BT-303 GENETIC ENGINEERING (4 0 0) 4

Basic Techniques, Cutting and joining DNA molecules, Cloning Vectors, Cloning strategies and DNA libraries, Sequencing and Mutagenesis, Molecular markers, Advances and applications of Transgenic and Recombinant DNA Technology

Text Books:

1. Old RW and Primrose SB .Sixth edition, "Principles of gene manipulation ", BlackWell Scientific Publications, 2001.

2. Bernard R. Glick and Jack J. Pesternak. Third edition, "Molecular Biotechnology: Principles and Applications of recombinant DNA", American Society for Microbiology, 2003.

Reference Books:

1. Nicholl DST, "An Introduction to Genetic Engineering" Cambridge University Press, 1994

BT-304 BIOREACTION ENGINEERING LABORATORY (0 0 3) 2

Demonstration of various Bioreactor configurations, In Situ sterilization of medium, sterilization cycle and Arrhenius plot, Microbial death kinetics, Demonstration of inoculation and sampling in a Continuous Stirred Tank Reactor, Determination of mixing time and power number in CSTR, Demonstration of batch, fed batch and continuous process in a CSTR, Study of kinetic parameters in batch, and continuous process in a CSTR, Determination of volumetric mass transfer coefficient in a batch reactor, Studies on biotransformation in continuous flow reactors, Study of rheology of fermentation broth in a batch bioreactor, Determination of power number in a batch bioreactor and Study of residence time distributions in batch and continuous bioreactors.

BT-305 BIOPROCESS ENGINEERING LABORATORY (0 0 3) 2

The Microbial cell growth kinetics, Preparation and characterization of immobilized enzyme, Determination of kinetic constants in free and immobilized enzyme systems, Analysis of mass transfer effects of kinetics of the immobilized enzyme reactions, Bio-conversion studies with immobilized enzyme packed bed reactors,

Effect of pH and temperature on enzyme activity, Kinetics of enzyme inhibition activity, Production of secondary metabolites in synthetic and complex industrial media, Estimation of monod parameters in batch, fed-batch and continuous cultures and Solid state fermentation

BT-306 GENETIC ENGINEERING LABORATORY (0 0 3) 2

Phage titration, Lambda Phage DNA Isolation and purification, Amplification of Lambda Phage DNA fragment by PCR, Elution of Lambda Phage DNA fragment from Agarose Gel, Restriction Digestion of Lambda Phage DNA fragment with Restriction enzymes, Cloning of Lambda Phage DNA fragment in a pUC 18 Plasmid and ligation, Green Florescence Protein GFP Cloning and Expression, Transformation of cloned plasmid in to bacterial host cells – blue white Screening, Southern Hybridization, Antibody Capture ELISA

MH-351 ENGINEERING ECONOMICS AND ACCOUNTANCY (3 0 0) 3

ENGINEERING ECONOMICS

1. Introduction to Engineering Economics, Fundamental concepts, Time value of money, Cash flow and Time Diagrams, Choosing between alternative investment proposals, Methods of Economic analysis (Pay back, ARR, NPV, IRR and B/C ratio), 2. The Effect of borrowing on investment, Equity Vs Debt Financing, Concept of leverage, Income tax and leverage 3. Depreciation and methods of calculating depreciation (Straight line, Sum of the years digit method, declining Balance Method, Annuity Method, Sinking Fund method). 4. National Income Accounting, Methods of Estimation, Various Concepts of National Income, Significance of National Income Estimation and its limitations. 5. Inflation, Definition, Process and Theories of Inflation and Measures to Control, 6. New Economic Policy 1991 (Industrial policy, Trade policy, and Fiscal policy) Impact on Industry

ACCOUNTANCY

7. Accounting Principles, procedure, Double entry system, Journal, ledger, Trial balance, Cash Book Preparation of Trading and Profit and Loss account, Balance

Sheet, 8. Cost Accounting, Introduction, Classification of costs, Methods of Costing, Techniques of Costing, Cost sheet and preparation cost sheet, Breakeven Analysis, Meaning and its application, Limitation.

