

PAPER-IV POPULATION GENETICS, EVOLUTION AND GAMETE BIOLOGY

(Questions will be set from each unit)

UNIT-I Population Genetics and Evolution - I

- 1. Concepts of evolution and theories of organic evolution with an emphasis on Darwinism :**
- 2. Neo - Darwinism :** A. Hardy - Weinberg law of genetic equilibrium. B. A detailed account of destabilizing forces. (I) Natural Selection (II) Mutation (III) Genetic drift (IV) Migration (V) Meiotic drive.
- 3. Quantifying genetic Variability :** A. Genetic Structure of natural populations. B. Phenotypic Variation. C. Models explaining changes in genetic structure of population. D. Factors affecting human disease frequency.
- 4. Molecular Population Genetics :** A. Patterns of changes in nucleotide and amino acid sequences. B. Ecological significance of molecular variations. C. Emergence of Non-Darwinism - Neutral Hypothesis.
- 5. Genetics of quantitative traits :** A. Analysis of quantitative traits. B. Quantitative traits and Natural selection. C. Genotype - environment interaction.

UNIT-II Population Genetics and Evolution-II

- 1. Molecular evolution :** A. Gene evolution. B. Evolution of Gene families. C. Assessment of Molecular Variation.
- 2. Origin of higher categories :** A. Phylogenetic gradualism and punctuated equilibrium. B. Major trends in the origin of higher categories. C. Micro and Macro - evolution.
- 3. Molecular Phylogenetics :** A. How to construct phylogenetic trees? B. Phylogenetic interence - Distance methods, Parsimony methods, Maximum likelihood method. C. Immunological techniques. D. Amino acid sequences and phylogeny. E. Nucleic acid phylogeny - DNA-DNA Hybridizations, Restriction Enzyme Sites, Nucleotide Sequence Comparisons and homologies. F. Molecular Clocks.
- 4. Origin and evolution of economically important microbes and animals.**
- 5. Population genetics and ecology :** A. Metapopulations. B. Monitoring natural populations. C. Why small populations become extinct? D. Loss of genetic Variations. E. Conservation of genetic resources in diverse taxa.

UNIT-III Gamete Biology-I

- 1. Comparative account of differentiation of gonads in a mammal and an invertebrate.**
- 2. Spermatogenesis :** A. Morphological basis in Rodents. B. Morphological basis in any invertebrate. C. Gamete specific gene expression and genomics.
- 3. Biochemistry of Semen :** A. Semen Composition and formation. B. Assessment of sperm functions. C. 'Y' specific probes.
- 4. fertilization :** A. Pre fertilization events. B. Biochemistry of fertilization. C. Post fertilization events.
- 5. Collection and cryopreservation of gametes and embryos.**
- 6. Ovarian follicular growth and differentiation :** A. Morphology. B. Endocrinology. C. Molecular Biology. D. Ovulation and ovum transport in mammals.

UNIT-IV Gamete Biology-II

1. **Biology of sex determination and sex differentiation a comparative account.**
2. **Multiple Oveulation and embryo transfer technology :**
A. **In vitro** oocyte maturation. B. Superovulation. C. **In vitro** fertilization.
3. **Transgenic animals and knock - outs :**
A. Production. B. Applications. C. Embryonic stems cells.
4. **Care and breeding of experimenral animals including bioethics.**
5. **Assisted reproduction technologies :**
A. Embryo Sexing and cloning. B. Screening for genetic disotders.
C. ICSI, GIFT etc. D. Cloning of animals by nuclear transter.
6. **Immunocontraception :** A. Gamete specific antigens. B. Antibody mediated fertilization block and termination of gestation. C. Other contraceptive fechnologies. D. Surgical methods. E. Hormonal methods. F. Physical barriers. G. IUCD.