

PG QUESTION BANK, ZOOLOGY

PG SEMESTER 2

PAPER	TOPIC	SUGGESTED QUESTIONS
ZCT 208	Structure and Function of Chordates	<ol style="list-style-type: none">1. Describe the fetal circulation in eutherian mammal. What are the changes observed in neonatal circulation? What are the significances of ductus venosus & ductus arteriosus?2. Describe with a help of a suitable diagram the origin of hepatic portal vein from the embryonic sub intestinal vein in shark. How are renal portals formed in fishes?3. Classify structural receptors and functional receptors with examples. What are somatosensory receptors? What do you mean by proprioception?4. Elucidate the types of odor pathways in man. Describe the retronasal pathway in brief. How the odor is processed and perceived?5.a) What criteria have been used to established whether a tissue has an endocrine function. b) What role does mucus play in exocytosis? Explain the rapid expulsion of mucus from vesicles associated with exocytosis. c) Discuss the differences between autocrine, paracrine, neurocrine, and endocrine secretion. What are pheromones? d) What is the significance of having the adrenal medulla and cortex collected together in a single organ? How does the circulatory pattern in the adrenal glands affect the relative secretion of epinephrine and norepinephrine? e) What are the functions of integumentary system? What are the fundamental differences between Osteoblatogenesis and osteoclastogenesis?6. Write the actual position of notochord in the body of <i>Amphioxus</i>. Discuss with diagram the fine structure of notochord in the animal.7. What are the essential features of an animal to be cursorial? Write with necessary diagrams the structural modifications for cursorial adaptation. Give two examples of cursorial adapted vertebrates from class Mammalia.8. Write the characters of an aquatic animal. Write with diagrams the external modifications for efficient locomotion in water. Discuss the internal modifications for the purpose in brief.

		<p>9. 'Evolution of jaws is often traced through how the mandible is attached to the skull'- make an illustrative account to justify the statement.</p> <p>10. Comment on various theories on the origin of jaws.</p> <p>11 Mention the skull components derived from neural crest cells in mammalian foetus with adequate diagram.</p> <p>12. 'In mammals, the splanchnocranium does not contribute to the adult jaws or to their suspension'-justify it.</p>
ZCT 209	Developmental Biology	<p>1. What is blastema? How does neural-derived mitotic factors like GGF affect in regeneration in salamander limb? When performing a <i>Xenopus</i> tadpole tail regeneration assay, should you keep the amputated and non-amputated tadpoles in separate containers? Give reasons behind your answer.</p> <p>2. What is meant by compensatory regeneration? Enlighten on this in case of mammalian liver. What is morphallactic regeneration? Give example.</p> <p>3. Distinguish between head activator gradient and head inhibitor gradient. Mention the role of genetic mutation in limb bud formation in <i>Hydra</i>. What is cytoplasmic determinant?</p> <p>4. What do you mean by regenerative medicine? Describe the role of embryonic stem cell (ESC) in regeneration of tissues and organs with proper diagram. What is Genomic Equivalence?</p> <p>5 What do you mean by Realisator gene? <i>Drosophila</i> axis determination is governed by cluster of gene activity-Justify. What is the importance of Hox gene? Mention the Hox cluster gene in <i>Drosophila</i></p> <p>6. Maternal Bicoid is functional _act both as transcription factor and activator-Justify. Hunchback and caudal has dual function and origin <i>Drosophila</i> embryonic development-Justify What do you mean by Wnt canonical and Non Canonical Pathway</p> <p>7. Describe the roles of gene expression during post embryonic organogenesis and vulval differentiation of <i>C.elegans</i>? What are the steps of vulval development of <i>C.elegans</i>? ---elaborate with diagram.</p>
ZCT 210	Immunology	<p>1.a) "Phenoloxidase activity acts as insect innate immune response against nonimmune pathogen" –Explain.</p> <p>b) What are PAMP ? "TLR recognizes bacterial and viral PAMP in <i>Drosophila</i> sp." –Explain</p> <p>c)What are the defense molecules found in haemocytes of horseshoe crab, cockroach and lamellidens?</p> <p>d) Elucidate the Intracellular killing through generation of ROS and RNS by immunocytes in Mollusca.</p> <p>2.a) How does VDJ recombination and somatic hypermutation give rise to variable region gene in immunoglobulin isomer?</p>