Reference Books:

1. Henry Malcom Steinar-Engineering Economics Principles, McGraw Hill Pub. (For Topic 1, 2, 3)
2. Dewett K.K., "Modern Economic Theory", Sultan Chand & Co. (Topics 4, 5)
3. Agrawal AN, "Indian Economy" Wiley Eastern Ltd, New Delhi (Topic 6)
4. Jain and Narang" Accounting Part-I", Kalyani Publishers (Topic 7)
5. Arora, M.N." Cost Accounting, Vikas Publication. (Topic 8)

BT-351 ADVANCED BIOPROCESS ENGINEERING (4 0 0) 4

Advanced Bioprocess Engineering with special emphasis on animal cell bioprocess technology, The use of animal cells to produce biological therapeutics, the pertinent concepts in the use of animal cells for production of recombinant proteins and monoclonal antibodies, kinetics of cell growth, cell death and product formation, Bioreactors for suspension and anchorage-dependent cells, Issues related to process validation and safety in the use of animal cells from a regulatory point of view.

Text Books:

1. Bioprocess Engineering Basic Concepts 2nd Edition, Michael Shuler, Fikret Kargi. Prentice-Hall India. 2006.
2. Bioprocess Engineering Principles. By Paulin M. Doran. Elsevier Science & Technology Books. 2002

Reference Books:

1. Bioprocess Engineering: Kinetics, Mass Transport, Reactors and Gene Expression by Wolf. R. Vieth. A Wiley-Interscience Publication. 2000.
2. Principles of fermentation technology by P F Stanbury and A Whitaker, Pergamon press, latest edition, 2002.

BT-352 BIOPROCESS CONTROL AND INSTRUMENTATION (4 0 0) 4

Linear Open-loop systems, Linear Closed-loop systems, Frequency Response, Bioprocess Instrumentation, Bioprocess Control

Text Books:

1. Process systems analysis and control by D.R. Coughanowr, 2nd edition. Mc Graw Hill 1991

Reference Books:

2. Biochemical Engineering Fundamentals, 2nd edition, James E. Bailey, David F. Ollis; McGraw Hill.2001.

3. Introduction to Biochemical Engineering, D. G. Rao, Tata McGraw Hill. 2007.

BT-353 DOWNSTREAM PROCESSING IN BIOTECHNOLOGY (4 0 0) 4

Scope of Downstream processing, Cell disruption methods, Solid- Liquid separation, Centrifugation, Concentration of products, Membrane separation processes, Drying, Chromatographic separation and electrophoresis methods

Text Books:

1. Product Recovery in Bioprocess technology, BIOTOL series, Butterworth–Heinemann, 2006

2. Bioseparations science and Engineering, Roger G. Harrison, Paul Todd, Scott. R. Rudge, Demetri P. Petrides, Oxford University, Indian Edition 2006

3. Separation process in biotechnology, Juan A. Aseujo Taylor & Francis Publishers 2007

1. Handbook of bioseparations, Edited by Satinder Ahuja, Academic Press Volume 2, Year 2000
2. Comprehensive Biotechnology, Volume 2nd Edition: M. Moo–young (1985)

Reference Books:

1. Principles of Downstream processing, by Ronald & J. Lee, Wiley Publications, 2007

BT 354 BIOPROCESS INSTRUMENTATION AND CONTROL LAB (0 0 3) 2

Dial Thermometer-Time constant calculation, Interacting liquid level system, Non-Interacting liquid level system, Time constant of a liquid in gas thermometer, Heat transfer dynamics in a stirred tank, Computer controlled flow process analyzer(P,PD,PI,PID Controls), Computer controlled level process analyzer, Computer controlled pressure process analyzer, Computer controlled temperature process analyzer, Computer controlled heat exchanger

Reference Books:

1. Process systems analysis and control by D.R. Coughanowr, 2nd ed. Mc Graw Hill 1991

2. C.S.Rangan,G.R.Sarma & V.S.V.Mani, “Instrumentation Devices and Systems” Tata McGraw Hill Publishing company Ltd.

BT-355 DOWNSTREAM PROCESSING LAB (0 0 3) 2

Extraction of Extra and Intra cellular Proteins from Microbial source, Centrifugation methods, Sonication methods, Precipitation methods, Lyophilization procedure, Ion exchange chromatography, Gel filtration chromatography, Affinity chromatography, Tangential filtration methods, NATIVE electrophoresis, SDS PAGE electrophoresis, Storage methods for isolated products

Reference Books:

1. Principles of Protein Purification by Thomson, Wiley International Edition, 2007.
2. Chromatographic Techniques by Amersham Pharmacia hand book,2008

ME-401 INDUSTRIAL MANAGEMENT (3 0 0) 3

General Management, Leading, Marketing Management, Quality Management, Inventory Management, Project Management

