



SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

Accredited "A" Grade by NAAC | 12B Status by UGC | Approved by AICTE

www.sathyabama.ac.in

School of Bio and Chemical Engineering
Department of Biotechnology
1.1.2 Revision & New Courses Introduced in 2022- 2023
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Board of Studies

Minutes of Meeting (EVEN SEM)

Date: 30th APRIL 2022

Time: 11 am

Chair-person : **Dr. Ramesh Kumar**

Attendees : **Ms. Sathya V**
Scientific Manager, Affigenix Biosolutions Pvt Ltd

Dr. Edward

Head of the Department, Department of Biotechnology,
St. Joseph's College (Autonomous), Trichy

Dr. Ramesh Kumar V, Internal member

Dr. Valli Nachiyar C, Internal member

Dr. Jayshree Nellore, Internal member

The Chair-person welcomed the members.

Following which discussions were held as follows,

Agenda Item 1: Review and approval of the course contents for the following courses of 'B.Tech-Biotech' students during the academic year 2022-2023.

- Biomechanics, Molecular Biology and Genetics, Genetic Engineering, Nanobiotechnology, Pharmaceutical Biotechnology, Nanotechnology and Computational Biology Lab
- Professional Elective (Molecular Therapeutics and Diagnostics) Has Been Introduced In 7th Semester

Resolutions: The Board reached a consensus and accorded its endorsement to the curriculum and outline for the above courses (Annexure I). The revised syllabus will be implemented accordingly.

Agenda Item 2: Proposed modifications of the course content for the following courses and Introduction of new elective for 'M.Tech-Biotech' for the academic year 2022-2023

- Advanced Biochemistry, Biochemistry and Microbiology Lab
- New Elective Biotechnology Entrepreneurship

Resolutions: The Board considered and approved the scheme and syllabus for the above courses.

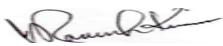
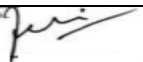
(Annexure II)

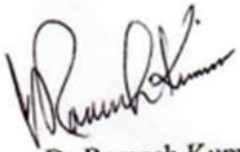
Agenda Item 3: Modifications proposed for the course contents for the following courses of 'Bachelor of Science (Microbiology and Biotechnology)

- Medical Bacteriology, Bacteriology and Virology Lab, Animal Biotechnology

Resolutions: The BoS sanctioned the proposal to revise the course syllabus and approved the same (Annexure III)

Based on the suggestions given by the members, BoS resolved to recommend the minutes to the Academic Council for further approval.

Internal Member	Designation	Signature
Dr. Edward	Head (External member)	
Ms.Sathya V	Scientific Manager (Industry Expert)	
Dr.Ramesh kumar	Head	
Dr.Valli Nachiyar	Professor	
Dr. Jayshree Nellore	Professor	


Dr.Ramesh Kumar
(Head of the Department)

HEAD OF THE DEPARTMENT
DEPARTMENT OF BIOTECHNOLOGY
SATHYABAMA
INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)
Jeppiaar Nagar, Rajiv Gandhi Salai
Chennai-600 119

ANNEXURE I

SBTA1102	BIOMECHANICS	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To gather adequate knowledge the mechanics involved in human beings.
- To understand the fundamental principles related to mechanical actions of biological tissues

UNIT 1 INTRODUCTION

9 Hrs.

Introduction to Biomechanics, History, Applications, Perspectives in Biomechanics and Ethical Considerations; Rigid Body BioMechanics and Anatomical Concepts in Biomechanics, Fundamentals of Biomechanics, Anthropometric Considerations, Newtons Laws of motions and Basic Principles of Mechanics

UNIT 2 MECHANICS OF HARD TISSUES MUSCULOSKELETAL BIOMECHANICS

9 Hrs.

Whole body modeling, Structure of bones – Composition and properties of bones and relationship to structure – Elastic properties of bones, Bone fracture mechanics, Implants for bone fractures, Lubrication of joints. The Human Body as a Biomechanical System: Basic Terminologies. Kinematics of Muscles and Joints: Free-Body Diagrams, Equilibrium, and Forces. Biomechanical Analysis of Upper Limb Joints: Shoulder, Elbow, Wrist, Hand, and Fingers. Upper Limb as a Mechanical System: Analysis of Reaching Movement. Biomechanical Analysis of Lower Limb Joints: Spine, Hip, Knee, Ankle.

UNIT 3 MECHANICS OF SOFT TISSUES SOFT TISSUE BIOMECHANICS AND GAIT ANALYSIS

9 Hrs.

Tissue Mechanics-Structure and functions of cartilages, tendons, ligaments, Mechanical Properties of Tissues, Mechanical Properties of Soft Tissues: Cartilages, Tendons, Ligaments, and Skin. Biological materials, Pseudo elasticity, Tissue Mechanics and nonlinear stress-strain relationships, viscoelasticity Properties of Soft Tissues and Maxwell & Voigt models, structure, function and mechanical properties of skin, ligaments and tendons, Mechanical testing of Soft tissue. Introduction to Postural Stability and Gait Analysis. Gait Analysis in Health and Disease: Basics.

UNIT 4 BIOMECHANICS OF HARD TISSUES AND CARDIOVASCULAR SYSTEM

9 Hrs.

Mechanics of Hard Tissues: Stress, Strain, and Deformation Mechanics. Structure and Mechanical Properties of Bone: Cortical and Cancellous Bones, Wolff's Law. Cardiovascular Physiology, Heart Valve Dynamics, Prosthetic Valve Dynamics. Mechanical properties of blood vessels, – arteries, arterioles, capillaries, veins, blood flow in the Cardiovascular System: laminar and turbulent.

UNIT 5 APPLICATIONS OF BIOMECHANICS

9 Hrs.

Applications of BioMechanics: of spinal distraction rods, Biomechanics of human motion and control interfaces with application to limb orthotics and prosthetics, Design of hip prosthesis, Automated driver's training programme and Sports. Biomechanics in Biotechnology: Designing Medical Devices and Implants. Emerging Trends in Biomechanics Research and Technologies. Ethical Considerations in Biomechanics: Human Subject Research and Privacy Concerns.

ax.45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understand the principles and mechanics of hard tissues.
- CO2 - Outline the principles of biofluid dynamics.
- CO3 - Explain the fundamentals of soft tissues
- CO4 - Apply the knowledge obtained in cardiovascular mechanics
- CO5 - Discover mechanics related to cardiovascular system.
- CO6 - Apply the knowledge gained to find solutions to various need in biomechanics

TEXT / REFERENCE BOOKS

- Robert L.Huston, Principles of Biomechanics, CRC Press, 2005.
- Ozkaya and Nordin, Fundamentals of Biomechanics: Equilibrium, Motion and Deformation, 2002.
- Gardiner M. Dena, The principles of exercise therapy, CBS Publisher, 2000.
- Fung Y.C., Bio-Mechanics - Mechanical Properties of Tissues, Springer-Verlag, 2000.
- Subrata Pal, Textbook of Biomechanics, Viva Books Private Limited, 2009.
- Bruce M. Koeppen and Bruce A. Stanton, Mosby, Berne & Levy Physiology, 6th Edition, 2009.



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SBTA1301	MOLECULAR BIOLOGY AND GENETICS	L	T	P	Credit	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- The course aims to give an understanding on the fundamentals of conventional genetics and the intricate molecular mechanisms of heredity and variations.
- To understand storage of genetic information and its translation at molecular level in prokaryotic and eukaryotic systems.

UNIT 1 CLASSICAL GENETICS

9 Hrs.

Fundamental principles of genetics- Mendel's principles and experiments, gene interaction, multiple alleles, complementation, **linkage**, sex linked, sex limited and sex influenced inheritance; Chromosomes basis of heredity- extra-chromosomal inheritance; Linkage and crossing over; Hardy-Weinberg equilibrium **and its** Extensions **of Hardy-Weinberg equilibrium**.

