal immunity. With diagram describe how do you differentiate between T<sub>H</sub>1 and T<sub>H</sub>2 cells from the aspect of surface phenotype and function. 5+5

**ZOO 103.2**

**(Methods in Biology)**

Answer **any two** questions

6. An aliquot of template DNA containing  $5 \times 10^5$  copies of a target gene is placed into a PCR reaction. The reaction has a mean efficiency of 80%. How many cycles are required to produce  $2 \times 10^{10}$  copies? Briefly explain the process of qPCR using TaqMan probe. 4+6
7. What are the function of stacking gel and resolving gel in discontinuous gel electrophoresis? State two limitations of SDS PAGE. Define isotachopheresis. What is electrophoretic mobility? 4+2+2+2
8. Comment on any two cryoprotecting agents used in cryopreservation. Compare between slow freezing and vitrification procedure used in cryofreezing. 5+5
9. Briefly explain different types on in-situ bioremediation techniques. 'Bioremediation is a triple-corners process'- explain. 6+4
10. What is Klenow polymerase? Comment on different types of restriction endonuclease. What do you mean by phytoextraction efficiency and how it is calculated? 2+5+3

**JHARGRAM RAJ COLLEGE**  
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**ZOOLOGY**  
Paper-ZOO 104

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**ZOO 104.1**

**(Cell Biology)**

Answer **any two** questions

1. What is the importance of fatty acid unsaturation for membrane fluidity? Why is membrane fluidity important to a cell? Explain that the proteins of a membrane are distributed asymmetrically. Write a short note on different phospholipids present on membrane. 2+2+2+4
2. What is PCM? State the mechanism of microtubule nucleation in brief. What do you mean by dynamic instability? What is the role of GTP in the assembly of microtubule? 2+4+2+2
3. How does RER differ structurally as well as functionally from SER? What is SRP? What is the role of dolichol phosphate in the synthesis of membrane glycoproteins? Contrast the roles of COPI- and COPII-coated vesicles in protein trafficking. 3+2+2+3
4. Distinguish between hemidesmosome and desmosome. How does the active and inactive conformation of integrin differ from each other structurally and functionally? State the significance of RGD motif present on integrin ligand. State the function of tight junction. 2+4+2+2
5. How does insulin work in cell signaling? What are the MAPK signaling components? 8+2

**ZOO 104.2**

**(Cytogenetics)**

Answer **any two** questions

6. (a) "The fate of the  $\lambda$  *dgal* and  $\lambda$  *dbio* DNA molecules after their injection into new host cells will depend on which  $\lambda$  genes are missing" – elaborate the statement with proper justification.  
(b) In a transformation experiment, donor DNA from a+ b+ strain was used to transform a recipient strain of genotype a b. The transformed classes were isolated & their frequencies determined to be

Class	Genotype	No. of Transformants
1	a+ b+	307
2	a+ b	215
3	a b+	278

What is the frequency with which the b locus is cotransformed with the a locus?

6+4

7. (a) How did Benzer establish that intragenic recombination occurred within rII locus of T<sub>4</sub> bacteriophage?  
 (b) Five deletion mutations within the B cistron of the rII region of phage T<sub>4</sub> were tested in all pairwise combinations for wild type recombinants. In the following table of results, + = recombination, 0 = no recombination. Construct topological map for these deletions. 6+4

	1	2	3	4	5
1	0	+	+	0	0
2		0	+	0	+
3			0	+	0
4				0	0
5					0

8. Suppose a population starts out with 5,000 AA individuals, 10,000 Aa, and 5,000 aa.  
 (i) What is the frequency of A? Is this population in Hardy-Weinberg?  
 (ii) Suppose all aa individuals die before reproducing, while (on average) AA and Aa individuals leave the same number of offspring. What will be the fitness of these three genotypes?  
 (iii) Following selection, what fraction of the surviving adults are AA, Aa, & aa? What is the frequency of a?  
 (iv) If these surviving adults mate at random, what is the frequency of aa in the next generation (before selection acts). 10