Reference Books:

1. Tripathi P.C. & Reddy P.C. – Principles of Management – Tata Mc Graw Hill Pub. Co. Ltd., New Delhi.
2. Notier, Philp, Marketing Management – Prentice Hall of India., New Delhi, 1996
3. Hajra Choudhury S. A , Nirjhar Roy and Hajra Choudhury A.R. – Product Management, Media Promoters and Pub. Pvt. Ltd. Bombay, 1990
4. Roontz, H., et. al, Essential of Management – Mc Graw Hill Book Co., New Work.
5. Schoroedar, Rodar,G – Operations Management -Mc Graw Hill Pub. Books Co. New Work, 1986
6. Buffa E.S. and Sarin R.K. – Modern Product / operations management Edition, John Wiley and Sons, Singapore, 1994

BT-401 BIOINFORMATICS (4 0 0) 4

Introduction to Bioinformatics, Biological Databases, Introduction to Whole Genomic analysis, Sequence Alignments and Statistics, Overview of Protein structure.

Text Books:

1. Arthur Lesk; Introduction to Bioinformatics, Oxford University Press, Second edition, 2002

2. David W. Mount; Bioinformatics: Sequence and Genome Analysis; CSHL Press; First edition, 2001

Reference Books:

1. Andreas D. Baxevanis, Bioinformatics, A Practical Guide to the Analysis of Genes and Proteins. Wiley-Interscience, 3rd edition 2004

2. Richard Durbin; Sean R. Eddy; Anders Krogh; Graeme Mitchison; Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic Acids, Cambridge University Press, 3rd edition, reprint 2008.

BT-402 MODELING AND SIMULATION OF BIOPROCESSES (4 0 0) 4

Modelling principles, Formulation of balance equations, Information for bioreactor modelling andbiological kinetics, Bioreactor modelling.

Text Books:

1. I. J. Dunn, E. Heinzle, J. Ingham, J. E. P. fenosil "Biological Reaction Engineering: Dynamic Modelling Fundamentals with Simulation Examples" WILEY-VCH Verlag GmbH & Co. KGaA, Weinheitn ,2003
2. J.R. Leigh, Modeling and Control of fermentation Processes, Peter Peregrinus, London, Revised edition, 2000.

Reference Books:

1. Syam S. Sablani et al. Hand book of food and bioprocess modeling techniques, Taylor & Francis Group, LLC,2006

BT-403 BIOINFORMATICS LAB (0 0 3) 2

Unix practice, PERL practice, Data retrieval practice, Pairwise sequence alignment and Blast practice, Multiple sequence alignment, Phylogenetic tree building, Gene

finding practice, Protein structure visualization, Protein structure modelling, Sequence assembly and comparative genomics, Relational database practice

BT-404 MODELING & SIMULATION OF BIOPROCESSES LAB (0 0 3) 2

Flow sheeting of the chemical process using ASPEN PLUS and CHEMCAD, Design of a Heat exchanger using ASPEN PLUS, DESIGN II and CHEMCAD, Design of a Distillation column using ASPEN PLUS, Calculation of volume of a bioreactor using ASPEN PLUS, Design of pressure valves and compressors using ASPEN PLUS and CHEMCAD, Design of a evaporator using ASPEN PLUS and CHEMCAD, Design of a absorption column using ASPEN PLUS and CHEMCAD, Design of a extractor using ASPEN PLUS and CHEMCAD, Design of a dryer using ASPEN PLUS and CHEMCAD. Design of a filter using ASPEN PLUS and CHEMCAD

BT-451 BIOETHICS, BIOSAFETY & IPR ISSUES (4 0 0) 4

Introduction to Biosafety, GMOs & LMOs, Introduction to Intellectual Property, Agreements and Treaties, Patent databases, Bioethics, Case studies.

Text Books:

1. Diane O. Fleming; Debra A. Long; Biological Safety: Principles and Practices, ASM Press; 4th edition, 2006.
2. Kankanala C., Genetic Patent Law & Strategy, 1st Edition, Manupatra Information, 2007.
3. Nancy Ann Silbergeld Jecker; Albert R. Jonsen; Robert A. Pearlman; Bioethics: Introduction to History, Methods, and Practice; Jones & Bartlett Publishers; 2nd edition, 2007.