UNIT 2 STRUCTURE AND PROPERTIES OF NUCLEIC ACIDS

9 Hrs.

Introduction to nucleic acids: Evidence for DNA&RNA as a genetic material: **Historical evidence and significance**; Structure and physicochemical properties of elements in DNA and RNA. **Biological significance of differences in DNA and RNA**. Primary structure of DNA: Chemical **and structural qualities composition of** 3',5'-Phosphodiester bond. Secondary Structure of DNA: Watson & Crick model and Chargaff's rule; DNA replication- **Overview of** differences in prokaryotic and eukaryotic **DNA replication**, **D-loop and rolling circle mode of replication**, Telomere replication in eukaryotes; Okazaki fragments, **mechanisms and Fidelity of DNA replication**, DNA repair and Mutagens. **DNA mutations and: various types of repair mechanisms, mutagens, and inhibitors of replication**

UNIT 3 TRANSCRIPTION **AND RNA PROCESSING**

9 Hrs.

Central Dogma in molecular biology - **Structure and function** **Role** of mRNA, rRNA tRNA and micro RNAs. Characteristics of promoter and enhancer sequences. RNA synthesis: Initiation, elongation and termination in **Transcription of RNA synthesis**, **Proteins of RNA synthesis**, Fidelity of RNA synthesis, Inhibitors of transcription, Differences in Prokaryotic and eukaryotic transcription: **Differences and Regulation**. **Basic concepts in RNA world**; RNA processing: 5'-Capping, Splicing (Alternative splicing), Poly 'A' tail addition and base modification.

UNIT 4 TRANSLATION **AND POST-TRANSLATIONAL MODIFICATIONS**

9 Hrs.

Introduction to Genetic code: Elucidation of genetic code, Codon degeneracy, Wobble hypothesis **and its importance**, Prokaryotic and Eukaryotic ribosomes: **Structural differences and roles**, Steps in translation: Initiation, Elongation and termination of protein synthesis. Inhibitors of protein synthesis. Post-translational modifications **and its importance: Significance and Types**.

UNIT 5 REGULATION OF GENE EXPRESSION

9 Hrs.

Organization of Genes in prokaryotic and eukaryotic chromosomes- operon concept; **Hierarchical Levels of Gene expression and regulation- Overview of transcriptional, post-transcriptional, translational, and post-translational regulation**, Prokaryotic gene regulation –lac and trp operon, Eukaryotic gene regulation- gene silencing and **epigenetics**.

Max.45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Explain the foundations of Mendelian genetics and chromosomal theory and apply these, with appropriate terminology, to contemporary concepts in genetics.
- CO2 - Emphasize the molecular mechanism of DNA replication and repair in various organisms
- CO3 - Explain the properties of genetic materials and storage and processing of genetic information.
- CO4 - Analyze the processes of transcription and translation in both prokaryotes and eukaryotes at molecular level.
- CO5 - Understand the redundant and universal qualities of the genetic code and how it is used to determine the amino acid sequence of a polypeptide.
- CO6 - Compare the mechanisms of gene regulation in prokaryotes and eukaryotes.

TEXT / REFERENCE BOOKS

- Lewin B., Genes XI, International Edition, Jocelyn Krebs, Stephen Kilpatrick and Elliott Goldstein, Jones & Bartlett Learning, 2017, ISBN 978-1-4496-5985-1
- Tropp, Burton E., Molecular Biology: Genes to Proteins, 3rd Edition, Jones and Bartlett, 2008.
- Glick B.R. and Pasternak J.J., Molecular Biotechnology: Principles and Applications of Recombinant DNA, 4th Edition. ASM, 2010.
- Weaver, Robert F., Molecular Biology, 2nd Edition, Tata McGraw Hill, 2003.
- Karp, Gerald, Cell and Molecular Biology: Concepts and Experiments, 4th Edition, John Wiley, 2005.

6. De Robertis E.D.P. and De Robertis, E.M.F., Cell and Molecular Biology. 8th Edition, Lippincott Williams and Wilkins, Philadelphia, 2006.
7. Watson J.D., Baker T.A., Bell S.P., Gann A., Levine M. and Losick R., Molecular Biology of the Gene, 6th Edition, Cold Spring Harbour Lab. Press, Pearson Publication, 2008.
8. Primrose S.B. and Twyman R.M., Principles of Gene Manipulation and Genomics, Blackwell Publishing, 7th Edition, 2006, ISBN 1-4051-3544-1
9. Gardner E.J., Simmons M.J. and Shustad D.P., Principles of Genetics, 8th Edition, John Wiley & Sons, Singapore, 2003.
10. Strickberger M.W., Genetics, 3rd Edition, Prentice Hall of India, New Delhi, 2008.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

Part A: 10 Questions of 2 marks each - No choice

20 Marks

Part B: 2 Questions from each unit of internal choice, each carrying 16 marks

80 Marks



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SBTA1501	GENETIC ENGINEERING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- Genetic Engineering course explores the manipulation of DNA using various tools and methods for its diverse application in the field of industry, medicine, plant and animal Biotechnology.

UNIT 1 **MOLECULAR TOOLS IN GENETIC ENGINEERING** INTRODUCTION TO GENETIC ENGINEERING AND DNA MANIPULATIVE ENZYMES 9 Hrs.

History, milestones and recent developments in Genetic Engineering; Steps involved in rDNA technology: **Overview of recombinant DNA Technology**, DNA manipulative enzymes -Restriction enzymes: Endo & Exonucleases. Modifying enzymes- DNA & RNA polymerase, reverse transcriptase, terminal transferase; **Modifying Enzymes: nucleases (DNases, RNases, S1)** T4 polynucleotide kinase, Alkaline Phosphatase and ligase (E. coli & T4). Ligation **Techniques**: cohesive & blunt end ligation– linkers, adaptor & homopolymer tailing.

UNIT 2 **CLONING VECTORS** **CLONING VECTORS AND GENE TRANSFER METHODS** 9 Hrs.

Ideal properties of a cloning vector. Plasmid vectors -pBR322 and its derivatives, phage vectors (λ & M13), Cosmid vectors, Shuttle and expression vectors; Yeast vectors-YAC & BAC (E.coli); Gene transfer methods.

UNIT 3 **CLONING STRATEGIES** **and Libraries** 9 Hrs.

Screening and selection of recombinants; Hybridization methods-Southern, Northern, Western; Construction of genomic & c DNA libraries. Expression in bacteria, yeast, insects, plant & mammalian cells.

UNIT 4 **TECHNIQUES IN GENETIC ENGINEERING** 9 Hrs.

DNA sequencing **Methods**– Maxam Gilbert & Sanger's, Nicolson sequencing methods, Pyrosequencing. PCR (Polymerase Chain Reaction)- Principle, types and applications; Site directed mutagenesis. Gene mapping-definition, types and **Techniques**. Molecular Markers for Gene mapping. **Restriction mapping, FISH. Molecular markers used for gene mapping .PCR based and Hybridization based methods** RFLP, AFLP, VNTR, STS.

UNIT 5 **APPLICATIONS, ETHICS, AND FUTURE OF GENETIC ENGINEERING** 9 Hrs.

Strategies in plant and animal genetic engineering. Application of Genetically modified organisms **(GMOs)** ; hazards and ethics associated with **use of** GMO use. Production of recombinant proteins. DNA vaccines. Chromosomes engineering, targeted gene replacement, gene editing, gene silencing. Gene therapy **and Overview of the** Human Genome Project.

Max.45 Hrs.

COURSE OUTCOMES

On completion of course, student will able to

- CO1 - Explain the steps involved in rDNA technology
- CO2 - Prioritize a specific cloning vector for cloning in prokaryotes and eukaryotes.
- CO3 - Express specific model organisms used for recombinant protein production
- CO4 - Consider the efficiency of PCR based cloning in comparison to traditional cloning strategies.
- CO5 - Show the prospects of gene editing
- CO6 - Evaluate the hazard and impact of genetically modified organisms

TEXT / REFERENCE BOOKS

1. Primrose, S.B. and Twyman, R.M., 2006. Principles of Gene Manipulation and Genomics - 7th Edition. Blackwell Publishing Company.
2. Dubey R.C., A Text Book of Biotechnology. S. Chand & Co Ltd, New Delhi.
3. Brown T.A., Genomes. 3rd Edition. New York: Garland Publishing Co. New York: Garland Science, 2008..
4. Satyanarayana U., Biotechnology, Books and Allied (P) Ltd., 2008.
5. Channarayappa, 2007, Molecular Biotechnology: Principle and Practices. CRC Press.

REFERENCE BOOKS:

1. Tropp, Burton E. "Molecular Biology: Genes to Proteins". 3rd Edition. Jones and Bartlett, 2008.
2. Benjamin Lewin. Gene VII. Oxford University Press, Nelson Cox



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SBTA1503	NANOBIOTECHNOLOGY	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To produce and apply various types of nanostructured materials.
- To suggest methods for the characterization of nanomaterials.
- To use basic principles to solve biotechnical problems
- To assess risks of nanobiotechnology to society and environment.

