SATHYABAMA
INSTITUTE OF SCIENCE AND TECHNOLOGY
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SCHOOL OF BIO AND CHEMICAL ENGINEERING

DEPARTMENT OF BIOTECHNOLOGY

Board of Studies 2019-2020 (ODD SEM)

Minutes of Meeting

Date : 01-06-2019 (Saturday) 10.00am-12.00pm

Chair-person : **Dr. Wilson Aruni**

Attendees : **Dr. Chirayu Padhiar**, External Member
Senior Medical Director, Life Cell International Pvt., Chennai.

Dr. Parthiban.M., External Member
Professor and Head, Department of Animal Biotechnology,
Madras Veterinary college, Chennai 600007

Dr. Elizabeth Rani, External Member
Head of the Department, Department of Biotechnology,
Hindustan College of Arts and Science, Chennai

Dr. Ramesh kumar V, Internal member

Dr. Valli Nachiyar C, Internal member

Dr. Jayshree Nellore, Internal member

The Chair-person welcomed the members. He invited Dr.Ramesh Kumar, Head, Department of Biotechnology to table the agenda.

Agenda of the meeting; Syllabus revisions and implementation in 2019- 2020;

B Tech Biotechnology

- The total number of credits have been revised from 190 to 165
- Industry 4.0 course to be implemented
- Interdisciplinary project to be introduced in Semester VI
- Major shuffling in elective courses.

M Tech Biotechnology

- The total number of credits have been revised from 94 to 68
- Industry 4.0 course to be implemented
- Major shuffling in elective courses.

Following which discussions were held as;

The Chairperson abridged the members that, as per AICTE norms for Engineering course, the total number of credits has to reduced. Accordingly, the number of credits to be obtained in 2019 regulations would be 165. To attain this number of credits along with introduction of few mandatory courses, a major reshuffling has to be done.

Dr Ramesh Kumar suggested introduction of Fundamentals of Python Engineering (theory and practical) and Biomechanics in Semester I

Dr Parthiban recommended implementation of both theory and practical basic course, Microbiology and Cell Biology in Semester I.

Dr Valli Nachiyar suggested the experiments to be included in the lab course.

Dr Elizabeth Rani elaborated on the need of implementation of interdisciplinary projects. She reinstated the need of the Industry 4.0 course, so as to prepare the students according to the Industrial requirements.

Dr Jayshree Nellore expressed the implementation new elective courses to keep up with current advances in the field. This requires a major reshuffling in the elective courses.

M Tech Biotechnology

As per AICTE regulations, Dr Ramesh Kumar informed that the credits for have been revised from 94 to 68. The board accepted for a major reshuffling of elective courses.

Industry 4.0 to be implemented as per Dr Elizabeth Rani suggestion. Dr Parthiban insisted the need of Seminar classes for PG with credits to encourage students to learn and share the advances in the field.

Meeting ended with vote of thanks to the Chair.

External Member	**Signature**
Dr. Chirayu Padhiar	
Dr.Prathiban M	
Dr. Elizabeth Rani	
Internal Member	**Signature**
Dr. Jayshree Nellore	
Dr. Valli Nachiyar	
Dr. Ramesh kumar V	

HEAD OF THE DEPARTMENT
DEPARTMENT OF BIOTECHNOLOGY
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Jeppiaar Nagar, Rajiv Gandhi Salai
Chennai-600 119

PRO VICE CHANCELLOR/CHAIR

B Tech

Sl. No.	Course Code	Course Title
1	SBTA3001	Marine Biotechnology
2	SBTA3002	Aquaculture
3	SBTA3003	Translational Biotechnology: From IPR to Licensing
4	SBTA3004	Biological Process in regulatory affairs
5	SBTA3005	Medical Biotechnology
6	SBTA3006	Neurobiology
7	SBTA3007	Food Processing Technology
9	SBTA3008	PERL for Bioinformatics
10	SBTA3009	Molecular Modelling and Drug design
11	SCHA3010	Bioprocess Instrumentation and Control