Reference Books:

1. Hambleton P.; Salisbury T.; Melling, J.; Biosafety in Industrial Biotechnology; Springer; 1stedition 1994.
2. Lim Li Ching; Terje Traavik; Biosafety First: Holistic Approaches to Risk and Uncertainty in Genetic Engineering and Genetically Modified Organisms; Tapir Academic Press, 2007.
3. BAREACT, Indian Patent Act 1970 Acts & Rules, Universal Law Publishing Co. Pvt. Ltd., 1stedition, 2007.

4. Bonnie Steinbock; The Oxford Handbook of Bioethics (Oxford Handbooks): Oxford University Press, USA; 1st edition, 2007.

BT-452 BIOPROCESS PLANT DESIGN (4 0 0) 4

Introduction, Scale up and scale down issues, Scale-up of downstream processes **,**Selection of bioprocess equipment (upstream and downstream),Facility design aspects Bioprocess economics.

Text Books:

1. Michael R. Ladisch, Bioseparations Engineering: Principles, Practice and Economics, 1st Edition, Wiley, 2001

2. Michael Shuler and Fikret Kargi, Bioprocess Engineering: Basic Concepts, 2nd Edition, Prentice Hall, Englewood Cliffs, NJ, 2002

3. Roger Harrison et al., Bioseparations Science and Engineering, Oxford University Press, 3rdedition.2003.

Reference Books:

1. Robert H. Perry and Don W. Green (eds.), Perrys Chemical Engineers Handbook, 7th Edition, McGraw Hill Book Co.,2000.

2. An introduction to Chemical Engineering Design, 2nd Edition, Butterworth-Heinemann Ltd., UK. (Indian Edition: Asian Books Private Limited, New Delhi).2002.

Departmental Elective Courses

III – Year I – Semester

BT-311 INDUSTRIAL MICROBIOLOGY AND ENZYME TECHNOLOGY (3 0 0) 3

Introduction, Production of Beer, Production of Vinegar, Single Cell Protein, Yeast Production,Production of Baker's Yeast, Production of Microbial Insecticides, Production of Fermented Foods, Production of Organic Acids and Industrial Alcohol, Enzyme technology, Immobilized enzymes, Enzyme Engineering, Lipases.

Text Books:

1. Nduka Okafor: Modern Industrial Microbiology and Biotechnology, Science publishers, Enfield, New Hampshire 03748, USA, 2007.
2. Julio Polaina and Andrew P. MacCabe: Industrial Enzymes- Structure, Function and Applications, Springer, Dordrecht, the Netherlands, 2007.

III – Year II – Semester

BT-364 PLANT BIOTECHNOLOGY (3 0 0) 3

Introduction to cell and tissue Culture, Tissue culture media (composition and preparation), Protoplast isolation, culture and fusion, Cryopreservation, Production of plant secondary metabolites *in vitro,*Plant Transformation technology (Direct, Indirect), Application of Plant Transformation for productivity and performance Application of Plant Transformation for productivity and performance Conventional Plant Breeding, limitations, Molecular Marker-aided Breeding

Text Books:

1. Hammond, R Mc Garvey and V. Yusibov (Eds.): Plant Biotechnology. Springer Verlag, 2000
2. J. Fu, G.Singh, and W.R. Curtis (Eds.): Plant Cell and Tissue Culture for the Production of Food Ingredients. Kluwer Academic/Plenum Press. 1999

Reference Books:

H.S. Chawla: Biotechnology in Crop Improvement. International Book Distributing Company, 1998
R.J. Henry: Practical Application of Plant Molecular Biology. Chapman and Hall, 1997
P.K. Gupta. Elements of Biotechnology. Rastogi and Co. Meerut. 1996

BT-365 BIOFUELS (0 0 3) 2

Introduction, Bioethanol, Lipid Derived Biofuels, BtL Fuels, Biomethane, Biohydrogen, First vs. second Generation Biofuels, Integrated Refining Concepts, Strategies for New Vehicle Technologies.

Text Books:

1. Dominik Rutz & Rainer Janssen; Biofuels Technology Hand Book, WIP Renewable Energies, 2nd Edition, Jan 2008.

Reference Books:

1. David M. Mousdale, "BIOFUELS – Biotechnology, Chemistry, and Sustainable Development",CRC Press Taylor & Francis Group,2008

IV – Year I – Semester

BT-411 BIONANOTECHNOLOGY (3 0 0) 3

Introduction to Nanoworld, Applications in various fields, Nanobiotechnology, Synthesis of nanostructures, Applications of nanobiotechnology, Biosynthesis of designer compounds.