UNIT 1 INTRODUCTION OF NANOTECHNOLOGY**9 Hrs.**

History of nanotechnology: Evolution and significant milestones., definitions in nanotechnology: Understanding the nanoscale and its significance, approaches in nanotechnology: Top-down and bottom-up approaches, generations of nanotechnology, properties and application of nanotechnology

UNIT 2 CHARACTERIZATIONS OF NANOMATERIALS**9 Hrs.**

Optical characterization: UV-Vis and Fluorescence spectroscopy, X-ray diffraction – Bragg's law and crystal structure determination, Imaging and Size Characterization: Electron microscopy, light scattering, Zeta potential, Surface and Composition Analysis: Techniques like EDAX, AFM/STM, Vibrational Characterization: FT-IR and Raman spectroscopy.

UNIT 3 SYNTHESIS AND PRODUCTION OF NANOPARTICLES**9 Hrs.**

Production of nanomaterials by Methods: physical, chemical and biological synthesis – Fabrication and Characterization of nanomaterials, Biopolymer derived nanomaterials: Chitosan, PHB, polysaccharides - applications

UNIT 4 NANOMATERIALS AND DIAGNOSTICS/DRUG DELIVERY AND THERAPEUTICS**9 Hrs.**

Self-assembly of nanoparticles, Modified Nanoparticles for drug delivery- Peptide/DNA /Lipid Nanoparticles, Metal/Metal Oxide Nanoparticles for biological activity: antibacterial, anti-fungal, anti-viral, anticancer applications, Nanomaterials for imaging and hyperthermia.

UNIT 5 TOXICITY EVALUATION OF NANOMATERIALS NANOMATERIALS SAFETY AND ENVIRONMENTAL IMPACT**9 Hrs.**

Toxicity Evaluation: genotoxicity, cytotoxicity assessment using nanoparticles using invitro and invivo systems. Nanoparticles disposal methods and risk management. Ethical Considerations: Addressing potential environmental and health impacts.

Max.45 Hrs.**COURSE OUTCOMES**

On completion of course, student will able to

- CO1 - Understand the evolution of Nanotechnology and its applications CO2 - Study the techniques used for characterization of nanomaterials CO3 - Production of nanoparticles by different methods CO4 - Understand the drug delivery system using nanotechnology CO5 - Understand the toxicity evaluation methods of nanoparticles CO6 - Understand the development of nanotechnology in biology

TEXT / REFERENCE BOOKS

1. Christof M. Niemeyer, Chad A. Mirkin, Nanobiotechnology: Concepts, Applications and Perspectives, Wiley, 2004
2. Arunava Goswami, Samrat Roy Choudhury, Nanobiotechnology: Basic and Applied Aspects, Anthem Press, 2017.
3. Tatsuya Okuda, Ben-Shung Chow, Nanobiotechnology: Concepts Applications and Perspectives, Scitus Academics LLC, 2018.
4. Yubing Xie, The Nanobiotechnology Handbook, CRC Press, 2012.



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SBTA1504	PHARMACEUTICAL BIOTECHNOLOGY	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVE

- To understand drug metabolism pathway, thereby we able to come up with novel lead molecules.

UNIT 1 INTRODUCTION TO PHARMACEUTICAL BIOTECHNOLOGY

9 Hrs.

Development Evolution of Drug Development and Pharmaceutical Industry: Integration of Biotechnology in Pharmaceuticals. Therapeutic agents, their uses and economics; Routes of drug administration. Biopharmaceutical Agents: Biologics, biosimilars, monoclonal antibodies, and their therapeutic applications, Selection criteria for route of administration. Routes of Drug Administration: Biotechnological considerations in route selection

UNIT 2 DRUG METABOLISM AND PHARMACOKINETICS

9 Hrs.

ADME of Drugs Biopharmaceuticals, Pharmacokinetics of Biologics: Influence of pharmacokinetic parameters on biologics efficacy and safety. Drug metabolism- pharmacokinetics-action of drugs on human bodies, Factors in influencing metabolism

UNIT 3 IMPORTANT UNIT PROCESSES AND THEIR APPLICATIONS

9 Hrs.

Bulk drug Manufacture: Types of Reactions in Bulk drug Manufacture and Processes. Special Requirements for Bulk Drug Manufacture and its regulatory aspects.

UNIT 4 PRODUCT FORMS AND DEVELOPMENT

9 Hrs.

Compressed tables, wet granulation-dry granulation or slugging-direct compression-tablet presses, coating of tablets, capsules sustained action dosage forms-parental solutions-oral liquids-injections-ointments-Topical Application, Preservation, analytical methods and test for various drugs and pharmaceuticals, Labeling, Packing, Packing Techniques, Quality Management, GMP.

UNIT 5 PHARMACEUTICAL PRODUCTS

9 Hrs.

Therapeutic categories such as laxatives - analgesics - non steroidal contraceptives - external antiseptics - antacids and other, antibiotics - biological - hormones - vitamins with respect to system. Pharmaceutical Development Regulatory Framework: Introduction to drug regulations, Advanced Drug Development: pre-clinical and clinical trials.

Max.45 Hrs.

COURSE OUTCOMES

On completion of course, student will able to

- CO1 - Summarise the drug development process and pharmaceutical industry CO2
- Discuss the mode of drug interaction and contra interaction
- CO3 - Apply the chemical processes in Drug manufacturing process
- CO4 - Sketch the steps involved in the manufacturing process of various formulation
- CO5 - Asses the quality control and good manufacturing practices in the pharmaceutical industry CO6
- Know the mechanism of drug action in the human body

TEXT / REFERENCE BOOKS

- Gary Walsh, Biopharmaceuticals: Biochemistry and Biotechnology, 2nd Edition, Wiley Publication, 2004.
- Crommelin, Daan J. A., Sindelar, Robert D., Meibohm, Pharmaceutical Biotechnology Fundamentals and Applications, Editors: Bernd (Eds.), 2013.
- liver Kayser, Heribert Warzecha, Pharmaceutical Biotechnology: Drug Discovery and Clinical Applications, 2nd Edition, First Published, 2012
- Chandrakant Kokate S.S., Jalalpure Pramod H.J. Elsevier, Textbook of Pharmaceutical Biotechnology Health Sciences, 2016.
- F. Brown, Anthony Mire-Sluis, The Design and Analysis of Potency Assays for Biotechnology Products: (Developments in Biologicals) London, 2000.



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SBTA2702	NANOTECHNOLOGY AND COMPUTATIONAL BIOLOGY LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVE

- To study the nanomaterial structure and synthesis process and to understand the mechanisms of computational biology.

SUGGESTED LIST OF EXPERIMENTS NANOTECHNOLOGY

1. Study the diverse form of nanomaterials
2. Synthesis of Nanoparticles using Chemical reduction method
3. Purification of Nanoparticles Nanoparticle Purification and Stability Evaluation
4. Primary characterization using spectroscopy methods
5. Phytochemical methods of nanoparticle synthesis
6. Synthesis of nanoparticles using microorganism (intracellular / extracellular)
7. Structural modification Functionalization of nanoparticles using polymer coatings
8. Evaluation of stability of nanomaterial
9. Nanotoxicity Assessment

COMPUTATIONAL BIOLOGY

1. Advanced Visualization Software and 3D representations Molecular Visualization and Structure Analysis with VMD and Rasmol
2. Coordinate generations and inter-conversions.
3. Secondary Structure Prediction
4. Fold Recognition, ab initio method
5. Homology based comparative protein modeling.
6. Energy minimizations and optimization
7. Validation of models.
 1. WHATIF
 2. PROSA
 3. PROCHECK
 4. VERIFY 3D
8. Protein Structure Alignment.
9. Modeller
10. Structure based Drug Design
 1. Molecular Docking
 2. De Novo Ligand Design
 3. Virtual Screening
11. Ligand based Drug Design
 1. Pharmacophore Identification
 2. QSAR

COURSE OUTCOMES

On completion of course, student will be able to

- CO1 - Understand the synthesis of nanoparticle by chemical and biological methods
- CO2 - Understand the purification methods of nanoparticles
- CO3 - Understand the structural modification and stability of the nanoparticle
- CO4 - Predict the protein modeling and to understand the validation of results
- CO5 - Understand Structure based Drug Design
- CO6 - Understand Ligand based Drug Design



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SBTA3010	Molecular Therapeutics and Diagnostics	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- Understand the principles and applications of molecular diagnostics techniques and biomarkers, and assess their significance in disease diagnosis, prognosis, and personalized medicine.
- Evaluate different molecular therapeutic approaches, including gene therapy, RNA-based therapies, and targeted treatments, and assess their potential impact on clinical practice and the challenges associated with translating them from bench to bedside.

