

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

III Year B.Tech - II Semester (R09)

S.No	Course code	Subject	L	T	P	CP
1	9A23601	Computational Molecular Biology		4		4
2	9A23602	Biochemical Reaction Engineering – II		4		4
3	9A23603	Transport Phenomena in Bioprocess		4		4
4	9A23604	Instrumentation and Bioprocess Control		4		4
5	9A23605	Immunology		4		4
6	9ABS304	Probability and Statistics		4		4
7	9A23606	Plant Tissue Culture Lab			3	2
8	9A23607	Immunology Lab			3	2
		contact periods / week		24	06	
Total/Week 30						
Total Credits (6 Theory + 2 Labs)						28

(9A23601) COMPUTATIONAL MOLECULAR BIOLOGY

UNIT I: INTRODUCTION TO COMPUTATIONAL MOLECULAR BIOLOGY

Introduction to active areas of research in Computational Molecular Biology, Functional Genomics, Comparative Genomics, Dynamic Programming, Graphical representation of biochemical systems, S-systems equations, steady state analysis, Model refinements

UNIT II : GENOMICS

DNA Sequence assembly and gene identification. Homology based gene prediction. SNPs and applications. Methods of studying gene expression, EST approach,

UNIT-III MICRO ARRAYS

Basics of Micro array

UNIT IV: PROTEOMICS I

Introduction to proteins. Protein identification, structure and function determination. Structure comparison methods. Prediction of secondary structure from sequence.

UNIT V: PROTEOMICS II

Protein homology modelling, Protein threading. Protein *ab initio* structure prediction. Protein design emphasis on structural Bioinformatics.

UNIT VI: TAXONOMY AND PHYLOGENY

Basic concepts in systematics, Molecular evolution, Definition and description of Phylogenetic trees and types of trees

UNIT-VII: DENDROGRAMS

Dendograms and its interpretation

UNIT-VIII: DRUG DESIGN

Drug discovery cycle, Role of Bioinformatics in Drug discovery

TEXT BOOKS:

1. David W Mount. Bioinformatics- Sequence and genome analysis. CSHL Press, 2005.
1. Jonathan Pevsner. Bioinformatics and Functional Genomics. A Jhon Wiley & Sons, Inc., Publication, 2004.
2. E.O.Voit Computational Analysis of Biochemical systems, Cambridge University Press, 2000.

REFERENCES:

1. Moody P C E and A J Wilkinson. Protein Engineering. IRL Press, 2006.
2. Creighton T E, Proteins. Freeman W H. Second edition, 1993.
3. Journal BIOINFORMATICS (Oxford University), 2009.
4. BRANDOND TOOZE – Proteomics, 2008.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR			
B.Tech. III –II Sem (BT)	T	P	C
	4	0	4

(9A23602) BIOCHEMICAL REACTION ENGINEERING -II

UNIT I: Basic concept. Definition of bioreactor, Fundamental principles, Concept in energy and mass balances and in biological reaction modeling.

UNIT II: Chemostat analysis. Definition of Chemostat, Turbidostat, Single flow single stage chemostat, single flow multistage chemostat, Recycle flow in chemostat, Concepts of dilution rate productivity analysis.

UNIT III: Mechanisms and Kinetics of Enzyme Action I. Mechanisms of Enzyme Action; Concept of active site and energetics of enzyme Kinetics, substrate complex formation; Specificity of enzyme action; Kinetics of single substrate reactions; Turnover number; Estimation of Michaelis-Menten parameters. Importance of K_M ,

UNIT IV: Mechanisms and Kinetics of Enzyme Action II. Multi-substrate reaction mechanisms and kinetics. Types of Inhibition- kinetic models; Substrate and Product Inhibition; Allosteric regulation of enzymes.

UNIT V: Enzyme Immobilization. Physical and Chemical techniques for enzyme Immobilization - adsorption. Matrix entrapment, encapsulation. cross-linking. covalent binding - examples; Advantages and disadvantages of different Immobilization techniques. overview of applications of immobilized enzyme systems, effect of pH, temperature on immobilized reaction kinetics.

