

Alagappa University, Karaikudi

Pre-Registration Qualifying Entrance Examination for Ph.D. Program (August
2019 onwards)

Discipline: **Molecular Biology**

Unit I:

Discovery of DNA. Molecular basis of DNA as genetic material. Structure of DNA – A, B and Z form. Forms of DNA – DNA heteroduplex, circular, superhelical DNA, twisted circle. Properties of DNA - denaturation, renaturation, melting curve, hyperchromicity. Structure of RNA - types of RNA - tRNA, mRNA and rRNA. Replication in prokaryotes and eukaryotes; DNA repair – light and dark mechanisms; Mutations – causes and types, isolation and characterization of mutants and revertants. Prokaryotic and Eukaryotic transcription, post transcriptional modification, translation, post translational modification. Genetic recombination (Homologous, non-homologous and site specific recombination).

Unit II:

Genetic code: Elucidation of triplet code, code characteristics, codon dictionary. Reading frames, sense and nonsense code. Degeneracy - wobble hypothesis, universality of genetic code. Process of translation in prokaryotes: Initiation and Termination. Role of rRNA in protein synthesis. Post translational modifications - post translational transport, signal hypothesis. Plasmids: Types of plasmids - F, R & Col plasmids. Properties of plasmids – sex factors, drug resistant, colicinogenic, *Agrobacterium* Ti and broad host range plasmid. Detection and purification of plasmid DNA. Transfer of plasmid DNA. Replication of plasmid. Control of copy number, plasmid amplification, curing and incompatibility. Gene concept - regulation of bacterial gene expression. Lactose system - coordinate regulation, Lac components, positive and negative regulation, catabolite repression. Tryptophan operon - attenuation. Arabinose operon and its regulation.

Unit III:

DNA modifying enzymes – nucleases, polymerases, ligases. cloning vectors – plasmids, cosmids, phasmids, phagemids, expression vectors, plasmid vectors – p^{BR322} and p^{UC18}, integrating shuttle vector –YAC vectors, viral vector – SV 40 and adeno virus. Lac Z promoter – expression system – Lambda, PL / PR Promoter, T⁷ promoter, Sp6 promoter, SV – 40 promoter, CaMV 35s promoter. Cloning methodologies – α complementation, sticky and blunt end cloning. Cloning from mRNA – synthesis of cDNA, cloning cDNA– cDNA library. Cloning from genomic DNA – genomic library. Shot gun cloning. Screening of recombinant – phenotypic

expression of characters – Blotting techniques – western, northern and southern. Mapping of human genes – Human genome project.

Unit IV:

Cloning of human insulin, interferon in *E.coli*. Recombinant vaccine development – HBs Ag in yeast. Cloning for commercial production of antibiotics (Penicillin). Bio steroid transformation. Production of biopolymers – Xanthum gum. Melanin biosynthesis in *E.coli*, adhesive biopolymer in yeast.

Unit V:

Gene silencing and antisense technology: Types and mechanism of gene silencing. Genetic factors of silencing, formation of antisense mRNA, inhibition of gene expression by antisense RNA. Gene silencing in crop plants: tomato. Si RNA and disease control. Plant genetic engineering: Ti plasmid, CaMV vector, Direct DNA delivery methods – micro projectile bombardment, microinjection and electroporation. Gene therapy

References:

1. Brown, T.A. 2000. Gene Cloning, Fourth Edition, Chapman and Hall Publication, USA.
2. David Freifelder. D. 2008. Microbial Genetics, Eighteenth Edition, Narosa Publishing House, New Delhi.
3. Glick, B.K. and Pasternak, J.J. 2002. Molecular Biotechnology Principles and Applications of Recombinat DNA, ASM Press, Washington.
4. Kornberg, A. and Baker, A. 1992. DNA Replication, Second Edition, W.H. Freeman and Company, New York.
5. Primrose, S.B. and Twyman, R.M. 2009. Principles of Gene manipulation and Genomics, Seventh Edition, Blackwell publishing, UK.
6. Singer, M. and Paul Berg, 1991. Genes & Genomes, University Science Books, California.
7. Stanley R. Maloy, John E.C. and Freifelder, D. 2008. Microbial Genetics, Narosa Publishing House, New Delhi.
8. Stryer, L. 2010. Biochemistry, Seventh Edition, W.H. Freeman and Company, New York.
9. Thieman, W.J. and Palladino, M.A. 2009. Introduction to Biotechnology, Dorling Kindersley India Pvt. Ltd., Noida.
10. Turner, P.E., McLennan, A.G., Bates, A.D. and White, M.R.H. 1999. Instant Notes in Molecular Biology, Viva Books Ltd., New Delhi.