UNIT 1 INTRODUCTION TO MOLECULAR THERAPEUTICS AND DIAGNOSTICS**9 Hrs.**

Overview of molecular therapeutics and diagnostics, Historical development and milestones in the field, Importance of personalized medicine and targeted therapies, Ethical considerations in molecular medicine research

UNIT 2 MOLECULAR DIAGNOSTICS TECHNIQUE,**9 Hrs.**

Polymerase chain reaction (PCR) and its variants, Nucleic acid hybridization methods (FISH, Southern blotting), Next-generation sequencing (NGS) for genetic analysis, Microarray technology for gene expression profiling, Point-of-care diagnostics and portable devices

UNIT 3 BIOMARKERS AND DISEASE DIAGNOSTICS**9 Hrs.**

Biomarkers as indicators of disease or treatment response, Role of genomics, transcriptomics, proteomics, and metabolomics
Identification and validation of disease-specific biomarkers, Clinical applications of biomarker-based diagnostics

UNIT 4 MOLECULAR THERAPEUTIC APPROACHES**9 Hrs.**

Gene therapy: viral and non-viral vectors, CRISPR-based therapies, RNA-based therapies: siRNA, antisense oligonucleotides, Monoclonal antibodies and antibody-drug conjugates, Small molecule inhibitors and targeted therapies
Nanomedicine and drug delivery strategies

UNIT 5 CLINICAL APPLICATIONS AND CHALLENGES**9 Hrs**

Molecular diagnostics in oncology, infectious diseases, and genetic disorders, Personalized medicine and tailoring treatments based on genetic profiles, Challenges in translating molecular therapeutics to clinical practice, Regulatory and ethical considerations in molecular medicine, Future trends and emerging technologies in the field

Max.45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1 - Understand the principles and fundamentals of molecular therapeutics and diagnostics
CO2 - Analyze various molecular diagnostic techniques and their applications.
CO3 - Evaluate the role of biomarkers in disease diagnosis and prognosis.
CO4 - Explore different molecular therapeutic approaches and their mechanisms.
CO5 - Assess the clinical applications and challenges of molecular medicine.
CO6 - Identify emerging trends and future directions in the field.

TEXT / REFERENCE BOOKS

1. Lela Buckingham and Maribeth L. Flaws, "Molecular Diagnostics: Fundamentals, Methods, and Clinical Applications" 2nd Edition, 2020
2. Runjan Chetty, Lawrence M. Weiss, and Zhong-Yin Zhang, "Principles of Molecular Medicine, 2nd Edition, 2020
3. Bernard R. Glick, Jack J. Pasternak, and Cheryl L. Patten, "Molecular Biotechnology: Principles and Applications of Recombinant DNA", 5th Edition, 2020
4. Jennifer L. Horsley and Ann M. Hornsby, "Introduction to Molecular Medicine", 3rd Edition 2019

New course

ANNEXURE II

SBTA5101	ADVANCED BIOCHEMISTRY	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVE

- The objective of the course is to provide a deeper insight into advanced understanding of the core principles and topics of Biochemistry, and to enable students to acquire a specialized knowledge and understanding of selected aspects.

UNIT 1 BIOMOLECULES AND METABOLISM/ADVANCED METABOLISM AND BIOENERGETICS 9 Hrs.

Review of Biological Macromolecules: proteins, carbohydrates and nucleic acids, Bioenergetics-Glycolysis, Gluconeogenesis, Pentose Phosphate pathway, Citric Acid Cycle, Oxidative Phosphorylation, Photosynthesis, Fatty Acid Metabolism, Fatty Acid Biosynthesis, Amino Acid Catabolism, DNA Metabolism and RNA Metabolism. Fatty Acid Metabolism: Oxidation, Biosynthesis, and Regulation. Amino Acid Metabolism: Catabolism, Urea Cycle, and Interconversion pathways. Nucleotide Metabolism: DNA and RNA Biosynthesis.

UNIT 2 ADVANCED ENZYMOLOGY/ENZYME STRUCTURE, FUNCTION, AND REGULATION 9 Hrs.

Theory of enzymatic catalysis, classification, specificity, Enzyme Catalysis: Mechanisms of enzymatic action, transition state theory, and the concept of active site and enzyme substrate complex, Mechanism of enzyme action. Enzyme Kinetics: Michaelis-Menten equation, enzyme inhibition, and allosteric regulation. Effect of different Factors affecting enzyme activity, transition state theory, Arrhenius equation, Determination of energy of activation, Enzyme kinetics and inhibition. Role of enzymes in regulation of metabolism: Allosteric enzymes, feedback inhibition, and covalent modification, allosteric enzymes and their kinetics. Immobilized enzymes: Techniques and applications in biotechnology.

UNIT 3 TRANSPORT BIOCHEMISTRY/MEMBRANE BIOCHEMISTRY AND CELL COMMUNICATION 9 Hrs.

Biomembranes: and their classification based on cellular organelles. Composition, structure, and properties of biological membranes; physico-chemical properties of different biological membranes. Membrane components - lipids, their distribution and organization; proteins, intrinsic and extrinsic, their arrangement; carbohydrates, their function. Membrane Transport: Active and passive transport mechanisms, ion channels, and carrier proteins. Cell Signaling: Signal transduction pathways, receptors, and second messengers. Nerve Impulse Transmission: Biochemistry of action potentials and synapse communication. Cellular Adhesion: Role of membranes in cell-to-cell interactions and tissue organization.

UNIT 4 PESTICIDE BIOCHEMISTRY 9 Hrs.

Entry and distribution of different classes of pesticides in plants and animals. Biochemistry of Xenobiotic Metabolism: Detailed study of pesticide metabolism, including microsomal oxidation, enzyme systems, and detoxification pathways. Mechanisms of Pesticide Toxicity: Molecular interactions and biochemical basis of pesticide-induced toxicity.

UNIT 5 PLANT BIOCHEMISTRY 9 Hrs.

Phytohormones and their mode of action, signal transduction. Biochemistry of seed development and germination, Biochemistry of fruit ripening. Biochemistry and significance of secondary metabolites - cyanogenic glycosides, glucosinolates, phenolic compounds, steroids and terpenoids, alkaloids; their role in plant defense system. Plant defense response, antimicrobial molecules; genes for resistance, hypersensitive response and cell death; systemic and acquired resistance.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - To describe the synthesis of proteins, lipids, nucleic acids, and carbohydrates and their role in metabolic pathways along with their regulation.
- CO2 - To understand the classification, structure, function, mechanism of action and kinetics of enzyme.
- CO3 - To demonstrate the structural organization of biomembrane and its role in transportation.
- CO4 - To explore the fixation and biochemical pathways of pesticide in living systems.
- CO5 - To demonstrate role of plant hormones, secondary metabolites and bio chemical mechanism behind the plant growth.

CO6 - The overall goal of this course is for the student to gain a knowledge of biochemical concepts and techniques which will be necessary for future scientific endeavors.

TEXT / REFERENCE BOOKS

1. Harpers review of biochemistry by David.W.Martin, Peter.A.Mayes, Victor.W.Rodwel, Lange Medical Publications.
2. Trevor Palmer, Philip L.R. Bonner, Enzymes: Biochemistry, Biotechnology, Clinical Chemistry, 2nd Edition, Horwood Publishing Ltd, 2007.
3. Mukherji, S and Gosh A. K. Plant Physiology. 2nd Edition, New Central Book Agency, Kolkata, 2005.
4. Albert L. Lehninger, David L. Nelson and Michael M. Cox, Lehninger Principles of Biochemistry, Worth Publishers.
5. Jeremy M. Berg, Lubert Stryer, John L. Tymoczko, Gregory J. Gatto, Biochemistry, Macmillan Learning.
6. Donald Voet, Judith G. Voet, Biochemistry, Wiley Publication.
7. Gray, Calvin and Bhatia, Enzyme Biotechnology, 1st Edition, CBS Publishers & Distributors, 2012.
8. J.L. Jain, Sunjay Jain and Nitin Jain, Fundamentals of Biochemistry, Chand Publication.
9. Hopkins, W. G and Huner, N.P.A. Introduction to Plant Physiology. 3rd Edition, John Wiley & Sons Inc. New York, 2004.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 5 Questions of 6 Marks each - No choice

30 Marks

PART B: 2 Questions from each unit of internal choice, each carrying 14 Marks

70 Marks



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SBTA6101	BIOCHEMISTRY AND MICROBIOLOGY LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVE

- The students understand experimental biochemistry with a problem-oriented approach.

