

MOHANLAL SUKHADIA UNIVERSITY, UDAIPUR

M. Sc. BIOTECHNOLOGY SEMESTER –II (2016-17)

Paper I: CC5 (M2BT01CT05): MOLECULAR BIOLOGY (THEORY)

TOTAL HOURS: 60

CREDITS: 4

Unit I

Credit hours: 10

Eukaryotic and Prokaryotic genetic materials: Structure, chemical composition, organization, mechanism of replication. Discontinuous synthesis of DNA, RNA primer for DNA synthesis, Enzymes and proteins associated with DNA replication, repetitive DNA. DNA repair: photo-reactivation, excision repair, post replication repair, SOS repair.

Unit II

Credit hours: 15

RNA: types, primary, secondary, tertiary and quaternary structure and synthesis.

Transcription: Prokaryotic transcription and RNA polymerase. Eukaryotic transcription and RNA polymerases. Transcription factors and their role. Modification in RNA: 5'-CAP formation, 3'-end processing, Polyadenylation, Splicing, Editing, Nuclear export of mRNA and mRNA stability. Processing of other RNAs, Ribosome formation. Reverse transcription. Inhibitors of RNA synthesis.

Unit III

Credit hours: 10

Translation: Prokaryotic and Eukaryotic translation, mechanism of initiation, elongation & termination, Amino acid activation, Inhibitors, Regulation of translation, Co-& post translation modification of proteins. Protein sorting: synthesis of secretory and membrane proteins, import into nucleus, mitochondria, chloroplast and peroxisomes, Receptor mediated endocytosis.

Unit IV

Credit hours: 15

Regulation of gene expression in prokaryotes and eukaryotes: Transcriptional control; enzyme induction and repression, constitutive synthesis of enzymes. The operon hypothesis: genes involved in regulation- regulatory gene, promoter gene, operator gene and structural gene, role of

cAMP and cAMP receptor protein (CRP) in the expression of e.g. Lac operon, Tryptophan operon. Catabolite repression. *Cis* control elements, promoters, enhancers, Transacting factors, DNA binding motifs of transcription factors, post transcriptional control.

Unit- V

Credit hours: 10

Principles and applications of blotting techniques: Southern, Northern, Western and Eastern blotting. Polymerase chain reaction: Types and applications. Radioactive and non radioactive probes. Autoradiography. DNA fingerprinting, DNA Foot printing and DNA sequencing , Antisense and siRNA technology. Chromosome walking.

Suggested Readings

1. Watson, J.D. Molecular Biology of Gene. Pearson Education.
2. Friefelder, D. Molecular Biology. Narosa Publishing House, New Delhi.
3. Weaver, R. Molecular Biology. McGraw Hill.
4. Lewin, B. Gene VIII. Pearson Education.
5. Lodish and Baltimore. Molecular Cell Biology. W.H. Freeman and Co.
6. Cooper, M. The Cell – A molecular approach. Sinauer.
7. Daniel. Molecular Cell Biology. Scientific American Books.
8. Smith. Molecular Biology. Faber and Faber Publications.
9. Dabre, P.D. Introduction to (Practical) Molecular Biology. John Wiley and Sons, Ltd.Meyers, R.A. (Ed). Molecular Biology and Biotechnology : A comprehensive desk reference. VCH Publishers, New York

MOHANLAL SUKHADIA UNIVERSITY, UDAIPUR

M. Sc. BIOTECHNOLOGY SEMESTER –II (2016-17)

Paper II: CC6 (M2BT02CT06): IMMUNOLOGY AND ENZYMOLOGY (THEORY)

TOTAL HOURS: 60

CREDITS: 4

Unit I

Credit hours: 10

Innate and acquired immunity, clonal nature of the immune response. Immune system: primary lymphoid organs, secondary lymphoid organs. Cells of the immune system: B-lymphocytes, T-lymphocytes, Macrophages, Natural killer, Lymphokine activated killer cells. Haptens and adjuvants. Nature of antigens, Antibody: types structure and function, Abzymes, Antigen-antibody reactions, serological techniques.