UNIT VI: Mass Transfer effects In Immobilized Enzyme Systems s. Analysis of Film and Pore Diffusion Effects on kinetics of Immobilized Enzyme Reactions; Formulation of dimensionless groups and calculation of Effectiveness Factors, Thiele modulus

UNIT VII : Design and analysis of enzyme reactors: Application tubular reactor concept in immobilized packed bed reactors, fluidized bed reactors

UNIT VIII: Specific bioreactors analysis and scale-up. Design and analysis of fed-batch and air-lift bioreactors. Application in animal cell culture. Basic concept of scale-up, non-dimensional analysis.

TEXT BOOKS:

1. M.L. Shuler and F. Kargi, Bioprocess Engineering: Basic Concepts, 2nd Edition, PHI New Delhi, 2007.
2. O. Levenspiel. Chemical Reaction Engineering, 3rd edition, Wiley, Newyork, 1999.

REFERENCES:

1. A.V.N Swamy, Fundamentals of Biochemical Engineering, BS Publications, 2007.
2. D.G. Rao, Introduction to Biochemical Engineering, McGraw-Hill, 2005.
3. H.J. Fromm, Initial rate Enzyme kinetics, Springer-Verlog. Berlin, 1975.
4. P.M. Doran Bioprocess Engineering Principles, Academic Press, London, 1995.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech. III –II Sem (BT) **T P C**
4 0 4
(9A23603) TRANSPORT PHENOMENA IN BIOPROCESSES

UNIT I: Momentum Transport

Mechanism of Momentum Transport: Newton's Law of Viscosity, Non-Newtonian fluids, theory of viscosity of liquids, time dependant viscosity, viscosity measurement (cone-and-plate viscometer, coaxial cylinder rotary viscometer, impeller viscometer), use of viscometers with biological reaction fluids, rheological properties of fermentation broth, factors affecting broth viscosity (cell concentration, cell morphology, osmotic pressure, product and substrate concentration), Velocity distribution in laminar flow and turbulent flow

UNIT II: Shell Momentum balances

Flow of Falling Film, Flow through circular tube, Flow through the annulus, Flow of two adjacent immiscible fluids

UNIT III: Equations of Change

Equation of change for isothermal system (equation of continuity, equation of motion, equation of mechanical energy), Solving Problems using equations of change). Equations of change in dimensionless form

UNIT IV:

Introduction to turbulent flow, time smoothening, mixing, mixing mechanism, power requirements in ungassed Newtonian and Non Newtonian fluids, gassed fluids, interaction between cell and turbulent Eddies, operating conditions for turbulent shear damage.

UNIT V: Energy Transport

Thermal conductivity and the mechanisms of energy transport- measurement of thermal conductivity, Fourier's law, steady state conduction, analogy between heat and momentum transfer

UNIT VI: Shell Energy Balances

Heat conduction with a electrical heat source, nuclear heat source, viscous heat source, chemical heat source. Free and Forced convection.

UNIT VII: Mass Transport & Shell Mass Balances

Theory of Diffusion and estimation of Diffusion coefficient for gases, liquids, in colloidal a polymers suspensions in polymers. shell mass balances: Diffusion

through a stagnant gas film, diffusion with in a heterogeneous and homogeneous chemical reaction. Diffusion and chemical reaction inside a porous catalyst.

UNIT VIII: Oxygen Transport

Oxygen uptake in cell cultures, Factors affecting cellular oxygen demand, oxygen transfer from gas bubbles to aerobic culture, oxygen transfer in fermentors-bubbles, factors affecting oxygen transport- sparging, stirring, medium properties, antifoam agents, temperature, mass transfer correlations, measurements of $k_L a$ - oxygen balance method, dynamic method.