SUGGESTED LIST OF EXPERIMENTS - BIOCHEMISTRY

1. Preparation of buffers with various pH and molarity thereby validating Hendersen-Hasselbach equation.
2. Quantitative estimation of protein by Lowry's method and thereby validating Beer-Lamberts law.
3. Separation of aliphatic, aromatic and polar amino acids by TLC.
4. **Enzyme Purification Techniques**: Ammonium sulphate purification of enzyme and Concentration of enzymes using dialysis.
5. Enzyme kinetics: Determination of K_m , V_{max} , k_{cat} and k_{cat} / K_m for acid phosphatase.
6. **DNA extraction and Quantification**: Qualitative analysis of DNA by diphenylamine method.
7. Assessment of DNA purity (Protein contamination) using spectrophotometry.

SUGGESTED LIST OF EXPERIMENTS - MICROBIOLOGY

1. Techniques for isolation of microorganisms-Pour plate technique and Spread plate technique
2. Purification of microorganisms from a mixed culture by streak plate preparation
3. Preservation of microorganisms-Glycerol stock method and Agar slant method
4. Microscopy
 - 4.1. Microscopic examination of stained cell preparation-Preparation of bacterial smears, simple staining, negative staining, gram staining
 - 4.2. Microscopic examination of live bacterial population-Hanging drop method
5. Biochemical Activities of Microorganisms: IMViC, catalase, oxidase
6. The Fungi Cultivation and identification of unknown fungi by lactophenol cotton blue staining
7. Microbiology of food- Methylene Blue Reductase Test and Microbiological Analysis of Food products
8. Microbiology of water- Standard Qualitative analysis of water: Presumptive test, Confirmed test, Completed Test

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Prepare basic solutions required for complex analysis.CO2 -

Employ tools in biochemistry to assess biomolecules. CO3 - Discuss the various steps of analysis.

CO4 - Interpret the results obtained from assay methods.

CO5 - Develop different strategies for analysis of novel molecules. CO6 -

Criticize on the results and validate methods.



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SBTA7014	BIOTECHNOLOGY ENTREPRENEURSHIP	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVE

1. To provide students with a comprehensive understanding of the principles and practices of biotechnology entrepreneurship.
2. To equip students with the skills and knowledge required to successfully plan, launch, and manage biotech startups.

UNIT 1 INTRODUCTION TO BIOTECHNOLOGY ENTREPRENEURSHIP**9 Hrs.**

Overview of entrepreneurship in the biotechnology sector, Importance of innovation and startups in biotechnology, Role of entrepreneurship in translating research into commercial products

UNIT 2 IDENTIFYING AND DEVELOPING BIOTECH IDEAS**9 Hrs.**

Idea generation and opportunity recognition in biotechnology, Evaluating the feasibility and viability of biotech ideas, Intellectual property (IP) considerations: patents, copyrights, trademarks

UNIT 3 BUSINESS PLANNING AND STRATEGY**9 Hrs.**

Elements of a business plan for biotech startups, Market analysis and target audience identification, Developing a unique value proposition and competitive advantage

UNIT 4 FUNDING AND FINANCIAL MANAGEMENT**9 Hrs.**

Sources of funding for biotech startups: angel investors, venture capital, grants, financial projections, budgeting, and managing startup finances, Strategies for attracting investment and securing funding

UNIT 5 LAUNCHING AND SCALING BIOTECH VENTURES**9 Hrs.**

Legal and regulatory challenges in biotechnology entrepreneurship, Building a startup team: recruitment, roles, and leadership, Scaling up operations, managing growth, and achieving sustainability

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1 - Identify and evaluate potential business opportunities within the biotechnology sector.
- CO2 - Develop and present a detailed business plan for a biotech startup, considering market analysis and financial projections.
- CO3 - Apply strategies for attracting funding and managing finances specific to biotech ventures.
- CO4 - Navigate legal, ethical, and regulatory challenges commonly encountered in biotechnology entrepreneurship.
- CO5 - Analyze the competitive landscape of biotech startups and formulate effective positioning strategies.
- CO6 - Demonstrate an understanding of the key factors involved in scaling up and sustaining a biotech venture.

TEXT / REFERENCE BOOKS

1. "The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses" by Eric Ries. 2011
2. "Biotechnology Entrepreneurship: Starting, Managing, and Leading Biotech Companies" by Craig Shimasaki. 2014
3. "Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers" by Alexander Osterwalder and Yves Pigneur. 2010
4. "Venture Deals: Be Smarter Than Your Lawyer and Venture Capitalist" by Brad Feld and Jason Mendelson. 4th Edition, 2016
5. "The Startup Owner's Manual: The Step-By-Step Guide for Building a Great Company" by Steve Blank and Bob Dorf. 1st Edition, 2012

 New course

ANNEXURE-III

SMB3101	MEDICAL BACTERIOLOGY	L	T	P	Credits	Total Marks
		3	1	0	4	100

COURSE OBJECTIVES

- This course aims at understanding important medically important bacteria its mode of infection, pathogenesis prophylaxis and treatment.

UNIT 1 INFECTION

12 Hrs.

Overview of Medical Bacteriology: Importance and scope, Historical perspectives on infectious diseases, Infection- Sources of infection, method of transmission of infection, Factors predisposing to microbial pathogenicity, Types of infectious diseases. Normal Microbial flora of human body. Gram-positive pathogens *Staphylococcus*, *Streptococcus*, *Corynebacterium*, *Clostridium*.

UNIT 2 GRAM NEGATIVE PATHOGENS

12 Hrs.

Gram negative pathogens- *Neisseria*, *E.coli*, *Klebsiella*, *Proteus*, *Salmonella*, *Shigella*, *Vibrio*, *Yersinia*.

UNIT 3 ACID FAST BACTERIS

12 Hrs.

Acid fast bacteria-*Mycobacterium tuberculosis* and *M.lepreae*.

UNIT 4 SPIROCHETES

12 Hrs.

Spirochetes-*Leptospira*, *Treponema*.

UNIT 5 OTHER MEDICALLY IMPORTANT ORGANISMS

12 Hrs.

Mycoplasma, *Chlamydia*, *Helicobacter* and *Campylobacter*. Other important anaerobic pathogens.

Max Hours.60

TEXT / REFERENCE BOOKS

1. Medical Microbiology-David Green wood
2. Text book of Microbiology, Ananthanarayan & Jayaram Panicker
3. Jawetz-Medical Microbiology-Geo F.Brooks, Janet S Butel.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

PART A : 10 questions of 2 marks each - No choice

20 Marks

PART B : 2 questions from each UNIT of internal choice; each carrying 16 marks

80 Marks



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SMB4501	BACTERIOLOGY AND VIROLOGY LAB	L	T	P	Credits	Total Marks
		0	0	3	2	100

SUGGESTED LIST OF EXPERIMENTS

1. Basic Microbiological Techniques

- Collection, transportation and processing of clinical specimen for microbiological examination.
- Staining techniques- Simple, Negative, Gram's, capsule, Spore staining (Organism – Bacillus, Enterobacter, Escherichia coli) Acid fast staining.
- Observation of different types of colony morphology on various culture media.

2. Bacterial Identification and Differentiation

- Study of composition and use of important differential media for identification of pathogenic bacteria: EMB Agar, McConkey agar, Mannitol salt agar, Deoxycholate citrate agar, TCBS isolation and identification of microorganisms from urine sample (E.coli, Proteus, Pseudomonas)
- Biochemical tests for bacterial identification (IMViC, TSI, nitrate reduction, urease production, coagulase and catalase tests.)
- Identification of unknown bacteria using a combination of differential tests.

3. Antimicrobial Susceptibility Testing

- Preparation of dried filter paper discs for susceptibility assay and Antimicrobial activity by Kirby – Bauer disc diffusion technique.
- Determination of MIC & MBC.

4. Preservation and Diagnostic Techniques

- Preservation of bacterial cultures by various techniques
- Studying isolation and propagation of animal viruses by chick embryo technique

5. Isolation and enumeration of bacteriophages (PFU) from water/sewage sample using double agar layer technique

6. Serological Techniques and Advanced Topics

- To perform HBsAg by ELISA
- To perform HIV Tridot method.