M Tech

Sl. No.	Course code	Course title
1	SBTA7001	Bioinformatics
2	SBTA7002	Molecular Modeling and Drug Designing
3	SBTA7003	Design and operation of bioreactors
4	SBTA7004	Pharmaceutical Biotechnology
5	SBTA7005	Biopharmaceuticals
6	SBTA7006	Advanced Bioinstrumentation
7	SBTA7007	Stem cell Research
8	SBTA7008	Cancer Biology
9	SBTA7009	Environmental Biotechnology
10	SBTA7010	Marine Biotechnology
11	SBTA7011	Bioethics, Biosafety and IPR
12	SBTA7012	Forensic Biotechnology
13	SBTA7013	Food and Nutraceuticals
14	SBTA7014	Scientific Approaches for Biotechnology

SCSA1102	FUNDAMENTALS OF PYTHON PROGRAMMMING	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To understand why Python is a useful scripting language for developers.
- To learn how to use lists, tuples, and dictionaries in Python programs.
- To learn how to build and package Python modules for reusability.
- To learn how to read and write files in Python.
- To learn how to use exception handling in Python applications for error handling.
- To learn how to design and program Python applications.

UNIT 1 INTRODUCTION **9 Hrs.**

History of Python- Introduction to the IDLE interpreter (shell) - Expressions – Data Types - Built-in function - Conditional statements - Iterative statements- Input/output - Compound Data Types - Nested compound statements – Introduction to Object Oriented Concepts.

UNIT 2 FILES AND EXCEPTIONS HANDLING, MODULES, PACKAGES **9 Hrs.**

File Operations –Iterators - Exception handling - Regular Expressions- Creating Modules-Import Statement-Introduction toPIP-Installing Packages via PIP-Using Python Packages

UNIT 3 GUI PROGRAMMING **9 Hrs.**

GUI Programming in Python - Introduction to GUI library - Layout management - Events and bindings - Fonts – Colours - Canvas - Widgets (frame, label, button, check box, entry, listbox, message, radiobutton, text, spinbox).

UNIT 4 DATABASE AND NETWORK **9 Hrs.**

Database (using NoSQL): Connector Module –Cursor – Statements - Exceptions in database. Network connectivity: Socketmodule - Client – Server – Email – URL Access

UNIT 5 CASE STUDY **9 Hrs.**

Web Programming using Python.
Image Processing – Facebook Analysis – Twitter Analysis.

Max.45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Describe the Numbers, Math functions, Strings, List, Tuples and Dictionaries in Python
CO2 - Do the decision Making and write functions in Python
CO3 - Explain how to design GUI Applications in Python and evaluate different database operations
CO4 - Design and develop Client Server network applications using Python
CO5 - Design real life situational problems and think creatively about solutions of them.
CO6 - Apply the best features of mathematics, engineering and natural sciences to program real life problems.

TEXT BOOKS/REFERENCE BOOKS

1. Daniel Liang Y., Introduction to Programming Using Python, Pearson, 2013.
2. Paul Gries, Jennifer Campbell, Jason Montojo, Practical Programming: An Introduction to Computer Science Using Python 3, Pragmatic Bookshelf, 2nd Edition, 2014.
3. Magnus Lie Hetland, Beginning Python: From Novice to Professional, Apress.

SBTA1101	MICROBIOLOGY AND CELL BIOLOGY	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVE

- The course aims to develop skills of the students in the area of Microbiology and Cell biology particularly to identify microbes, structure, metabolism and Cell Signaling pathways

UNIT 1 CLASSIFICATION AND MULTIPLICATION **9 Hrs.**

Overview of history of Microbiology- Classification of Microbes - Systems of classification, Numerical taxonomy, Identifying characters for classification, General properties and principles of classification of microorganisms' Structural organization and multiplication of bacteria, viruses, algae and fungi.