Text Books:

1. M.Ratner and D.Ratner, Nanotechnology, Pearson education, Ist edition, 2007.
2. Nanobiotechnology: Concepts, Applications and Perspectives by Christof M. Niemeyer, Chad A. Mirkin. Wiley, John & Sons, 1st edition, 2004.

Reference Books:

1. L. E. Foster, Nanotechnology-Science, Innovation and opportunity, Person education Inc, 1st edition. 2007.

BT-414 DRUG & PHARMACEUTICAL BIOTECHNOLOGY (3 0 0)3

Introduction, Enzymes, Antibiotics, Vitamins, ergot alkaloids, steroid and other metabolites, Microbes, Gene therapy and diagnostic aids

Text Books:

1. Purohit, Kulkarni, Saluja—Pharmaceutical biotechnology (Agrobios) 2003
2. Templeton and Lasic –Gene therapy (Marcel and Dekkn) 2000

3. Mulligan-The basic science of gene therapy, Science, 260: 926-932, 1993
4. Chanock etc (Eds) Vaccines 87.Modern approaches to new vaccines including Prevention of AIDS Cold Spring harbour Lab, N.Y. 1987
5. Pharmaceutical biotechnology: drug discovery and clinical applications by kayser, Wiley publishers, 2007

Reference Books:

1. Murray Moo-Young (Ed)-Comprehensive biotechnology Vol.3. (Permagon Press) 2004
2. Drug discovery and design AP publisher, 2006
3. Pharmaceutical biotechnology 2nd edition by crommel, 2004

IV – Year I – Semester

BT-465 IMMUNOTECHNOLOGY (3 0 0) 3

Hybridoma techniques and monoclonal antibody, Purification and characterization of monoclonal antibodies, T-cell cloning, MHC class II molecules in T- cell cloning, Immunity to virus, Principles and strategy for developing vaccines, Immuno diagnosis of infectious diseases, Recent advances in immunotechnology.

Text Books:

1. Monoclonal antibodies: Principles and practice by J.W. Goding. Academic Press 1996
2. Hybridoma Technology in the Biosciences and Medicine T. A. Sringer (Editor) Plenum Press, N.Y. 1988
3. Hybridoma Techniques: A Laboratory Course by VR. Muthukkaruppan, S. Baskar and F. Sinigagalia, Macmillan India Ltd. 2000

Reference Books:

1. Basic and Clinical Immunology by D. P. Stites, J. D. Stobo, H. H. Fudenberg J.V. Wells. 5th Edition Large medical publications.1994.
2. Isolation, Characterization and Utilization of T-lymphocyte clones by C.Garrison Fathman, F.W. Fitch academic Press. 2002.

BT-464 STEM CELL TECHNOLOGY (3 0 0) 3

Stem cell – Definition, Cell types and sources Reconstruction of connective tissues, Isolation and identification of stem cells Type of stem cell, Haematopoietic stem cell therapy for autoimmune disease Human stem cell research in India, Human embryonic stem cell ethics and Public policy.

Text Books:

1. Stem Cells Handbook, Editor: Stewart Sell, Humana Press; Oct. 2003
2. Stem Cell Biology, Editors: Daniel R. Marshak, Richard L. Gardner and David Gottlieb Cold Spring Harbor Laboratory Press, Cold Spring Harbor NY, USA; 2001
3. Adult Stem Cells, Editor: Kursad Turksen, Humana Press; Jan. 2004
4. Human Embryonic Stem Cells, Editors: Arlene Chiu, Mahendra S. Rao, Humana Press; 2003
5. Neural Stem Cells for Brain and Spinal Cord Repair, Editors: Tanja Zigova, Evan Y. Snyder, Paul R. Sanberg, Humana Press; 2002
6. Stem Cells and the Future of Regenerative Medicine, Committee on the Biological and Biomedical Applications of Stem Cell Research, Board on Life Sciences, National Academies Press, 2002.

Reference Books:

1. Neural Stem Cells: Methods and Protocols, Tanja Zigova, Paul R Sanberg, Juan R Sanchez-Ramos,Humana Press; 2002
2. Human Embryonic Stem Cells: An Introduction to the Science and Therapeutic Potential
3. Ann Kiessling and Scott C. Anderson,Jones and Bartlett Publishers, 2003