SMB4502	MYCOLOGY AND PARASITOLOGY LAB	L	T	P	Credits	Total Marks
		0	0	3	2	100

SUGGESTED LIST OF EXPERIMENTS

1. Fungal Identification and Cultivation

- Identification of common fungus like Mucor, Rhizopus, Penicillium, Aspergillus by Lactophenol cotton blue mount examination.
- Preparation of fungal media and Cultivation of fungi study of colony characters of yeast and mold.

Observation of fungal spore formation and conidial structures.

2. Parasitological Techniques

- Leishman staining for malarial parasites
- Demonstration of permanent slide of Trichuris, Ascaris and Hookworm
- Saline wet mount for observing ova and eggs of parasites.
- Iodine wet mount for observing ova and eggs of parasites.

3. Stool Examination and Advanced Parasitology

- Concentration of stool samples by floatation method
- Zinc sulphate conc. Method for stool sample
- Demonstration of various parasites by permanent slides.
- Concentration of stool sample by sedimentation method



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SBB3104	ANIMAL BIOTECHNOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 INTRODUCTION TO ANIMAL TISSUE CULTURE**12 Hrs.**

History and Scope of Animal tissue culture. Design & layout of Setup of an ATC laboratory. Requirements for Animal cell culture: Equipment, Sterilization, Aseptic Techniques. Types of media, ingredients of media. Foetal Bovine Serum.

UNIT 2 CELL LINES AND CELL CULTURE**12 Hrs.**

Basic Techniques of mammalian cell culture; Disaggregation of animal tissue. Primary culture & secondary culture. Evolution Establishment of cell line : Evolution from Primary Culture to Continuous Cell Lines, characterization of cell lines: Monolayer, suspension culture. Organ culture, Embryo culture. Maintenance of cell culture: Feeding, Passage, Cryopreservation. Identification and Prevention of Common cell culture contaminants.

UNIT 3 GENETIC ENGINEERING IN ANIMALS**12 Hrs.**

Genetic engineering in animals: Methods of DNA transfer into animal cells- calcium phosphate co precipitation, micro-injection, electroporation, Liposome encapsulation, Biological vectors. Hybridoma technology, Applications of Genetic Engineering: Vaccine production. Recombinant Protein Expression

UNIT 4 APPLICATIONS OF GENETIC ENGINEERING**12 Hrs.**

Gene therapy, mapping of human genome. RFLP and applications. DNA finger printing and Forensic Science. Molecular diagnosis of Genetic disorders.

UNIT 5 ANIMAL CELL AND TISSUE BASED PRODUCTS AND THEIR APPLICATIONS**12 Hrs.**

Applications of animal tissue culture for in vitro testing of drugs. Cell-Based Assays for Toxicity and Efficacy Production of transgenic animals & molecular pharming, animal cloning techniques. Cell culture based vaccines. Ethical values in animal biotechnology: Animal Welfare, Regulations, and Bioethics.

Max Hours.60**TEXT / REFERENCE BOOKS:**

1. Freshney, E. D. 2000. Animal Cell Culture: A practical approach. John Wiley Pub. New York.
2. Mather, J.P. and Barnes, D. (Eds.). 1998. Animal Cell Culture Methods (Methods in Cell Biology. VOL. 57). Academic Press, London.
3. Butler, M. (Ed.). 1990. Mammalian Cell Biotechnology- A Practical Approach. Oxford Univ. Press, Oxford.
4. R.C. Dubey., A Text Book of Biotechnology. S. Chand & Co Ltd, New Delhi.
5. Sudha Gangal, Animal Tissue culture. Second edition. University Press (India) Pvt Ltd. Hyderabad.
6. Sverdrup H.V., Oceans & their Physics, Chemistry & Biology –Johns & R.H. Fleming, Prentice Hall Inc.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 questions of 2 marks each - No choice**20 Marks****PART B:** 2 questions from each unit of internal choice; each carrying 16 marks**80 Marks**

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SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

Accredited "A" Grade by NAAC | 12B Status by UGC | Approved by AICTE

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Board of Studies

Minutes of Meeting (EVEN SEM)

Date: 26th November 2022

Time: 11 am

Chair-person : **Dr. Ramesh Kumar**

Attendees : **Ms. Sathya V**
Scientific Manager, Affigenix Biosolutions Pvt Ltd

Dr. Edward
Head of the Department, Department of Biotechnology,
St. Joseph's College (Autonomous), Trichy

Dr. Ramesh Kumar V, Internal member

Dr. Valli Nachiyar C, Internal member

Dr. Jayshree Nellore, Internal member

The Chair-person welcomed the members.

Following which discussions were held as follows,

Agenda Item 1: A proposition was raised, suggesting the incorporation of a new course intended for the 2019 Batch of 'B.Tech-Biotech' students during the academic year 2022-2023.

Resolutions: The Board reached a consensus and accorded its endorsement to the curriculum and outline for the course "RESEARCH METHODOLOGY IN BIOTECHNOLOGY" (**SBTA3007**) (Annexure I).

Agenda Item 2: It was proposed to introduce New Course for 2020 Batch 'B.Tech-Biotech' for the academic year 2022-2023

Resolutions: Universal Human Values course was introduced for Batch 2020 as per the AICTE guidelines, 3 credits was given according to norms of AICTE. The Board considered and approved the scheme and syllabus for "UHV". (Annexure II)

Agenda Item 3: Proposed modifications for the 'B.Tech-Biotech' students of the 2020 Batch in Animal Biotechnology Lab for the academic year 2022-2023.

The lab's title was altered to "Animal Cell and Tissue Culture Lab" (SBTA2602), and corresponding changes were made to the syllabus in accordance with the Regulations of 2019. These revisions were presented before the board for their endorsement.

Resolutions: The Board reached a unanimous agreement and provided its official approval to the curriculum and structure of the course titled "Animal Cell and Tissue Culture Lab" (SBTA2602) (Annexure III)

Agenda Item 4: It was proposed to introduce New elective Course for 2022 Batch 'M.Tech-Biotech' for the academic year 2022-2023

Resolutions: The Board reached a consensus and accorded its endorsement to the curriculum and outline for the course "Synthetic Biology" (SBTA7015) (Annexure IV).

Agenda Item 4: Modifications proposed for 2021 batch 'Bachelor of Science students in Research Methodology

The syllabus for Research Methodology in Life sciences (SBT1002) was revised under Regulations 2019 and the same was tabled before the board for approval

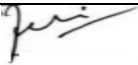
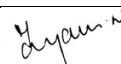
Course code	Course	Units	Old	Changes
SBT1002	Research Methodology	1	Research methodology-basic concepts-types- definition of research problems- statistical methods- Correlation and Regression, Binomial, Poisson and Normal Distributions (mean and variance applications only) - Sampling Distributions: Tests based on t, F, Z and Chi square distributions- Analysis of Variance.	Basic concepts of Research: Research-definition and types of research. Research methods vs methodology, Literature-review and its consolidation, Problem Identification & Formulation, Research Questions and hypothesis
		2	Research design-Nature and Classification of research designs, data classification,	No change

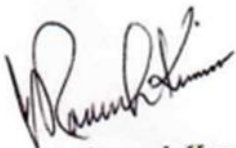
			primary and secondary data, primary and secondary data-sources-advantages-Sampling- sampling concepts and methods	
		3	Principles of biophysical methods used for analysis. X-ray diffraction, Fluorescence, UV, ORD/CD, visible, NMR and ESR spectroscopy, Hydrodynamic methods, Atomic absorption, Plasma emission spectroscopy.	CONCEPTS OF PROBABILITY AND STATISTICS - Rules of probability, discrete and continuous probability distribution. Moments: Mean, variance and covariance. Bayes theorem and likelihood. Statistical tests – t-test, ANOVA, Chi square test
		4	Principles and techniques of nucleic acid hybridization and cot curves, sequencing of proteins and nucleic acids, southern, northern and south-western blotting techniques, PCR, methods for measuring nucleic acids and protein interactions.	CORRELATION AND REGRESSION Correlations, linear regression, multiple linear regression, nonlinear regression and logistic regression.
		5	Principles and applications of tracer techniques in biology, radiation dosimetry, radioactive isotopes and half-life of isotopes, effect of radiation on biological systems, autoradiography, cerenkov radiation and liquid scintillation spectrometry	The art of scientific writing and its presentation: Layout of a Research Paper, Journals in Life sciences, Impact factor of Journals, When and where to publish ? Ethical issues related to publishing, Plagiarism and Self-Plagiarism. Use of Encyclopedias, Research Guides, Handbook etc., Academic Databases for life science Discipline. Use of tools / techniques for Research: methods to

				search required information effectively, Reference Management Software like Zotero/Mendeley, Software for paper formatting like LaTeX/MS Office, Software for detection of Plagiarism
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Resolutions: The BoS sanctioned the proposal to revise the course syllabus and approved the same (Annexure V)

Based on the suggestions given by the members, BoS resolved to recommend the minutes to the Academic Council for further approval.