UNIT 2 MICROBIAL NUTRITION, GROWTH AND METABOLISM **9 Hrs.**

Nutritional requirements of bacteria and different media used for bacterial culture; growth curve. Mathematical nature and expression of microbial growth and different methods to quantitate bacterial growth, aerobic and anaerobic bioenergeticsand utilization of energy for biosynthesis of important molecules.

UNIT 3 CONTROL OF MICROORGANISMS **9 Hrs.**

Definition of sterilization, Physical and chemical control of microorganisms; host-microbe interactions; antibacterial, anti- fungal and anti-viral agents, mode of action and resistance to antibiotics; clinically important microorganisms.

UNIT 4 CELL ORGANELLES **9 Hrs.**

Evolution of cell; Cell as a unit of living organism, evolution and structure of prokaryotic cell, evolution of eukaryotic cell - Structural and functional features of eukaryotic cell: cell organelles; endoplasmic reticulum, golgi complex, lysosomes, vacuoles, peroxisomes, mitochondria, chloroplast, cytoskeleton, microtubules, nucleus, extracellular matrix etc.

UNIT 5 CELL CYCLE AND APOTOSIS **9 Hrs.**

Cell cycle - An overview of cell cycle; Components of cell cycle control system; Intracellular and Extra-cellular control of cell division, Programmed cell death (Apoptosis), intrinsic & extrinsic pathways of cell death, Apoptosis in relation with Cancer, Viral disease (AIDS) & Organ transplant

Max.45 Hrs.

COURSE OUTCOMES On completion of the course, student will be able to

CO1 - Familiar with overview and scope of microbiology.
CO2 - Explore the systemic classification of microbes.
CO3 - Study the methods for cultivation of organisms.
CO4 - Understand the basic principles of cellular components.
CO5 - Study the cell cycle principle.
CO6 - Understand the application of microbiology and cell biology in biotechnology.

TEXT / REFERENCE BOOKS

1. Berg, Jeremy M., John L. Tymoczko, Lubert Stryer, J.M. Berg, J.L. Tymoczko and L. Stryer, Biochemistry International version, 2002.
2. Nelson D.L., Lehninger A.L. & Cox, M.M., Lehninger principles of Biochemistry, Macmillan, 2008.
3. Moat A.G., Foster J.W. & Spector, M. P. (Eds.), Microbial Physiology, John Wiley & Sons, 2003.
4. Alberts, Bruce, Dennis Bray, Karen Hopkin, Alexander D. Johnson, Julian Lewis, Martin Raff, Keith Roberts and Peter Walter. Essential Cell Biology, Garland Science, 2015.
5. Karp G., Cell and Molecular Biology: concepts and experiments, John Wiley & Sons, 2009.
6. Robertis De., Cell and Molecular Biology, 1987.
7. Lodish H., Berk A., Darnell J.E., Kaiser C.A., Krieger M., Scott M.P., Bretscher A., Ploegh H. and Matsudaira P., Molecular Cell Biology, Macmillan, 2008.

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.**

Biomechanics, History, Applications, Perspectives in Biomechanics; Rigid Body BioMechanics; Anatomical Concepts in Biomechanics., Fundamentals of Biomechanics, Anthroprometric Considerations, Newtons Laws of motions

UNIT 2 MECHANICS OF HARD TISSUES **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.

UNIT 3 MECHANICS OF SOFT TISSUES **9 Hrs.**

Tissue Mechanics-Structure and functions of cartilages, tendons, ligaments,, Mechanical Properties of Tissues, Biological materials, Pseudo elasticity, nonlinear stress-strain relationship, viscoelasticity and models, structure, function and mechanical properties of skin, ligaments and tendons, Mechanical testing of Soft tissue.

