PUNJAB PUBLIC SERVICE COMMISSION
COMBINED COMPETITIVE EXAMINATION (CCE) SYLLABUS

ZOOLOGY

Total Marks: 100

TOPICS

1. **ANIMAL DIVERSITY (INVERTEBRATES)**

Introduction, taxonomy, general organization, structure and function, reproduction and life cycles, phylogenetic relationships, and economic importance of major invertebrate groups:

Protozoa and Parazoa:

***Protozoa*:** Locomotion and types of pseudopodia, reproduction and parasitic protozoans.

***Porifera*:** Cellular organization, body wall, skeleton, and canal systems.

Radiata, Triploblastic Acoelomates, and Pseudocoelomates:

***Cnidaria*:** Body wall, nematocysts, polymorphism, alternation of generations and coral reefs.

***Platyhelminthes*:** Body wall, parasitic adaptations, and life cycles of some major groups (e.g., *Fasciola hepatica*, *Taeniasolium*).

***Aschelminthes and Nematoda*:**Pseudocoelomate organization, body wall, and life cycles of human parasitic nematodes (e.g., Hookworms, Pinworms, filarial worms).

Coelomate Invertebrates and Major Lineages:

Mollusca: Modifications of foot, feeding mechanisms and predatory adaptations of cephalopods.

Annelida &Arthropoda: Metamerism, tagmatization, mouthparts, ecdysis, metamorphosis, and ecological importance.

Echinodermata: Diversity; water vascular system, larval forms and development.

2. **Animal Diversity (Vertebrates)**

Chordata: Introduction and General Organization

Origin, diagnostic characteristics and basic chordate body plan; major subdivisions of chordates, including proto-chordates and vertebrates.

Fishes: Vertebrate Success in Water

Origin, diversity, classification and phylogenetic relationships of major fish groups. Structural and functional adaptations for aquatic life: swim bladder; respiration; excretion and osmoregulation.

Amphibians: The First Terrestrial Vertebrates

Origin, classification and evolutionary relationships of amphibians. Structural, physiological and behavioral adaptations for aquatic and terrestrial life: Respiration, reproduction and development.

Reptiles: The First Amniotes

Evolution of reptiles, adaptations for terrestrial life, excretion, osmoregulation, reproduction and development; Extinction of dinosaurs; poisonous apparatus and biting mechanism of snakes.

Aves: Feathers, Flight and Endothermy

Evolutionary history and major adaptations associated with feathers, flight and endothermy. Structural and functional adaptations for aerial locomotion and respiration. Bird migration and navigation.

Mammalia: Specialized Teeth, Hair, Endothermy and Viviparity

Origin, diversity and emphasis on major mammalian groups. Dentition in vertebrates. Comparative account of the evolution of the heart and vertebrate stomach. Temperature regulation and endothermy.

3. PRINCIPLES OF LIFE AND GENERAL ZOOLOGY

Cell and Molecular Biology

Comparative analysis of prokaryotic and eukaryotic cells. Structure and specialized functions of the nucleus, plasma membrane and cytoplasmic organelles. Enzyme structure, catalytic mechanisms, regulation, and inhibition. Major metabolic pathways: glycolysis, the Krebs cycle, and the electron transport chain. DNA as genetic material, structural organization of nucleic acids, the genetic code, transcription, and translation. Mitosis and meiosis, and their biological significance.

Animal Form, Function and General Physiology

Vertebrate integument. Ultra-structure of muscle fibrils and mechanisms of muscle contraction. Regional functional organization of the gastrointestinal tract. Composition and functions of blood and internal fluids. Cardiovascular dynamics: electrical activity of the heart, cardiac output and blood pressure regulation. Comparative account of respiratory organs; properties and functions of respiratory pigments. Functional anatomy of the vertebrate nephron and urine formation. Mechanism of osmoregulation, and thermoregulation. Structural and functional units of the nervous system. Nerve impulse and its transmission. Structure and function of sensory organs (eye and ear). Endocrine glands, classes of hormones, mechanisms of hormone action.

Genetics & Recombinant DNA Technology

Mendelian principles of inheritance, gene interactions, multiple alleles, linkage, crossing over and sex-linked inheritance. Eukaryotic chromosome structure; chromosomal aberrations, gene mutations, and the evolving gene concept. Recombinant DNA technology, cloning strategies, applications of genetic engineering, and transgenic animals.

Evolutionary Biology

Theories of the origin of life. Darwinism and Neo-Darwinism. Causes of variation and types of natural selection. Genetic drift and Hardy-Weinberg equilibrium. Species concepts, mechanisms of speciation (allopatric, parapatric, sympatric), adaptive radiation, phylogeny and ontogeny.

Environmental Biology & Ecology

Ecosystem concepts: components, primary/secondary productivity, trophic levels, food chains, food webs, and energy flow dynamics. Biogeochemical cycles (carbon, nitrogen). Environmental pollution (air, water, land), greenhouse effect, acid rain, global warming, climate change, and wildlife conservation and management.