Note: In all units relevant basic numerical problems should be practiced

TEXT BOOKS

1. R.B.Bird, W.E.Stewart, E.N.Lightfoot, Transport Phenomena, John wiley and sons, Singapore , 1994.
2. P.M.Doran, Bioprocess Principles, Academic Press, 1995.
3. Harvey W. Blanch, Douglas S. Clark Biochemical Engineering, Marcecel, Dekker, 2007.

REFERENCE BOOK

1. M.L.Shuler and F. Kargi, Bioprocess Engineering: Basic concepts, 2nd edition, Prentice Hall of India, 2003.

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(9A23604) INSTRUMENTATION AND BIOPROCESS CONTROL

UNIT I:

Thermocouples, resistance thermometers, rotameters, pH meters.

UNIT II:

Gas analysis by thermal conductivity, Analysis of moisture in gases (humidity), psychometric method, hygrometer method, dew-point method, principles of spectroscopic analysis.

UNIT III:

Response of first-order systems, Physical examples of first-order systems.

UNIT IV:

Response of first-order systems in series, Second-order systems, Transportation lag.

UNIT V:

The control system, controllers and final control elements, Block diagram of a chemical-reactor control system

UNIT VI:

Closed loop transfer functions, transient response of simple control systems, stability, root locus.

UNIT VII:

Introduction to frequency response, control system design by frequency response.

UNIT VIII

Cascade control, Feed forward control, Ratio control, dead time compensation, internal model control, controller tuning, end process identification, control valves.

TEXT BOOKS:

1. Industrial instrumentation, Donald P. Eckman, Wiley Eastern, 1950.
2. Process Systems Analysis and Control, Donald R. Coughanowr, McGraw-Hill, 1991.

REFERENCES:

1. Principles of Industrial Instrumentation, Third Edition, D.Patranabis, Tata McGraw Hill Education Pvt. Ltd, New Delhi, 2010.
2. Automatic process control, Eckman D.P., Wiley Eastern Ltd. New Delhi. 1993.
3. Chemical Process Control, Stephanopoulos, G., Prentice Hall, New Delhi, 1990.

(9A23605) IMMUNOLOGY

UNIT I: THE IMMUNE SYSTEM

Introduction, Phylogeny of the Immune system, Innate and acquired immunity. Immunochemistry: Immunogens, antigens, their chemical nature, Properties influencing immunogenicity, Haptens, adjuvants.

UNIT II: BIOLOGY OF THE IMMUNE SYSTEM

Cells of the IS: Haematopoiesis, lymphocyte leafficking, T, B, Macrophases, Dendritic cells, Natural killer cells, Eosinophils, Neutrophils, Mast cells and Phasocytosis.

UNIT III: ORGANS OF THE I.S. :

Primary and Secondary organs of I.S. (Thymus, Spleen, Lymphnode, lymphoid fo kicle, MALT, CALT, SALT

UNIT IV: HUMORAL IMMUNITY-I

B-lymphocytes, their lineage, Immunoglobulins, their structure function, classes, sub classes, genetic control of ab production. (Maturation of B cell) Isotype, allotypes, Idiotypes. Antigen-Antibody intereactions, hypersensitivity.

UNIT V: HUMORAL IMMUNITY -II

Activation of B cells, their differentiation and effector functions. Hybridoma Technology Monoclonal antibodies their application. Immunotoxing chimeric antibodies and abzymes – Monoclonal Antibodies as Bio-Pharmaceuticals.

UNIT VI: CELL MEDIATED IMMUNITY

T-cells subclasses their lineage, maturation TCR diversity, MHC, Ag processing and presentation, T-cell artivation, effector functions.

UNIT VII: Hypersensitivity

Hypersensitivity: Types of hypersensitivity, Principle, mechanisms their relevance & significance. Role of immune system in transplantation, autoimmunity, tumors.

UNIT VIII: Role of immune system in transplantation, autoimmunity, tumors Transplantation- Graft rejection evidence and mechanisms of graft rejection, prevention of graft rejection, immuno suppressive drugs, Autoimmunity – experimental models of autoimmune disease treatment of autoimmune disorders and Tumor immunology.