9. (a) How does F' differs from F factor?  
 (b) What is Hfr lysates?  
 (c) Suppose a researcher conjugated six different Hfr strains that were thr<sup>+</sup> leu<sup>+</sup> ton<sup>s</sup> str<sup>r</sup> azi<sup>s</sup> lac<sup>+</sup> gal<sup>+</sup> pro<sup>+</sup> met<sup>+</sup> to an F<sup>-</sup> strain that was thr<sup>-</sup> leu<sup>-</sup> ton<sup>r</sup> str<sup>s</sup> azi<sup>r</sup> lac<sup>-</sup> gal<sup>-</sup> pro<sup>-</sup> met<sup>-</sup>, and obtained the following results:

Strain	Order of Gene Transfer
1	ton <sup>s</sup> azi <sup>s</sup> leu <sup>+</sup> thr <sup>+</sup> met <sup>+</sup> str <sup>r</sup> gal <sup>+</sup> lac <sup>+</sup> pro <sup>+</sup>
2	leu <sup>+</sup> azi <sup>s</sup> ton <sup>s</sup> pro <sup>+</sup> lac <sup>+</sup> gal <sup>+</sup> str <sup>r</sup> met <sup>+</sup> thr <sup>+</sup>
3	lac <sup>+</sup> gal <sup>+</sup> str <sup>r</sup> met <sup>+</sup> thr <sup>+</sup> Leu <sup>+</sup> azi <sup>s</sup> ton <sup>s</sup> pro <sup>+</sup>
4	leu <sup>+</sup> thr <sup>+</sup> met <sup>+</sup> str <sup>r</sup> gal <sup>+</sup> lac <sup>+</sup> pro <sup>+</sup> ton <sup>s</sup> azi <sup>s</sup>
5	ton <sup>s</sup> pro <sup>+</sup> lac <sup>+</sup> gal <sup>+</sup> str <sup>r</sup> met <sup>+</sup> thr <sup>+</sup> leu <sup>+</sup> azi <sup>s</sup>
6	met <sup>+</sup> str <sup>r</sup> gal <sup>+</sup> lac <sup>+</sup> pro <sup>+</sup> ton <sup>s</sup> azi <sup>s</sup> leu <sup>+</sup> thr <sup>+</sup>

Draw a circular map of the *E. coli* chromosome that shows the locations and orientations of the origin of transfer in these six Hfr strains. 3+2+5

10. (a) Write a note on the genome organization of Rous sarcoma virus with appropriate diagram  
 (b) Co-transduction of genes leu<sup>+</sup> and trp<sup>+</sup> to recipient leu<sup>-</sup> trp<sup>-</sup> cells produced the following transductants:

Class	Genotype	No. of Tranductants
1	leu <sup>+</sup> trp <sup>+</sup>	369
2	leu <sup>-</sup> trp <sup>+</sup>	31
3	leu <sup>+</sup> trp <sup>-</sup>	46

Calculate the map distance between leu and trp. 6+4

**JHARGRAM RAJ COLLEGE**  
**M.Sc. Semester II Examination, 2021**  
**ZOOLOGY**  
**Paper- ZOO 201**

Time- 2 hour

**Use separate scripts for each unit**

Full Marks- 40

*The figures in the right hand margin indicate marks  
Candidates are required to give their answers in their own words as far as practicable*

**Unit I: ZOO 201.1**

(Biosystematics)

Answer **any two** questions

1. Write a detail note on biological species concept. Describe the mounting and preservation for the order Hymenoptera. 6+4
2. Write notes on principle of co-ordination and principal of homonymy in respect to binomial nomenclature. 5+5
3. Define clade. Where is the conflict between phenetic and cladistic schools? Why parsimony is important in constructing a 'cladogram'? Discuss the 'Out group Method' in taxonomy. (1+3)+2+4
4. Write down the principle of DNA barcoding for species identification. Write a note on Micro-Complement Fixation and its use in molecular systematic. 6+4