Suggested readings:

1. Alberts, B., Heald, R., Johnson, A., Morgan, D., Raff, M., Roberts, K., & Walter, P. (2022). Molecular Biology of the Cell (7th ed.). W. W. Norton & Company, New York.
2. Alcock, J., & Rubenstein, D. R. (2022). Animal Behavior: An Evolutionary Approach (12th ed.). Oxford University Press, New York.
3. Brusca, R. C., Giribet, G., & Moore, W. (2023). Invertebrates (4th ed.). Oxford University Press, New York.
4. Barnes, R. D. (1987). Invertebrate Zoology (5th ed.). W. B. Saunders Company, Philadelphia.
5. Campbell, N. A., Urry, L. A., Cain, M. L., Wasserman, S. A., Minorsky, P. V., & Orr, R. B. (2020). Campbell Biology (12th ed.). Pearson, New York.
6. De Robertis, E. D. P., & De Robertis, E. M. F. (2017). Cell and Molecular Biology (8th ed., Indian Reprint). Lippincott Williams & Wilkins, Philadelphia.
7. Eckert, R., Randall, D., Burggren, W., & French, K. (2002). Eckert Animal Physiology: Mechanisms and Adaptations (5th ed.). W. H. Freeman and Company, New York.
8. Futuyma, D. J., & Kirkpatrick, M. (2023). Evolutionary Biology / Evolution (5th ed.). Oxford University Press, New York.
9. Guyton, A. C., & Hall, J. E. (2020). Guyton and Hall Textbook of Medical Physiology (14th ed.). Elsevier, Philadelphia.
10. Hickman, C. P., Keen, S. L., Eisenhour, D. J., Larson, A., &I'Anson, H. (2020). Integrated Principles of Zoology (18th ed.). McGraw-Hill Education, New York.
11. Hyman, L. H. (1940–1967). The Invertebrates (Vols. I–VI). McGraw-Hill Book Company, New York.
12. Karp, G., Iwasa, J., & Marshall, W. (2020). Karp's Cell and Molecular Biology: Concepts and Experiments (9th ed.). John Wiley & Sons, Inc., Hoboken, NJ.
13. Kardong, K. V. (2018). Vertebrates: Comparative Anatomy, Function, Evolution (8th ed.). McGraw-Hill Education, New York.
14. Kent, G. C., & Carr, R. K. (2001). Comparative Anatomy of the Vertebrates (9th ed.). McGraw-Hill Higher Education, New York.
15. Lodish, H., Berk, A., Kaiser, C. A., Krieger, M., Bretscher, A., Ploegh, H., Martin, K. C., Yaffe, M. B., & Amon, A. (2021). Molecular Cell Biology (9th ed.). W. H. Freeman and Company / Macmillan Learning, New York.
16. Loewy, A. G., &Siekevitz, P.1991. Cell Structure and Function (3rd ed.) Saunders College Publishing, Philadelphia.
17. McKinney, M. L., Schoch, R. M., &Yonavjak, L. (2019). Environmental Science: Systems and Solutions (6th ed.). Jones & Bartlett Learning, Burlington, MA.
18. Miller, S. A., & Tupper, T. A. (2023). Zoology (12th ed.). McGraw-Hill Education, New York.
19. Moody, P. A. (1970). Introduction to Evolution (3rd ed.). Harper & Row Publishers, New York.
20. Miller, S. A., & Harley, J. P. (2016). *Zoology* (10th ed.). McGraw-Hill Education, New York.

21. Nebel, B. J., & Wright, R. T. (2014). Environmental Science: Toward a Sustainable Future (12th ed.). Pearson Education, Boston.
22. Odum, E. P., & Barrett, G. W. (2004). Fundamentals of Ecology (5th ed.). Cengage Learning, Boston.
23. Pechenik, J. A. (2014). Biology of the Invertebrates (7th ed.). McGraw-Hill Education, New York.
24. Pough, F. H., & Janis, C. M. (2018). Vertebrate Life (10th ed.). Oxford University Press, New York.
25. Ridley, M. (2004). Evolution (3rd ed.). Blackwell Publishing, Malden, MA.
26. Romer, A. S., & Parsons, T. S. (1986). The Vertebrate Body (6th ed.). Saunders College Publishing, Philadelphia.
27. Rose, K. D., & Archibald, J. D. (Eds.). (2005). The Rise of Placental Mammals. The Johns Hopkins University Press
28. Ruppert, E. E., Fox, R. S., & Barnes, R. D. (2004). Invertebrate Zoology: A Functional Evolutionary Approach (7th ed.). Brooks/Cole Cengage Learning, Belmont, CA.
29. Smith, R. L., & Smith, T. M. (2015). Ecology and Field Biology (9th ed.). Pearson Education, Boston.
30. Snustad, D. P., & Simmons, M. J. (2015). *Principles of Genetics* (7th ed.). John Wiley & Sons, Inc., Hoboken, NJ.
31. Strickberger, M. W. (2015). Genetics (3rd ed., Indian Edition). Pearson India, New Delhi.

Note: **The above list is only suggestive and not exhaustive. Candidates may consult other standard books and relevant material covering the prescribed syllabus.**

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