UNIT II

Credit hours: 10

Major histocompatibility Complex, complement system. Regulation of the immune response, activation of B and T-lymphocytes, cytokines, T-cell regulation, MHC restriction, Immunological tolerance. Hybridoma technology and monoclonal and polyclonal antibodies. Autoimmunity.

UNIT III

Credit hours: 15

Classification of Enzymes, Mechanism of Enzyme Action; Concept of active site and energetics of enzyme substrate complex formation; Specifically of enzyme action; Kinetics of single substrate reactions; turnover number; estimation of Michaelis-Menten parameters, multi - substrate reactions- mechanism and kinetics; Types of inhibition-kinetic models; Substrate and Product Inhibition; Allosteric regulation of enzyme; Deactivation kinetics.

UNIT IV

Credit hours: 15

Extraction and purification of enzymes, Physical and Chemical methods used for cell disintegration. Enzyme fractionation by precipitation (using Temperature, Salt, solvent, pH,

chemicals), Liquid-liquid extraction, ionic exchange, Gel Chromatography, Affinity chromatography and other special purification methods. Enzymes for analytical and diagnostic applications. Multi enzyme complex, isozymes, Coenzymes, Ribozymes.

UNIT V

Credit hours: 10

Physical and Chemical techniques for enzyme immobilization-adsorption, matrix entrapment, encapsulation, cross linking, covalent binding. Advantages and disadvantages of different immobilization techniques, overview of application of immobilized enzyme systems. Enzyme crystallization techniques. Commercial applications of enzymes in food, pharmaceutical and other industries.

Suggested Readings

1. Harvey W. Blanch, Douglas S. Clark, "Biochemical Engineering", Marcel Dekker, Inc.
2. James M. Lee, "Biochemical Engineering", PHI, USA.
3. James, E. Bailey & David F. Ollis, "Biochemical Engineering fundamentals", McGraw-Hill.
4. Wiseman, "Enzyme Biotechnology" Ellis Horwood Pub.
5. Kuby, J. "Immunology". W. H. Freeman and Company.
6. Roitt, Brostoff, Male and Mosby, Immunology.
7. Palmer, T. Understanding Enzymes.
8. Coleman, R.M. Fundamental Immunology. McGraw Hill.

MOHANLAL SUKHADIA UNIVERSITY, UDAIPUR

M. Sc. BIOTECHNOLOGY SEMESTER –II (2016-17)

Paper III: CC7 (M2BT03CT07): BIOINFORMATICS AND BIOSTATISTICS (THEORY)

TOTAL HOURS: 60

CREDITS: 4

Unit I

Credit hours: 10

Computer Architecture, Internal and External devices, computer software, operating system windows, Unix, Application software like word processor, spread sheet, Database, RDBMS. Computer Network- Advantages of network, types of network (LAN, WAN & MAN), Network protocols, Internet protocol (TCP, IP), and File transfer protocol (FTP), WWW, HTTP, HTML, VRL.

Unit II

Credit hours: 15

Computer words coding (ASCII and EBCDIC), Numeric data. Introduction to programming languages, C++ Perl. Databases: Introduction to databases- Relational databases- Oracle, SQL, Database generation, Sequence databases- Resources-Human Genome project (HGP), Microbial genomes, Structural databases- protein data bank (PDB).

Unit III

Credit hours: 15

Principles behind computational analysis, Sequence analysis, sequence alignment, scoring matrices for sequence alignment, Similarity searching (FASTA and BLAST), Pair wise comparison of sequences, multiple alignment of sequences.

Unit IV

Credit hours: 10

Brief description of tabulation of data and their graphical representation, measures of central tendency and dispersion: Mean, median, mode, range, standard deviation, variance. Simple linear regression and correlation. Brief idea of statistical softwares and their applications.