**Unit II: ZOO 201.2**

(Ecological Principles)

Answer **any two** questions

5. Define a cybernetic system. Discuss how stability of an ecosystem is maintained through feedback control & redundancy of components. What are resistance & resilience stability? 2+6+2
6. State the differences of WPC and BPC of niche width and comment on the effect of the nature of resource on utilization. Discuss different types of resource partitioning with examples. Add a note on character displacement. (3+1)+3+3
7. Explain the dynamics of prey predator system through Lotka Volterra model. Diagrammatically explain the situation with respect to prey & predator isoclines. 6+4
8. What are altruism & reciprocal altruism? What are the features of Hamilton's rule? Comment on Prisoner's dilemma to explain Hamilton's rule. 4+3+3

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**ZOOLOGY**  
**Paper- ZOO 202**

Time- 2 hour

**Use separate scripts for each unit**

Full Marks- 40

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**Unit I: ZOO 202.1**

(Biophysics)

Answer **any two** questions

1. Differentiate between dark field & light field microscopy. Write a short note on fluorescence microscopy & phase contrast microscopy. 2+4+4
2. 'Diffusion depends on mean molecular velocity'- explain. Write a short note on Gibbs Adsorption equation. 5+5
3. Establish the concept of viscosity in dynamics of circulation applying Hagen-Poiseuille's equation. "Viscosity in the capillaries is less than other vessels"- explain the statement with proper justification. Compare laminar flow with turbulent flow. 5+3+2
4. State the first and second laws of thermodynamics. Prove that free energy change must be negative for a process to take place spontaneously. 5+5

**Unit II: ZOO 202.2**

(Biochemistry)

Answer **any two** questions

5. Why the person having G6PD deficiency should not eat Fava Bean or should not treat with primaquine drug? State the role of ATP and  $Ca^{2+}$  in citric acid cycle regulation. 5+5
6. Briefly describe the mechanism of competitive and uncompetitive mode of enzyme inhibition with Lineweaver Burk Plot. What do you mean by allosteric modification in enzyme action? Give examples. 6+4
7. Why peptide bond is called quasi-double bond structure? Show with suitable diagrams how Ramachandran plot is utilized in determining secondary structure of proteins in reference to amino acids Glycine and Proline. 2+ (4+4)
8. Define redox potential. How one can measure redox potential of a redox couple? State the significance of Aspartate-argininosuccinate shunt in amino acid catabolism. 1+4+5

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**ZOOLOGY**  
**Paper- ZOO 203**

Time- 2 hour

**Use separate scripts for each unit**

Full Marks- 40

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**Unit I: ZOO 203.1**

(Molecular Biology)

Answer any two questions

1. Explain the role of carboxy terminal domain (CTD) of RNA Pol II. What are the general transcription factors (GTFs)? State how RNA Pol II and GTFs are assembled at the transcription initiation site to form pre-initiation complex. 3+(2+5)
2. What is Kozak sequence? What is translational coupling phenomenon? State the mechanism by which high accuracy of aminoacyl-tRNA synthetases are maintained during charging of tRNA. How do release factors recognize stop codons? 2+2+3+3
3. Write a short note on 'Shelterin complex'. Name an antibiotic that blocks DNA replication and how? How does DNA polymerase discriminate between dNTPs from rNTPs? What is licensing of DNA replication? 3+2+3+2
4. Explain how does the cellular concentration of tryptophan regulates the tryptophan operon? You have given a strain of *E. coli* with  $F' I^+ P^+ O^C Z^- / I^+ P^+ O^+ Z^+$  genotype, predict whether  $\beta$ -galactosidase will be produced in absence of glucose (a) if lactose is absent from the growth medium (b) if lactose is present in the growth medium. 7+3

**Unit II: ZOO 203.2**

(Parasitology)