		<p>b) What mechanisms generate the three hypervariable regions (CDR) of immunoglobulin heavy and light chains? Why is the third hypervariable region (CDR3) more variable than the other two (CR1 an CDR2)?</p> <p>c) Describe one advantage and one disadvantage of N-nucleotide addition during the rearrangement of immunoglobulin heavy chain gene segment.</p> <p>3. a) Describe the structure and probable function of the B-cell-coreceptor complex</p> <p>b) Discuss the origin of the competence and progression signals required for activation and proliferation of B cells induced by a) soluble protein antigens b) bacterial LPS.</p> <p>4. Write short note on:</p> <ul style="list-style-type: none"> i) Antimicrobial peptides ii) Missing self model iii) Immunoproteasome iv) Dendritic cell v) Superantigen <p>Q5. a) Illustrate the steps of leukocyte extravasation with proper diagram.</p> <p>b) Describe the role of T helper–2 (Th2) cytokines on various cells in the lung during asthma induced inflammation.</p> <p>c) Describe the role of different inflammatory cells in COPD induced lung damage.</p> <p>Q6. Illustrate host innate immune response upon Covid-19 infection. Comment on the probable therapeutics against this infection.</p> <p>Q7. Describe two signal hypothesis of T cell activation. What is T cell energy? How T cells become anergic?</p>
ZCT 211	Biochemistry and Genetic Engineering	<p>1. What are L- stereoisomers and enantiomers? Schematically describe the hierarchical structures of proteins with examples.</p> <p>2. What are significances of zinc finger motif and helix-loop-helix motif? Structural and functional domains are modules of tertiary structure of proteins- Justify the statement.</p> <p>3. What are the functions of membrane lipids? Name a few of this category. Describe with example the effect of double bonds on the shape of fatty acids.</p> <p>4. What are cerebrocides and gangliosides? State how lipid vesicles can be formed from phospholipids. Membrane fluidity is controlled by fatty acid composition and cholesterol content- Explain.</p> <p>5. What are major physiological roles of fatty acids? Steps in fatty acid degradation and synthesis are mirror image relationship- Justify the statement.</p>

