



C. U. SHAH UNIVERSITY

FACULTY OF LIFE SCIENCES
MASTERS OF SCIENCE (BIOTECHNOLOGY)

SEMESTER: II

NAME: Bioprocess Technology

CODE: 5SC02BPT1

	Course contents
UNIT 1	Introduction to bioprocess engineering, bioreactors, isolation, preservation and maintenance of industrial microorganisms, kinetics of microbial growth and death, media formulation for industrial fermentation, Air and media sterilization. Designing of a fermenter/Bioreactor.
UNIT 2	Types of fermentation process, analysis of batch fed batch and continuous bioreactions, biotransformation, stability of microbial reactors, analysis of mixed microbial populations, specialized bioreactors (pulsed, fluidized, photo bioreactors etc.) Measurement and control of bioprocess parameters
UNIT 3	Downstream processing: introduction, removal of microbial cells and solid matters, foam separation, precipitation, filtration, centrifugation, cell disruption, liquid-liquid extraction, chromatography, membrane process, drying and crystallization, effluent treatment
UNIT 4	Cytoskeleton and cell motility: Microtubules, microfilaments and intermediate elements. Nuclear ingredients: Nuclear membrane Nature of the genetic material, Proteins associated with nuclei. Packaging of genetic material: nucleosome model, Organisation of chromatin: chromosome structure. Industrial production of chemicals: alcohols, acids (citric, acetic and gluconic), solvents (glycerols, acetone, butanol), antibiotics (penicillin, streptomycine, tetracycline) amino acids (lysine, glutamic acid), single cell proteins
UNIT 5	Food Biotechnology: Food spoilage and preservation process, dairy products, wine, beer and other alcoholic Beverages and formulated plant products, petro crops, food from water, fungal protein food from yeast, hybrid seeds, conventional breeding of plant for food production. Transformation of steroids and non steroid compounds. Mushroom -types, isolation and culture.

Teaching & Learning Methodology:-

- Use of audiovisual aids.
- Use of charts.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.



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MASTERS OF SCIENCE (BIOTECHNOLOGY)

Books Recommended:

- 1. Sullia S. B& Shantharam S: (1998) General Microbiology, Oxford & IBH Publishing Co. Pvt.Ltd.**
- 2. Glaser A.N & Nilaido.H (1995) Microbial Biotechnology,W.H Freeman & Co.**
- 3. Prescott & Dunn (1987) Industrial Microbiology 4th Edition, CBS Publishers & Distributors.**
- 4. Prescott & Dunn (2002) Industrial Microbiology, Agrobios (India) Publishers.**
- 5. Crueger W. & Crueger A. (2000) A text of Industrial Microbiology, 2nd Edition, PanimaPublishing Corp.**
- 6. Stanbury P.F, Ehitaker H, Hall S.J (1997) Priciples of Fermentation Technology,, Aditya Books (P) Ltd.**
- 7. S.N.Jogdan (2006) Industrial Biotechnology, Himalaya Publishing House**



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MASTERS OF SCIENCE (BIOTECHNOLOGY)

NAME: **Molecular Biology & Genomics**

CODE: **5SC02MBG1**

	Course contents
UNIT 1	<p>Nuclear organization: Chromosomal DNA and particles, nucleosomes. Modern Concept of gene organization. Chromosomal replication, synthesis and processing (DNA replication, Enzymology of DNA replication), DNA repair.</p> <p>Gene mutation: Types of mutations, Molecular mechanism of mutations Chromosomal mutations: changes in the structure of chromosome and changes in number of chromosomes, polyploidy.</p>
UNIT 2	<p>Transcription and Transcriptional control: Structure of bacterial RNA polymerase, Transcription events, and sigma factor cycle, Eukaryotic RNA polymerase, Promoter sequences, TATA box, Hogness Box, CAAT box, Enhancers, upstream activating sequences, Initiation and termination of transcription factor, RNA processing in Prokaryotes Vs Eukaryotes, Spliceosome. Transcriptomics.</p>
UNIT 3	<p>Translation: Prokaryotic and Eukaryotic translation, the translation machinery, Mechanisms of initiation, elongation and termination, Regulation of translation. Post-translational modifications and intracellular proteins transport</p>
UNIT 4	<p>Control of gene expression in prokaryotes and eukaryotes, operon model- lac and trp operon, Autogenous regulation, Feedback inhibition, Lytic cascades and lysogenic repression. Molecular Biology of Cancer causes and Genetics of cancer, Tumor suppressor genes and onco genes, anticancer agent (p53 and pRB).</p>
UNIT 5	<p>Whole Genome analysis, DNA microarray. Genome analysis for global patterns of gene expression using fluorescent-labelled cDNA or end-labelled RNA probes. Gene mapping and applications- Transcriptome and Proteome- General Account. Protein sequence analysis by mass spectroscopy. Protein microarrays. Advantages and disadvantages of DNA and protein microarrays.</p>

Teaching & Learning Methodology:-

- Use of audiovisual aids.
- Use of charts.



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- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

Books Recommended:

1. Molecular Biology of the Gene (1987) Watson J. D., Hopking N., Robast J. and Steiz, J.
2. Gene IX: Lewine Benjamin.
3. The Biochemistry of the nucleic acid (1996) Adams et al
4. Microbial Genetics: David Fridfelder.
5. Molecular cell Biology (1999) Lodish, H., Baltimore, D., Berk, A, Zipursky SL, Paul M and Darnell J.
6. Cell and Molecular Biology (1996) Gerald Karp.