Answer any two questions

5. What is zoonosis? Comment on the Amastigote and Promastigote form of *Leishmania*. Add a short note on its biology. 2+4+4
6. Describe any of the two strategy taken by parasite to avoid the host immune response. Write a short note on Phoresy and Parasitoid. 6+4
7. Describe the detailed mechanism of host immune response against helminth parasite. 10
8. Write down the life cycle of *Plasmodium falciparum*. What causes *Plasmodium falciparum* infected RBCs to adhere to vascular endothelium? What is the importance of Maurer's Cleft? 6+3+1

**JHARGRAM RAJ COLLEGE**  
**M.Sc. Semester II Examination, 2021**  
**ZOOLOGY**  
Paper C-ZOO 204

Time- 2 hour

**Use separate scripts for each unit**

Full Marks- 40

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**Unit I : C-ZOO 204.1**  
(Wildlife & Environmental Management)  
Answer **any two** questions

1. Define wildlife. Mention the objectives of wildlife conservation. What are the changing trends in contrast to the classical idea about wildlife conservation in current scenario?  
2+4+4
2. What do you mean by “threatened species”? Mention the IUCN categories (version 3.1) regarding threatened species with features & examples. What are the main aims of CITES?  
2+6+2
3. State two salient features of Asiatic Elephant conservation initiatives. What are nodes and corridors? State any four causes for depletion of tiger population. What is capture (mark) and recapture method?  
2+2+4+2
4. State the principles of PRA method. What is pollution? What are the point & non point source of pollutants? What is radio collar & why it is used?  
3+1+2+4

**Unit II: C-ZOO 204.2**  
(Aquainformatics)  
Answer **any two** questions

5. Discuss about research focus and research initiative on climate change impacts upon fish resource in Indian Sundarbans.  
10
6. Write four important component technologies of aquainformatics or aquaculture information based tool.  
10
7. Give four important principles & applications of remote sensing technology on aquaculture.  
10
8. Write importants of a) e-Journal b) e-books c) MIS in fishery d) Geoinformatics in aquaculture.  
2.5 × 4

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JHARGRAM RAJ COLLEGE  
M.Sc. Semester-III Examination, 2021  
ZOOLOGY  
Paper-ZOO 301

Time- 2 hours

Use Separate Scripts for Each Group

Full Marks- 40

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**ZOO 301.1**  
**(Basic and Applied Entomology)**  
Answer any two questions

1. State the significance of extra-oral digestion. Enumerate the structure of Peritrophic matrix with suitable diagram. Mention the function of it. 2+6+2
2. Describe the life cycle of the pest *Callosobruchus chinensis* in brief. Mention the nature of damages it causes. 7+3
3. What is diapause? Give a brief account of the stages of insect diapause. How do the insects meet up the energy budget required to pass the period of diapause? 2+4+4
4. What are allelochemicals? How does it differ from pheromones? Write a short note on sex pheromones with suitable example. What are allomones? 1+2+5+2
5. Mention the differences between prognathous and hypognathous type of mouthparts. Name the major sutures present on insect head. Enumerate the structure and function of antenna in brief. 2+2+6

**ZOO 301.2**  
**(Ecotoxicology)**  
Answer any two questions

6. Write a short note on different biomarkers while determining hypersensitivity response in an organism in response to a toxicant. What kind of immunotoxic effects will be found in a person suffering from Arsenic toxicity. 6+4
7. Write four essential properties of a good chelating agents. Comment on endogenous complexing and detoxification compounds that plays important roles on metal detoxification in an organism. 2+8
8. What do you mean by Environmental bioavailability and Toxicological bioavailability of a toxicant for aquatic organism? Comment on “how route of exposure determines the toxicity for an aquatic organism”? 5+5
9. Briefly explain different types of Phase I biotransformation reactions. 10
10. What is Metabolic toxin? What is basic difference between poison and venom? What do you mean by toxicokinetics and toxicodynamics? Write a note on Botulinum Toxin. 1+1+2+6

JHARGRAM RAJ COLLEGE  
M.Sc. Semester-III Examination, 2021  
ZOOLOGY  
Paper-ZOO 302