	<p>6. What is restriction modification system? How blue and white bacterial colonies can help in the selection of recombinant DNA molecule? Why are plasmids good vector? What is engineered plasmid?</p> <p>7. What is fosmid? Why do some bacteria survive in culture plate having antibiotics while others can not? How does retroviral vectors promote gene transfer? What is α-peptide?</p> <p>8. What is transgenesis? How does it differ from therapeutic cloning? What is knock-out gene? The presence of functional beta-galactosidase in <i>E.coli</i> can be monitored on the basis of its ability to cleave substrate 5-bromo 4-chloro 3-indolyl beta D galactoside to galactose and 5-bromo-4 chloro -3-indigo - explain the underlying molecular mechanism with RDT experimental design.</p> <p>9. Write down the process of production of transgenic mouse by using ESCs. Give example of some GMOs. Mention the application of genetic engineering in the production of medicines and GM crops.</p> <p>10. State the applicational difference between Northern, Southern and Western blotting.</p> <p>11. What are the applications of FISH?</p> <p>12 How can you use PCR to Identify COVID19 Virus affected patient?</p> <p>13. What are the different types of Micro array? State the application of DNA microarray.</p> <p>14. Define gene therapy. Differentiate between in vivo and ex vivo gene therapy.</p> <p>15 What do you mean by transgene and transgenic cell?</p> <p>16. What is transfection? What is its demerit?</p> <p>17. What is somatic gene therapy? Explain with example.</p> <p>18. Differentiate between somatic cell gene therapy and germ line gene therapy.</p> <p>19. Write the mechanism of in vivo and ex vivo gene therapy.</p> <p>20. Define vector. Mention different types of vectors used in gene therapy.</p> <p>21. Write short notes on:</p> <ol style="list-style-type: none"> Gene gun Micro injection Lipofection Gene augmentation therapy Gene inhibition therapy Lentivirus vector system Herpes simplex virus vector Lipoplexes <p>22. What are the disadvantages of gene therapy?</p> <p>23. What ethical issues are raised in practising gene therapy?</p> <p>24. What is NLX - P101?</p> <p>25. What is monogenic and multifactorial disease? Give</p>
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		<p>example.</p> <p>26. What are the properties of an ideal vector?</p> <p>27. What is Human Artificial Chromosome?</p> <p>28. Define stem cell. Mention the unique properties of stem cell.</p> <p>29. Classify stem cells with example.</p> <p>30. Define pluripotent and unipotent stem cell. Give example.</p> <p>31. Describe the process of development of stem cells.</p> <p>32. What is stem cell therapy? How stem cell therapy is done for leukemia?</p> <p>33. Name two neural disorder where stem cell therapy is successfully done.</p> <p>34. What do you mean by embryonic stem cell? What are the advantages of embryonic stem cells over adult stem cells?</p> <p>35. What do you mean by Hatopietic Stem Cell Transplantation (HSCT)?</p> <p>36. What is micro RNA? Explain the mechanism of biogenesis of micro RNA.</p> <p>36. Explain the mechanism of action of micro RNA.</p> <p>37. What are the challenges for micro RNA therapy?</p> <p>38. What is pharmaco genomics and pharmacogenetics?</p> <p>39. What are the potential opportunities of phaacogenomics?</p> <p>40. What are the factors involved in inter individual variation in drug response?</p> <p>41. How SNPs effect on pharmacogenomics?</p> <p>42. How pharmacogenomics predict the response of a particular drug in a particular patient?</p> <p>43. Explain the effect of cytochrome P450 enzymes on drug metabolism.</p> <p>44. What are the essential measures to be taken for advancement of pharmacogenetics in future?</p> <p>45. What do you mean by personalized medicine?</p> <p>46. Write the principles of pharmacogenetics.</p> <p>47. What are the ethical issues raised in pharmacogenomics?</p>
ZCT 212	Endocrinology	<p>1. Describe the biosynthesis of melatonin. Add a note on rhythmicity in melatonin production</p> <p>2. SCN controls pineal melatonin release through a multisynaptic pathway-Explain.</p> <p>3. Describe neuroendocrine integration of gastric acid secretion State the function of secretin.</p> <p>4. What is General Adaptation Syndrome? Explain the role of cortisol in inflammation.</p> <p>5. Describe the role of insulin in carbohydrate metabolism. Add a note on Hypothalamic nuclei.</p> <p>6. What do you know about Releaser and Primer Effects?</p> <p>7. Write notes on Lee Boot Effect, Whitten effect, Bruce effect.</p>

		<p>8. Write the difference between allomones, kairomones and synomones.</p> <p>9. Write the chemical nature of pheromone and also its application in field.</p>
ZCT 213	Aquatic Biology	<ol style="list-style-type: none"> 1. Describe the ultrastructure of secondary gill lamellae with a suitable diagram. Mention the modification of 'dual pump' into a 'pulse pump' in lungfishes. Enumerate differences between the counter current and cross current mechanisms of gas exchange. 2. What do you mean by 'ventilation-perfusion ratio' with regard to respiration in fish? How spiracles help in aspiratory ventilation in polypterids? Describe briefly the morphological specializations related to Ram ventilation in fish. 3. Describe briefly the development of primordial germ cells (PGC) in fish. Explain salient cytological features of PGCs in sex organs in fish. What do you mean by Gonochoristic species? State its features. 4. What do you mean by Hydrothermal vents and their significance? Diagrammatically mention the food web in hydrothermal vent. What do you mean by Black smoke theory? 5. Comment on Hydrothermal vent Ecology. How are Hydrothermal Vents formed? What are smokestacks and chimneys? Mention the difference between white smokers and Black smokers 6. State the difference between marine and freshwater eutrophication. 7. How biomanipulation can be used as a lake restoration strategy? 8. Write the steps how an invasive insect becomes a pest? Also write the factors for successful Pest eradication 9. State the difference between Bioindicator and Biomarker? 10. Write the Key components of IMP. 11. Write the control Measures following IMP for <i>Pomacea canaliculata</i>. 12. Write note on Immunocontraception, Sterile insect technique. Push Pull Strategy, Phyto remediation, Secondary water treatment, Ecosystem services. 13. What is Maximum Sustainable yield? Explain with formula.
PG QUESTION BANK, ZOOLOGY		
PG SEMESTER 4		