TEXT BOOKS:

1. E. Roitt Essential Immunology, Vaccines conventional, subunit and recombinant, antidiotypic vaccine, Blackwell Scientific publications, Oxford,1991.
2. Kuby Immunology, 5th Edition. Richard A Goldsby, Thomas J Kindt Barbara A Osborne. W H Freeman and Company, 2006.

REFERENCES:

1. Benjamin E and Leskowitz S, immunology A short Course. Wiley LISS NY, 1991.
ELISA Immunological Techniques. DNA vaccines Immunotechnology
2. Cellular Molecular Immunology. Abul Abbas and Litchman, 2003.

(9ABS401) PROBABILITY AND STATISTICS

UNIT – I

Probability: Sample space and events – Probability – The axioms of probability – Some Elementary theorems – Conditional probability – Baye’s theorem.

UNIT – II

Random variables – Discrete and continuous Distributions – Distribution functions.

UNIT – III

Binomial and poison distributions Normal distribution – Related properties.

UNIT – IV

Sampling distribution: Populations and samples – Sampling distribution of mean (known and unknown) proportions, sums and differences.

UNIT – V

Estimation: Point estimation – Interval estimation – Bayesian estimation

UNIT – VI

Test of Hypothesis – Means – Hypothesis concerning one and two means – Type I and Type II errors. One tail, two-tail tests.

UNIT – VII

Tests of significance – Student’s t-test, F-test, Ψ^2 test. Estimation of proportions.

UNIT – VIII

Queuing Theory: Pure Birth and Death process, M/M/1 model and simple problems.

TEXT BOOKS:

1. Probability & Statistics, T.K.V. Iyengar, B. Krishan Gandhi and Others, S. Chand & Company.
2. Probability & Statistics, Ravindranath, B.S.R. Murthy, I.K. International Pvt. Ltd.
3. Probability & Statistics, Walpore, Myers, Ye 8th edition, Pearson Education.

REFERENCES:

1. Probability & Statistics, Amold O. Allen, Academic Press.
2. Probability & Statistics, D.K. Murugesan & P. Guru Swamy, Anuradha Publications.

3. Introduction to Probability, Charles M. Grinstead, J. Laurie Snell, University Press.
4. Probability & Statistical inference : Hogg, Tanis, Rao – 7th edition, Pearson education.

(9A23606) PLANT TISSUE CULTURE LAB

1. Preparation of Culture Media
2. Preparation of Standard Solution
3. Surface sterilization
4. Callus induction
5. Organ culture
6. Protoplast isolation, culture and Cytological examination
7. Demonstration of Protoplast fusion using PEG
8. *Agrobacterium* mediated gene transfer, selection of transformants, reporter gene (GUS) assays.

REFERENCE:

Plant Biotechnology: Practical Manual, C.C.Giri & Archana Giri, IK International, 2007.

Practical Bio technology and Plant Tissue Culture, Madhaviadhav (2010), Santhosh Nagar, S. Chand Publications, New Delhi.

EQUIPMENTS:

1. Autoclave.
2. pH Meter.
3. Laminar air flow chamber.
4. B.O.D. Incubator.

(9A23607) IMMUNOLOGY LAB

1. Immunoprecipitation
 - a) Ouchterlony's immuno diffusion technique.
 - b) Counter current immuno electrophoresis.
2. Agglutination: Haemagglutination & Blood typing / grouping.
3. Enzyme linked immunosorbant assay(ELISA)
4. Immunoglobulins purification.
5. Differential (Identification of cell types) & Total leukocyte counts of blood
6. Isolation & Viability determination of Lymphocytes from peripheral blood.
7. Lymphocyte proliferation with mitogen and migration with capillary tubes.
8. Identification of cell types by receptors – Immunofluorescence.
9. Raising of antibodies in animals – Polyclonal antibodies.

Equipments:

1. Haemocytometer
2. ELISA reader
3. Centrifuge
4. Electrophoresis unit
5. Microscope