Time- 2 hours

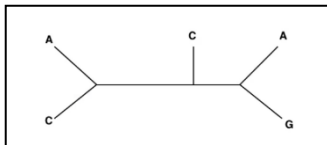
Use Separate Scripts for Each Group

Full Marks- 40

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**ZOO 302.1**  
**(Molecular evolution)**  
Answer **any two** questions

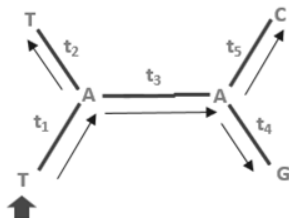
1. What is tree length? Sort-out the length of the given tree using a suitable algorithm. Clearly demonstrate all the steps. 2+8



2. What is tree space? Why exhaustive search is impossible for large number of data set (i.e., taxa)? Explain mathematically. 2+8
3. From the given distance matrix derive the phylogenetic relationship between these 4 taxa using the Neighbour Joining algorithm. 10

	A	B	C	D
A	-	17	21	27
B		-	12	18
C			-	14
D				-

4. What is the maximum likelihood approach of phylogenetic reconstruction? The given tree shows the topology, branch lengths, and other relevant parameters. For now, assume ancestral states were A and start computation at the external node (indicated by wide arrow). Arrows indicate "direction" of computations. Now compute the probability of the given column in the sequence alignment (indicated by black box). 4+6



A	T	G	G	A	T	T	C	A
A	T	G	G	T	T	T	-	A
A	C	G	G	A	T	T	-	A
A	G	G	G	T	T	T	-	A

5. Explain how branch and bound method allows us to apply parsimony method with large data set of taxa? In this context explain the importance of 'local optimum' and 'global optimum'? 6+4



**JHARGRAM RAJ COLLEGE**  
**M.Sc. Semester-III Examination, 2021**  
**ZOOLOGY**  
**Paper-ZOO 303B**  
**Ecology Special Paper**

Time- 2 hours

**Use Separate Scripts for Each Group**

Full Marks- 40

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**ZOO 303B.1**  
**(Biodiversity & Conservation Ecology)**  
Answer **any two** questions

1. What do you mean by species richness & species diversity? How a wilderness area differs from a strict nature reserve? What are conservation & community reserve? Comment on the criteria that makes a species to be considered as a good bioindicator. 2+2+2+4
2. State the importance of 'local to global' in evolution of approaches in wildlife conservation. What are the five schedules under Wild life protection act 1972? Define social forestry. State the role of non-wood forest product in JFM. What is Arabari model? 2+2.5+1.5+2+2
3. Write short notes on biodiversity profile, threats & ecosystem restoration measure of river Ganga. What are the initiatives to conserve the Bengal tiger? What is vulture restaurant? 6+2+2
4. What are IBA & EBA? What are the criteria of IBA? Comment on wetland bird interaction. State the threats of the vultures in India. 2+3+3+2
5. What is telemetry? State the importance of radio collar. Write a note on GPS & its role in habitat & wildlife conservation. 2+3+5

**ZOO 303B.2**  
**(Aquatic ecology)**

Answer **any two** questions

6. What do you mean by water foot print & virtual water? Explain "lake effect snow fall". Discuss the factors affecting surface run off. 3+4+3
7. State the importance of NRCP in river conservation strategy. State the role of zooplanktons as water quality indicator of fresh water ecosystem. What is the objective of sewage treatment plant? What do you mean by secondary treatment? 2+3+2+3
8. Comment on extent & zonation of marine ecosystem with special reference to ocean zones & continental margins. What is the effect of human interaction to shoreline? Which ecosystem is called "natural laboratory" for studying intertidal ecology and other biological processes & why? 5+3+2



JHARGRAM RAJ COLLEGE  
M.Sc. Semester-III Examination, 2021  
ZOOLOGY  
Paper-C ZOO 304  
(CBCS)