PAPER	TOPIC	SUGGESTED QUESTIONS
ZCT 432	Applied Ecology	<ol style="list-style-type: none"> 1. What do you mean by recalcitrant compound? Give an example where addition of chlorine to a molecule makes it recalcitrant. Distinguish between Bioventing and Bioaugmentation process. Describe the process of Phytoextraction. Name two hyper accumulator plants. 2. Explain the following terms with examples: <ul style="list-style-type: none"> Biosparging Phytoremediation Rhizofiltration Phytodegradation Biopile system 3. Distinguish between ex-situ and in-situ bioremediation. State the advantages and limitations of bioremediation strategies. 4. State the difference between marine and fresh water eutrophication. 5. How biomanipulation can be used as a lake restoration strategy? 6. Write the steps how an invasive insect becomes a pest? Also write the factors for successful pest eradication. 7. State the difference between Bioindicator and Biomarker? 8. Write the Key components of IMP. 9. Write the control Measures following IMP for <i>Pomacea canaliculata</i>. 10. Write note on Immunocontraception, Sterile insect technique, Push Pull Strategy, Phyto remediation, Secondary water treatment, Ecosystem services. 11. What is Maximum Sustainable yield? Explain with formula.
ZCT 433	Evolution	<ol style="list-style-type: none"> 1. (a) What are meant by systematic and dispersive evolutionary processes that bring about changes in gene frequency of a population? <ul style="list-style-type: none"> (b) Expand your idea about fitness and selection coefficient. (c) "Selection against a rare recessive lethal allele is very inefficient and its removal from the population is very slow."- Justify. 2. (a) How does overdominance differ from underdominance? <ul style="list-style-type: none"> (b) Briefly describe the effect of directional selection, overdominance and underdominance selection on the allelic frequencies of a population. (c) What factors affect the rate of change in allelic frequency due to natural selection?

3. In a large, randomly mating population, the frequency of sickle cell recessive allele 's' is 0.028. The results of study have shown that people with the following genotypes at β -chain locus produce the average number of offspring given:

Genotype	Average no of offspring produced
SS	5
Ss	6
ss	0

a) What will be the frequency of sickle cell allele (s) in the next generation?

b) What will be the frequency of 's' at equilibrium?

4. Two chromosomal inversions standard (ST) and Arrowhead (AR) are commonly found in the population of *Drosophila melanogaster*. When treated with the insecticide DDT, the genotypes for these inversions exhibit overdominance, with following fitness:

Genotype	fitness
ST/ST	0.47
ST/AR	1
AR/AR	0.62

What will the frequencies of ST and AR be after equilibrium is reached?

5. Alcohol is a common substance in rotting fruit, where fruit fly larvae grow and develop. Larvae use the enzyme ADH (alcohol dehydrogenase) to detoxify the effects of this alcohol. Two alleles have been found at the locus that encode ADH: Adh^F (it encodes a form of the enzyme that migrates rapidly (fast) on an electrophoretic gel and Adh^S (enzyme migrates slowly on the electrophoretic gel. Female fruit flies with different Adh genotypes produce following number of offspring when alcohol is present:

Genotype	Average number of offspring produced
$Adh^F Adh^F$	120
$Adh^F Adh^S$	60
$Adh^S Adh^S$	30

(a) Calculate the relative fitness of females of said genotypes.

(b) If a population has an initial frequency of Adh^F equal to 0.2 what will the frequency be in the next generation when alcohol is present.

6. (a) Enumerate the propositions of neutral theory of molecular evolution.