Unit V

Credit hours: 10

Elementary idea of probability, definition and properties of binomial, poisson and normal distributions. Elementary idea of random sampling, selection of simple random samples from a finite population, definition of sampling distribution, Randomized block design, sampling variance and standard error. Analysis of Variance (ANOVA), Idea of two types of errors and level of significance, test of significance, chi-square test of independence and homogeneity test based on Z and T statistics.

Suggested Readings

1. Zar, J.H. Biostatistical Analysis. Pearson Edu.
2. Gupta, S.C. and Kapoor, V.K. Fundamentals of applied statistics. S. Chand and Company.
3. Dutta, N.K. Fundamentals of Biostatistics. Kanika Pub. New Delhi.
4. Arora, P.N. and Malhan, P.K. Biostatistics. Himalya Publishers.
5. Daniel, M. 1999. Biostatistics (3rd Edition). Panima Publishing Corporation.
6. Campbell, R.C. Statistics for Biologist. Cambridge University Press.
7. Bliss, C.J.K. Statistics in Biology. McGraw Hill.
8. Swardlaw, A.C. (Practical) statistics for experimental Biology. John Wiley and Sons.

MOHANLAL SUKHADIA UNIVERSITY, UDAIPUR

M. Sc. BIOTECHNOLOGY SEMESTER –II (2016-17)

Paper IV: CC8 (M2BT04CT08): GENETIC ENGINEERING (THEORY)

TOTAL HOURS: 60

CREDITS: 4

Unit I

Credit hours: 10

Recombinant DNA Technology: History and Milestones In Genetic Engineering, Application of enzymes in recombinant DNA technology- exo and endonucleases, restriction enzymes, DNA ligases, polymerases, DNA modifying enzymes etc. General concept and principle of cloning: Cloning vectors, classification, plasmids: pBR 322, pBR327, pUC8. Phage vectors: M13 and λ . Phagemids and cosmids.

Unit II

Credit hours: 10

Purification of DNA from living cells- Extraction of bacterial DNA, Plasmid DNA. Isolation of DNA, molecular probes, insertion of DNA into living cell- microinjection, electroporation, shot gun method, ultrasonication, microlaser, uptake of DNA by bacterial cell and introduction of phage DNA in to bacterial cell. Nucleic acid purification, yield analysis.

Unit III

Credit hours: 15

Methods for Constructing rDNA and cloning: Inserts; vector insert ligation; Use of linkers, adaptors and homo-polymer tailing. Methods for screening and selection of recombinant clones. Nucleic Acid sequencing: Sanger's, Maxam Gillbert's method and pyrosequencing. Site-directed mutagenesis. Protein engineering and its applications.

Unit-IV

Credit hours: 15

Shuttle and expression vectors: Design and characteristics of expression vectors for cloning in prokaryotes and factors that affects expression. Yeast cloning vectors: 2 μ m plasmid, Yep, Yip and YAC. Animal virus derived vectors: SV40 and retroviral vectors. Applications of cloning in

gene analysis: Obtaining clone of specific gene, Study of gene location, expression and regulation of gene expression, Study of translated product of a cloned gene. DNA Libraries: types, construction and screening of Genomic and C- DNA libraries.

Unit V

Credit hours: 10

Principle and applications of gel mobility shift assay, Ribozyme, Antisense and siRNA technology. Gene Therapy: Vector engineering, gene replacement/augmentation, gene correction, gene editing, gene regulation and silencing. Restriction Mapping of DNA Fragments and Map Construction.

Suggested Readings

1. Watson, J.D. Molecular Biology of Gene. Pearson Education.
2. Friefelder, D. Molecular Biology. Narosa Publishing House, New Delhi.
3. Weaver, R. Molecular Biology. McGraw Hill.
4. Lewin, B. Gene VIII. Pearson Education.
5. Lodish and Baltimore. Molecular Cell Biology. W.H. Freeman and Co.
6. Cooper, M. The Cell – A molecular approach. Sinauer.
7. Daniel. Molecular Cell Biology. Scientific American Books.
8. Smith. Molecular Biology. Faber and Faber Publications.
9. Dabre, P.D. Introduction to (Practical) Molecular Biology. John Wiley and Sons, Ltd