Time- 2 hours

Use Separate Scripts for Each Group

Full Marks- 40

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**C ZOO 304.1**

**(Genetics)**

Answer **any two** questions

1. Why supercoiled DNA is advantageous over nonsupercoiled DNA? Briefly describe the structure of nucleosome with diagram. Distinguish between constitutive heterochromatin and facultative heterochromatin. 2+(4+2) +2
2. Determine the gene sequence, calculate the map distance & C.O.C from the following data: 2+6+2

Phenotypes	Number
+ b +	104
a b c	180
a + c	109
+ + c	21
a + +	5
+ b c	5
a b +	31
+ + +	191
Total	646

3. How X : A ratio determines the expression of sex-lethal gene during embryogenesis in *Drosophila*? Briefly narrate the role of tra in *Drosophila* sex determination. 5+5
4. In a test cross the no of nonrecombinant progeny is 133 and the no of recombinant progeny is 19. Calculate the recombination frequency in percentage. State the criteria to identify X linked dominant traits. Comment on the different modes of replication. 2+5+3





**JHARGRAM RAJ COLLEGE**  
**M.Sc. Semester-IV Examination, 2021**  
**ZOOLOGY**  
**Paper-ZOO-401**

Time- 2 hours

Full Marks- 40

**Use Separate Scripts for Each Group**

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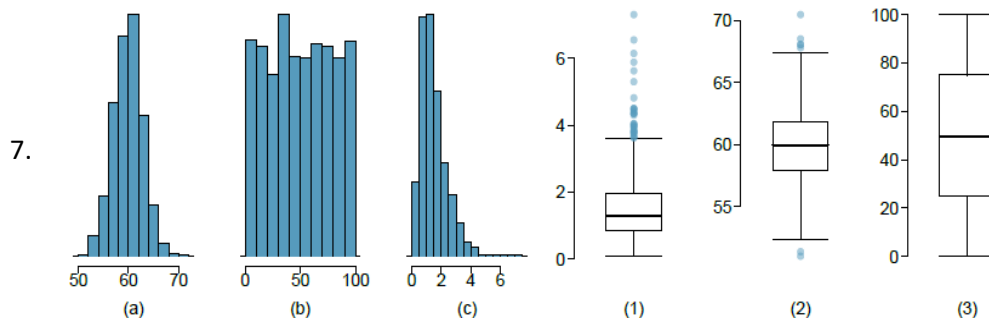
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**Group – A (Unit I: ZOO 401.1)**  
**(Environmental Pollution & Management)**  
Answer any two questions

1. Comment on different biomarkers that are used in molluscs in the practice of biomonitoring. 10
2. Write a short note on Bishnoi movement. Comment on the role of anthropogenic activities in Sundarban mangrove region that promotes bioinvasion. 4+6
3. How acid rain is formed? Discuss about the impact of acid rain on aquatic system. Comment on the “Green-house effect” stating whether it is a blessing or curse for the earth. 2+4+4
4. What is eutrophication? Differentiate between sewage and sludge. Comment on different sources of water pollution. 2+4+4

**Group – B (Unit II: ZOO 401.2)**  
**(Biostatistics)**  
Answer any two questions

5. Differentiate associated and independent variables. What is positive and negative association? What are the two primary types of data collection? Which one you think is superior and why? 3+2+2+3
6. What are robust statistics and why it is called so? Describe the distribution in the histograms below (based on their modality and skewness) and match them to the box plots. (2+2)+(3+3)



7. a) From the given distribution calculate, lower whisker, Q1, median, Q3, IQR, upper whisker and maximum whisker reach. Now draw a box plot from these data.