		<p>(b) 'Rate of substitution per generation (λ) is equal to the rate of mutation/generation(μ) following neutral theory of evolution'-Prove it.</p> <p>7. (a) Make a comparison between gradualism and saltation as processes in the macroevolution.</p> <p>(b) Highlight the propositions of punctuated gradualism. How does it differ from punctuated equilibrium?</p> <p>8. (a) Explain the terms: i. Absolute and Relative fitness; ii. Selection Co-efficient, iii. survival rate.</p> <p>(b) For a directional selection against a lethal recessive allele, prove that $\Delta q = -spq^2/1-sq^2$ [where s= selection co-efficient; p= frequency of dominant allele and q= frequency of lethal recessive allele].</p> <p>(c) What do you mean by mutational load and segregational load?</p> <p>9. (a) Name four known molecular processes that can generate novel gene structure in a genome.</p> <p>(b) 'Four levels of duplications have fueled the organic evolution of complex genome'- make an illustrative justification.</p> <p>(c) LINEs and SINEs are considered to be so called selfish DNA, yet they can, in some instances, confer a selective advantage on the organisms. What are two ways in which a LINE and SINE can change the genome?</p> <p>10. (a) Elaborate Orthologous and Paralogous genes to highlight species divergence.</p> <p>(b) State the evolutionary significance of pseudogenes.</p> <p>(c) A, B, and C are three orthologous proteins derived from a speciation event and A & B split from the common ancestor (t_c) 100 mya. The value of K_{AB} is 1 and values of K_{AC} & K_{BC} are 10 each [where K is the average number of amino acid substitutions between the proteins concerned]. From the given data determine the divergence time (t_T) between C and AB.</p> <p>11. (a) What is exon shuffling? What are the splice frame rules followed by exon shuffling?</p> <p>(b) 'Shuffling of exons enable the newly evolved genes to encode multidomain proteins'-justify the statement citing suitable example.</p> <p>(c) Why the formation of multidomain proteins from pre-existing domain may have major evolutionary significance?</p> <p>12. (a) Briefly explain the classical model of neofunctionalization and the DDC model of sub functionalization in relation to the recently duplicated genes.</p> <p>(b) Why δ-globin gene is highly expressive in adult <i>Galagos</i>, a relative of Madagascar lemur?</p> <p>13. (a) Distinguish between 'multi-gene family' and 'gene super-family'.</p>
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		<p>(b) Elucidate your idea on the evolution of gene superfamily taking example from mouse globin gene superfamily.</p> <p>(c) How pseudogenes are evolved following 'Birth and Death' model?</p> <p>14. Write brief notes on i. Molecular Clock Hypothesis; ii. Horizontal gene transfer; iii. canalization; iv. Phenotypic plasticity; v. Additive and Non-additive genetic variation; vi. Phyletic gradualism; vii. Overdominance and Underdominance; viii. Motif multiplication.</p> <p>15. What is Population?</p> <p>16. Define allele frequency and genotypic frequency.</p> <p>17. Define gene pool.</p> <p>18. Explain Hardy-Weinberg principle.</p> <p>19. What do you mean by panmictic population?</p> <p>20. What is Hardy-Weinberg formula of binomial expression?</p> <p>21. Why does a population in Hardy-Weinberg equilibrium do not show evolution?</p> <p>22. What is mutation? Define recurrent and non-recurrent mutation.</p> <p>23. What is migration? What do you mean by migration ratio?</p> <p>24. What is inbreeding? Differentiate inbreeding depression and inbreeding avoidance with proper example.</p> <p>25. Define selection. Differentiate differential selection and balancing selection.</p> <p>26. What are the merits and demerits of inbreeding?</p> <p>27. What is Haldane's rule?</p> <p>28. What do you mean by selection coefficient?</p> <p>29. Explain how selection acts upon allelic frequencies?</p> <p>30. What is stabilizing selection and negative frequency dependent selection?</p> <p>31. What is narrow sense and broad sense heritability?</p>
<p>ZCT 434</p>	<p>Comparative Animal Physiology</p>	<ol style="list-style-type: none"> 1. What do you mean by supercooling? What are the different types of heat transfer mechanism between animal and environment? Define Pejus and critical temperature 2. What are the importance of biological antifreeze compounds? What are the different types of antifreeze compounds? Comment on Fish anti-freeze protein. Briefly explain how these antifreeze molecules allow icfish to live in subfreezing water 3. Mention four characteristic features of Homeostasis? What are the factors that control homeostasis? Explain the mechanism of homeostasis during migration of Salmon fish

		<p>5 “Plant-insect interaction is a dynamic system, subjected to continual variation and change.—Explain.</p> <p>6 Write short note on mammalian pheromone, kiromone, primer pheromone and releaser pheromone.</p> <p>7 How knowledge of insect and plant interaction can be use to manage pest from its host plant?</p> <p>8. Describe the counter current multiplier exchanger mechanism.</p> <p>9. What is GFR? Illustrate how GFR is regulated for proper urine formation.</p> <p>10. What is JG apparatus? Illustrate how kidney maintains acid base balance.</p>
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