Internal Member	Designation	Signature
Dr. Edward	Head (External member)	
Ms.Sathya V	Scientific Manager (Industry Expert)	
Dr.Ramesh kumar	Head	
Dr.Valli Nachiyar	Professor	
Dr. Jayshree Nellore	Professor	


Dr.Ramesh Kumar
(Head of the Department)

HEAD OF THE DEPARTMENT
DEPARTMENT OF BIOTECHNOLOGY
SATHYABAMA
INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)
Jeppiaar Nagar, Rajiv Gandhi Salai
Chennai-600 119

ANNEXURE I

NEW COURSE-B.Tech Biotechnology (2019 Batch)

Regulations: 2019

SBTA3007	Research Methodology in Biotechnology	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To acquaint the students with key concepts and tools of data analysis techniques.

UNIT 1: BASIC CONCEPTS OF PROBABILITY AND STATISTICS**9 Hrs.**

Rules of probability, discrete and continuous probability distribution. Moments: Mean, variance and covariance. Bayes theorem and likelihood. Statistical tests – t-test, ANOVA, Chi square test.

UNIT 2: BASIC CONCEPTS OF LINEAR ALGEBRA**9 Hrs.**

Vector and vector operations, matrix and matrix operations. Determinant and inverse of matrix. Eigen value and eigenvector. Linear system of equations, singular value decomposition.

UNIT 3: CORRELATION AND REGRESSION**9 Hrs.**

Correlations, linear regression, multiple linear regression, nonlinear regression and logistic regression.

UNIT 4: CLUSTERING, CLASSIFICATION AND HIGHER DIMENSIONAL DATA**9 Hrs.**

Distance measures for clustering, k-means clustering, hierarchical clustering, decision tree classifier, support vector machines. Higher dimensional data in biology, Principal component analysis, t-SNE, diffusion maps.

UNIT 5: Research and publication**9 Hrs.**

Forming a Hypothesis, Techniques of Scientific Measurement, Testing of hypothesis, Methods of Theoretical Research, The Art of Scientific Communication, Presentation in Seminars and Conferences, Sponsored Research, Ethical Conduct in Science.

COURSE OUTCOMES

On completion of course, student will able to

CO1 –Interpret scientific data using statistical methods.

CO2 –Articulate biological data as algebraic equations

CO3 –Correlate and deduce inference from data.

CO4 –Categorize data to infer scientific knowledge.

CO5 –Write a research report and analyze ethical issues.

CO6 –Write a research proposal following ethical norms.

TEXT / REFERENCE BOOKS

1. Whitlock, Michael C.; Schluter, Dolph. The Analysis of Biological Data (2nd edition). Freeman, W. H. & Company, 2014.
2. Yang, Zheng R.; Machine Learning Approaches to Bioinformatics. World Scientific, 2010.
3. Moses, Alan; Statistical Modeling and Machine Learning for Molecular Biology. Chapman and Hall/CRC, 2016.
4. Hartvigsen, Gregg. A Primer in Biological Data Analysis and Visualization Using R, (1st Edition). Columbia University Press, 2014.
5. Stewart, James; Day, Troy; Biocalculus: Calculus for Life Sciences. Cengage Learning, 2015
6. James, Gareth, et al. An introduction to statistical learning with application in R. Vol. 112. New York: springer, 2013.

 New course

ANNEXURE II

NEW COURSE-B.Tech Biotechnology (2020 Batch)

Regulations: 2019

SAIC4003	UNIVERSAL HUMAN VALUES	L	T	P	Credits	Total Marks
		2	1	0	3	100

COURSE OBJECTIVES

- To develop a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence
- To understand (or developing clarity) the harmony in the human being, family, society and nature/existence
- To strengthen self-reflection
- To develop commitment and courage to act

MODULE 1 COURSE INTRODUCTION - NEED, BASIC GUIDELINES, CONTENT AND PROCESS FOR VALUE EDUCATION

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
2. Self-Exploration-what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels. Practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

MODULE 2 UNDERSTANDING HARMONY IN THE HUMAN BEING - HARMONY IN MYSELF!

7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
8. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of 'I' and harmony in 'I'
11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
12. Programs to ensure Sanyam and Health. Practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease.

MODULE 3 UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY- HARMONY IN HUMAN-HUMAN RELATIONSHIP

13. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
14. Understanding the meaning of Trust; Difference between intention and competence
15. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship

16. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals

17. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family. Practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss scenarios. Elicit examples from students' lives.

MODULE 4 UNDERSTANDING HARMONY IN THE NATURE AND EXISTENCE - WHOLE EXISTENCE AS COEXISTENCE

18. Understanding the harmony in the Nature

19. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self regulation in nature

20. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space

21. Holistic perception of harmony at all levels of existence.

Practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

MODULE 5 IMPLICATIONS OF THE ABOVE HOLISTIC UNDERSTANDING OF HARMONY ON PROFESSIONAL ETHICS

22. Natural acceptance of human values

23. Definitiveness of Ethical Human Conduct

24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order

25. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.

26. Case studies of typical holistic technologies, management models and production systems

27. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations

28. Sum up. Practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. To discuss the conduct as an engineer or scientist etc.

Total: 28 Lectures And 14 Practice Sessions

COURSE OUTCOMES

On completion of the course, the student are expected

CO1: To become more aware of themselves, and their surroundings (family, society, nature)

CO2: They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind

CO3: To have better critical ability

CO4: To become sensitive to their commitment towards what they have understood (human values, human relationship and human society)

CO5: To apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction

TEXT /REFERENCE BOOKS

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

2. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.

3. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.

4. The Story of Stuff (Book).
5. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
6. Small is Beautiful - E. F Schumacher.
7. Slow is Beautiful - Cecile Andrews
8. Economy of Permanence - J C Kumarappa
9. Bharat Mein Angreji Raj – PanditSunderlal
10. Rediscovering India - by Dharampal
11. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
12. India Wins Freedom - Maulana Abdul Kalam Azad
13. Vivekananda - Romain Rolland (English)
14. Gandhi - Romain Rolland (English)

ASSESSMENT:

Assessment by faculty mentor: 10 marks

Self-assessment:: 10 marks

Assessment by peers: 10 marks

Socially relevant project/Group Activities/Assignments: 20 marks

Semester End Examination: 50 marks

ANNEXURE III

MODIFIED COURSE-B.Tech Biotechnology (2020 Batch)

Regulations: 2019

SBTA2602	ANIMAL CELL AND TISSUE CULTURE LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVE

- To develop the ability to handle animal cell cultures proficiently through aseptic techniques and media preparation, while also recognizing the practical applications of these skills in biotechnological areas such as drug discovery and cell studies

SUGGESTED LIST OF EXPERIMENTS

1. Introduction to Aseptic Techniques and Cell Culture Equipment
2. Preparation of Cell Culture Media
3. Primary Cell Culture
4. Subculturing and Passaging of Cell Lines.
5. Cryopreservation and Revival of Cell Lines.
6. Cell Viability and Cytotoxicity Assays
7. Application of Cell Culture in Biotechnology

COURSE OUTCOMES

On completion of course, student will be able to

CO1: Demonstrate aseptic techniques and use of cell culture equipment.

CO2: Prepare various cell culture media and understand their composition.

CO3: Isolate, culture, and subculture primary cells from animal tissues.

CO4: Perform cryopreservation and revival of cryopreserved cells.

CO5: Assess cell viability, perform cytotoxicity assays, and analyze cell morphology.

CO6: Apply cell culture techniques in biotechnological research and understand their relevance in drug discovery and tissue engineering.

New course

ANNEXURE IV

Regulations: 2019

SBTA7015	SYNTHETIC BIOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE:

- The course aims to provide students with a comprehensive understanding of the principles, techniques, and applications of synthetic biology, enabling them to design and engineer novel biological systems for various scientific, medical, and industrial purposes.

Unit 1: Introduction to Synthetic Biology**9hrs**

Definition, scope, and historical overview of synthetic biology. Key concepts: genetic circuits, modular design, standard biological parts. Ethical and societal implications of synthetic biology.