Data distribution: 3, 5, 6, 7, 20

b) What is anecdotal evidence and how could it affect inferences if not properly handled? 8+2

8. a) Suppose there is a new disease outbreak called VBS (Very Bad Syndrome). Researchers developed a test kit to detect the disease and the kit is going under clinical trial. Carefully follow the bellow sets and represent these sets in a proper Venn diagram to show the false negative and false positive test outcome:

$X$  = set of people in a clinical trial

$S = \{x \in X : x \text{ has VBS}\}$

$H = \{x \in X : x \text{ does not have VBS}\}$

$P = \{x \in X : x \text{ tests positive for VBS}\}$

$N = \{x \in X : x \text{ tests negative for VBS}\}$

b) Sampling randomly helps to resolve Bias. But in practice you can face bias even in simple random sample. What kind of biases can arise in such a situation according to you? Explain in details. 6+4

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**JHARGRAM RAJ COLLEGE**  
**M.Sc. Semester-IV Examination, 2021**  
**ZOOLOGY**  
**Paper-ZOO-402**

Time: 2 hours

**Use Separate Scripts for Each Group**

Full Marks: 40

*Each question carries EQUAL mark*  
*Candidates are required to give their answers in their own words as far as practicable*

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**Group – A (Unit I: ZOO 402.1)**  
**(Developmental Biology)**  
Answer any two questions

1. What is regeneration blastema? Schematically represent the amphibian regeneration with suitable diagram. 2+8
2. Define induction. Why are the dorsal lip cells referred as ‘organizer’? State the functions of organizer. 2+3+5
3. Compare the mechanism of slow block polyspermy between sea urchin and mammals. What is the role of JUNO protein in gamete fusion? 7+3
4. State the role of Calcium ions in fertilization of sea urchin. 10

**Group – B (Unit II: ZOO 402.2)**  
**(Neuroendocrinology)**  
Answer any two questions

5. What is orphan receptor? Write down a comparative account on the mechanism of Type-I and Type-II nuclear receptor signaling mechanism. 2+8
6. Write a short note with diagram on Melatonin synthesis pathway. Discuss the role of pineal gland secretion on reproductive system of seasonal breeding animals and human. 3+7
7. Write a short note on excitatory and inhibitory synapse. Describe the role of  $Ca^{+2}$  in synaptic vesicle fusion and neurotransmitter release. 3+7
8. Briefly describe the role of Tau protein in pathogenesis of Alzheimer’s disease. How this disease can be treated through using selective biomolecule inhibition. 5+5

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**JHARGRAM RAJ COLLEGE**  
**M.Sc. Semester-IV Examination, 2021**  
**ZOOLOGY**  
**Paper-ZOO-403 B**  
**Ecology Special**

Time: 2 hours

**Use Separate Scripts for Each Group**

Full Marks: 40

*Each question carries EQUAL mark*  
*Candidates are required to give their answers in their own words as far as practicable*

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**Group – A (Unit I: ZOO 403B.1)**  
**(Systems Ecology)**

Answer any two questions

1. How the structure of a community is dependent on number of species & number of individuals belonging to each species of a community? What do you mean by dominance in a community and how dominance of a species can be ascertained with the help of relative abundance? State one disadvantage & one advantage of Shannon's index. 4+4+2
2. What are the standards that characterize ecotourism? Mention the provisions required for a successful ecotourism. What are the rationales of ecorestoration? Mention the differences between active & passive ecorestoration. 2+2+3+3
3. What are the habitat services of ecosystem? Comment on the concept of payments for ecosystem service. What do you mean by TEEB? 5+3+2
4. Classify the forest on the basis of canopy area density. Distinguish between natural and man made forest. Name the group where *Heritiera* and *Acasia* belong and write brief notes on those groups. 2+3+5

**Group – B (Unit II: ZOO 403B.2)**  
**(Human Ecology)**

Answer any two questions

5. What is environmental management system? State its two main goals. Discuss the objective, criteria & significance of ecomark. 1+2+(2+3+2)
6. Distinguish between wet & dry forms of acid deposition. Comment on the sources, pathways & ecological effect of acid deposition. 2+(2+2+4)
7. What are different types of agricultural solid wastes? Discuss whether biomedical wastes have any role in spreading Covid 19. Discuss the objectives & drawbacks of EIA. 3+2+(3+2)
8. Write short notes on: Wasteland, Watershed management, Urbanization, Carbon trading 2.5×4

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