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FACULTY OF LIFE SCIENCES
MASTERS OF SCIENCE (BIOTECHNOLOGY)

NAME: Enzymology and Enzyme technology

CODE: 5SC02EET1

	Course contents
UNIT 1	Introduction to Enzymes, enzyme nomenclature, enzyme commission numbers, and classification of enzymes. Isolation and purification of enzymes, preparation of purification chart, Enzyme activity, Specific activity and turn over number, Marker enzymes.
UNIT 2	Enzyme Kinetics: Steady state, pre-steady state, equilibrium kinetics, Michaelis and Menten Equation and its derivation, Different methods to calculate the K_m and V_{max} and their significance.
UNIT 3	Factor affecting enzyme activity and catalysis: pH, substrate and enzyme concentration, temperature, coenzyme and cofactors, Mechanism of action of enzymes involving two/more substrates. Role of metal ions in enzyme catalysis. Enzyme inhibition, different types of inhibitors and activators.
UNIT 4	Structure and function of enzymes: Lysozyme, chymotrypsin, DNA polymerase, RNase, proteases. Enzyme regulation and control of their activity. Introduction to allosteric enzymes and isozymes. Immobilization of enzymes, whole cell immobilization and their application, commercial production of enzymes, Protein and Enzyme engineering: Design and construction of novel enzymes.

Teaching & Learning Methodology:-

- Use of audiovisual aids.
- Use of charts.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

Books Recommended:

1. Enzyme Kinetics (1995) Palmer
2. IUPAC Enzyme nomenclature series.
3. Enzyme kinetics: Dixon W. B.
4. General Enzymology :Kulkarni & Deshpande
5. Enzyme Assays:J. Raymond



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FACULTY OF LIFE SCIENCES
MASTERS OF SCIENCE (BIOTECHNOLOGY)

NAME: **Industrial Microbiology**

CODE: **5SC02IMB1**

Course content:

	Course contents
UNIT I	Introduction and scope of industrial microbiology; Biology of industrially important microbes (metabolic pathways and control mechanisms); Isolation and selection of industrially important microorganisms; Genetic improvement of microbes; Preservation and maintenance of microbial cultures.
UNIT II	Microbial substrate- Media formulation, Optimization of media; Cell growth kinetics: Kinetics of substrate utilization, biomass production and product formation in batch, fed batch and continuous cultivations; Kinetics of death of microorganisms
UNIT III	Types of fermentation processes; Solid state, Static and submerged fermentations; Design of laboratory bioreactor; Types of Bioreactor: Stirred tank reactor, bubble column reactor, Airlift reactor, Packed bed reactor, Fluidized bed reactors; Scale-up principles; Instrumentation and control of bioprocesses; Downstream process; Fermentation economics.
UNIT IV	Types of microbial products; Production of Biomass: Baker's Yeast, Mushroom, Single cell proteins, Biopesticides and biofertilizers; Production of primary metabolites: Ethanol; organic acids e.g. citric acid and lactic acid; Amino acids: Glutamate; Vitamins; Industrial enzymes. Production of secondary metabolites: Antibiotics (penicillin, cephalosporins, streptomycin, etc), Pigments, enzyme inhibitors; Microbial transformation, Production of metabolites of non-microbial origin eg Insulin, Interlukin, Cytokines etc using rDNA technology. Designer microbes using synthetic genome.

Teaching & Learning Methodology:-

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Books Recommended:



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1. Stanbury P. F., A. Whitaker, S. J. Hall. Principles of Fermentation Technology Publisher: Butterworth-Heinemann
2. Shuler M.L. and F. Kargi: Bioprocess Engineering Basic Concepts by Publisher Prentice Hall.
3. Vogel H.C., C.L. Todaro, C.C. Todaro: Fermentation and Biochemical Engineering Handbook: Principles, Process Design, and Equipment by Publisher: Noyes Data Corporation/ Noyes Publications.
4. W. Crueger and A. Crueger: Biotechnology. A Textbook of Industrial Microbiology, Publisher : Sinauer Associates.
5. Prescott and Dunn's Industrial Microbiology. Publisher: Gerald Reed: Books.
6. Casida L. E. J. R: Industrial Microbiology by Publisher: New Age (1968)



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FACULTY OF LIFE SCIENCES
MASTER OF SCIENCE (MICROBIOLOGY)

DEPARTMENT OF MICROBIOLOGY

SEMESTER: II

CODE: 5SC02BTL1

NAME: Biotechnology Lab-II

Experiment
Methods of isolation, purification and maintenance of microorganisms from different environments (air, water, soil, milk and food). Staining of bacteria and actinomycetes, Use of selective media, Enrichment culture technique – isolation of asymbiotic nitrogen fixing bacteria; Isolation of symbiotic nitrogen fixing bacteria from nodules, Isolation of antibiotic producing microorganisms. Morphological, physiological and biochemical characterization of isolated bacterial cultures.
Determination of viable and total number of cells, Measurement of cell size, Growth – types of growth (synchronous, diauxic, batch), study factors affecting growth, Enzyme Kinetics: Steady state, pre-steady state, equilibrium kinetics, Michaelis and Menten Equation and its derivation, Different methods to calculate the K_m and V_{max} and their significance..
Isolation of industrially important microorganism from different sources using specific substrates; Design and Preparation of Media for Bioprocesses; Growth curve studies of bacteria/Yeasts in batch culture and calculation of maximum specific growth rate; To study the various methods of biomass measurement; Production of ethanol from sucrose by yeast; Determination of yield coefficient and Monod's constant and metabolic quotient of <i>E.coli</i> culture on glucose.; To study the design of fermenter and its working; Production of citric acid using sucrose and molasses; Production of extracellular enzymes.