Unit 2: Genetic Engineering Techniques**9hrs**

Overview of recombinant DNA technology. DNA synthesis, assembly, and editing methods (PCR, Gibson assembly, CRISPR-Cas). Design principles for creating synthetic DNA constructs.

Unit 3: Synthetic Biological Systems**9hrs**

Building blocks and biological parts in synthetic biology. Introduction to genetic circuits and their components. Examples of synthetic biological systems: toggle switches, oscillators, logic gates.

Unit 4: Applications of Synthetic Biology**9hrs**

Biomedical applications: biosensors, drug delivery systems, engineered microbes for therapy. Industrial applications: biofuel production, enzyme engineering, specialty chemical synthesis. Environmental applications: bioremediation, biosensors for pollutants.

Unit 5: Advanced Topics in Synthetic Biology**9hrs**

Metabolic engineering and pathway design. Directed evolution and protein engineering. Computational tools for synthetic biology design and modeling. Future directions and emerging trends in synthetic biology.

COURSE OUTCOMES On completion of course, student will able to

CO1: Understand the fundamental concepts and principles of synthetic biology, including genetic circuits, modular design, and standard biological parts..

CO2: Apply various genetic engineering techniques, such as DNA synthesis, assembly, and editing methods, to construct synthetic DNA constructs.

CO3: Design and create synthetic biological systems, utilizing genetic circuits and components to engineer specific functionalities.

CO4: Analyze and evaluate the diverse applications of synthetic biology in biomedical, industrial, and environmental contexts, including biofuel production and bioremediation.

CO5: Utilize computational tools to model, simulate, and optimize synthetic biological systems, fostering a deep understanding of their behavior.

CO6: Recognize and discuss the ethical, societal, and environmental implications of synthetic biology applications, demonstrating a responsible approach to technological advancements.

TEXT BOOKS and References

1. Paul S. Freemont and Richard I. Kitney, "Synthetic Biology: A Primer" 2021, 2nd Edition
2. Yinong Yang, "Biological Engineering: An Introduction to Synthetic Biology" 2016, 1st Edition
3. Huimin Zhao, "Synthetic Biology: Tools and Applications" 2020 1st Edition
4. Josefine Liljeruhm, Maria F. Suarez, et al. "Synthetic Biology: A Lab Manual" 2017 1st Edition
5. Darren N. Nesbeth, Christina D. Smolke, et al. "Synthetic Biology Handbook" 2019 2nd Edition
6. Natalie Kuldell, Rachel Bernstein, Karen Ingram, et al. "BioBuilder: Synthetic Biology in the Lab" 2018 2nd Edition

7. Editors: Markus Schmidt, Vitor Martins dos Santos, et al. "Synthetic Biology: An Interdisciplinary Challenge" 2020 1st Edition
8. Andrew S. Balmer "Synthetic Biology: A Sociology of Changing Practices" 2014 1st Edition

 New course

**ANNEXURE V
OLD SYLLABUS**

SBBA1602	RESEARCH METHODOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- This course aims at understanding the research terminology.
- Be aware of the ethical principles of research, ethical challenges and approval processes. Describe quantitative, qualitative and mixed methods approaches to research.
- Identify the components of a literature review process. Critically analyze published research.

UNIT 1 STATISTICAL METHODS 9 Hrs.

Research methodology-basic concepts-types- definition of research problems- statistical methods- Correlation and Regression, Binomial, Poisson and Normal Distributions (mean and variance applications only) - Sampling Distributions: Tests based on t, F, Z and Chi square distributions- Analysis of Variance.

UNIT 2 DESIGN OF EXPERIMENT, SAMPLING AND DATA COLLECTION 9 Hrs.

Research design-Nature and Classification of research designs, data classification, primary and secondary data, primary and secondary data- sources-advantages- Sampling- sampling concepts and methods

UNIT 3 ANALYTICAL METHODS AND SPECTROSCOPY 9 Hrs.

Principles of biophysical methods used for analysis. X-ray diffraction, Fluorescence, UV-VIS, ORD/CD, NMR and ESR spectroscopy, Hydrodynamic methods, Atomic absorption, Plasma emission spectroscopy.

UNIT 4 MOLECULAR TECHNIQUES FOR BIOTECHNOLOGY 9 Hrs.

Principles and techniques of nucleic acid hybridization and cot curves, sequencing of proteins and nucleic acids, southern, northern and south-western blotting techniques, PCR, methods for measuring nucleic acids and protein interactions.

UNIT 5 RADIO LABELLING AND ANALYSIS 9 Hrs.

Principles and applications of tracer techniques in biology, radiation dosimetry, radio-active isotopes and half-life of isotopes, effect of radiation on biological systems, autoradiography, Cerenkov radiation and liquid scintillation spectrometry.

Max. 45 Hours

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Discuss some basic concepts of research and techniques used in research works
- CO2 - Explain basic computer skills necessary for the conduct of research.
- CO3 - Assess the basic functions and working of analytical instruments used in research
- CO4 - Propose the required numerical skills necessary to carry out research.
- CO5 - Identify appropriate research topics, research problem and parameters •
- CO6 - Understand how to prepare a project proposal, organize and conduct research.

TEXT / REFERENCE BOOKS:

1. Principles of biochemistry and molecular biology – Keith Wilson & John Walker
2. Biostatistics – Khan & Khanum

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NEW SYLLABUS

MODIFIED COURSE-B.Sc Biotechnology/Microbiology/Biochemistry (2020 Batch)

Regulations: 2019

SBT1003	Research Methodology in Life sciences	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE This course aims at understanding the research terminology. Be aware of the ethical principles of research, ethical challenges and approval processes. Describe quantitative, qualitative and mixed methods approaches to research. Identify the components of a literature review process. Critically analyze published research.

UNIT 1: Basic concepts of RESEARCH 9 Hrs.

Research-definition and types of research. Research methods vs methodology, Literature-review and its consolidation, Problem Identification & Formulation, Research Questions and hypothesis

UNIT 2: Research design and SAMPLING 9 Hrs.

Research design-Nature and Classification of research designs, data classification, primary and secondary data, primary and secondary data- sources-advantages- Sampling- sampling concepts and methods.

UNIT 3: concepts of probability and statistics 9 Hrs.

Rules of probability, discrete and continuous probability distribution. Moments: Mean, variance and covariance. Bayes theorem and likelihood. Statistical tests – t-test, ANOVA, Chi square test

UNIT 4: Correlation and regression 9 Hrs.

Correlations, linear regression, multiple linear regression, nonlinear regression and logistic regression.

UNIT 5: THE ART OF WRITING AND ITS PRESENTATION 9 Hrs.

Layout of a Research Paper, Journals in Life sciences, Impact factor of Journals, When and where to publish? Ethical issues related to publishing, Plagiarism and Self-Plagiarism. Use of Encyclopedias, Research Guides, Handbook etc., Academic Databases for life science Discipline. Use of tools / techniques for Research: methods to search required information effectively, Reference Management Software like Zotero/Mendeley, Software for paper formatting like LaTeX/MS Office, Software for detection of Plagiarism.

COURSE OUTCOMES

On completion of course, student will able to

CO1 – understand some basic concepts of research and its methodologies

CO2 – Choose the appropriate research design and develop appropriate research hypothesis for a research project Articulate biological data as algebraic equations

CO3 – Interpret scientific data using statistical method

CO4 – Correlate and deduce inference from data.

CO5 –Write a research report and analyze ethical issues.

CO6 –Use of tools/techniques for research

References

1. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.
2. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International. 418p.
3. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, Ess Ess Publications. 2 volumes.
4. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.

5. Wadehra, B.L. 2000. Law relating to patents, trade marks, copyright designs and geographical indications. Universal Law Publishing.

Additional reading

1. Anthony, M., Graziano, A.M. and Raulin, M.L., 2009. Research Methods: A Process of Inquiry, Allyn and Bacon.
2. Carlos, C.M., 2000. Intellectual property rights, the WTO and developing countries: the TRIPS agreement and policy options. Zed Books, New York.
3. Coley, S.M. and Scheinberg, C. A., 1990, "Proposal Writing", Sage Publications.
4. Day, R.A., 1992. How to Write and Publish a Scientific Paper, Cambridge University Press.
5. Fink, A., 2009. Conducting Research Literature Reviews: From the Internet to Paper. Sage Publications
6. Leedy, P.D. and Ormrod, J.E., 2004 Practical Research: Planning and Design, Prentice Hall.
7. Satarkar, S.V., 2000. Intellectual property rights and Copy right. Ess Ess Publications.



Added Content



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