UNIT 4 CARDIOVASCULAR MECHANICS **9 Hrs.**

Cardiovascular Physiology, Heart Valve Dynamics, Prosthetic Valve Dynamics. Mechanical properties of blood vessels –arteries, arterioles, capillaries, veins, blood flow: laminar and turbulent.

UNIT 5 APPLICATIONS OF BIOMECHANICS **9 Hrs.**

Mechanics 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, Sports biomechanics.

Max.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

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

SCSA2102	FUNDAMENTALS OF PYTHON PROGRAMMMINGLAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

1. Program to handle Input and Output statements
2. Program using Lists, Tuples, Dictionary and Sets
3. Program using conditional statements
4. Program using looping constructs
5. Program using functions and modules
6. Program using File handling
7. Program using Exception handling
8. GUI Programming using Python - Canvas Widget
9. GUI Programming using Python - Frame, label, button, check box, entry, listbox, message, radio button, text, spinbox
10. Database Programming using Python
11. Socket Programming using Python

CASE STUDIES

- Quora : Question similarity
- Amazon :Fashion Discovery Engine

SBTA2101	MICROBIOLOGY AND CELL BIOLOGY LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVE

- To study the basic laboratory techniques of microbiology and cell biology

SUGGESTED LIST OF EXPERIMENTS

1. Microscopy– Description and operation of compound microscope, use of oil immersion objective. Micrometry
2. Staining Methods
    - Simple staining – *Bacillus* spp.
    - Differential staining – *Bacillus* and *E.coli.*
    - Special staining - Capsular staining
    - Fungal staining - Lactophenol cotton blue, staining of mold (Penicillium, Aspergillus).
3. Sterilization- Operation of autoclave, hot air oven, membrane filtration (demonstration only),
4. Culture transfer from solid to solid, solid to liquid and liquid to liquid: Checking of possible contamination.
5. Culture techniques
   Culture media preparation- Nutrient broth, nutrient agar slant, potato dextrose agar.
6. Isolation and viable cell count of bacteria by Pour plant and spread plate method
7. Isolation of pure culture by streak plate method.
8. Bacterial motility (a) Hanging drop method (b) Stabbing method.
9. Antibiotics sensitivity assay
10. Study of chromosomal abnormalities (Permanent slides)
11. Study of cancer cell lines (Permanent slides)
12. Preparation of buccal smear for identification of Barr bodies
13. Study of Mitotic stages
14. Study of Meiotic stages

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Understand basic principles of microscopy and microscopic examination.

CO2 - Determination of primary identification of bacteria and fungi by staining techniques.

CO3 - Differentiate bacterial species by suitable macroscopic techniques.

CO4 - Understand different sterilization techniques.

CO5 - Differentiate cell cycle stages.

CO6- Compare normal cells from cancer cells.

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SCHOOL OF BIO AND CHEMICAL ENGINEERING

DEPARTMENT OF BIOTECHNOLOGY

Board of Studies 2019-2020 (EVEN SEM)

Minutes of Meeting

Date: 01-12-2019 (Saturday) Time: 10.00am-12.00pm

Chair-person : **Dr. Wilson Aruni**

Members : **Dr. Chirayu Padhiar**, External Member

Senior Medical Director, LifeCell International Pvt., Chennai.

Dr. Parthiban.M., External Member

Professor and Head, Department of Animal Biotechnology,

Madras Veterinary college, Chennai 600007

Dr. Elizabeth Rani, External Member

Head of the Department, Department of Biotechnology,

Hindustan College of Arts and Science, Chennai

Dr. Ramesh kumar V, Internal member

Dr. Valli Nachiyar C, Internal member

Dr. Jayshree Nellore, Internal member

The Chair-person welcomed the members. Dr.Ramesh Kumar, Head, Department of Biotechnology put forth the agenda of the meeting.

Agenda of the meeting; Syllabus revisions and implementation in 2019- 2020 even semester. Following which discussions were held as;

The Chairperson abridged the members that, as per AICTE norms the implementation of Basis Electrical and Electronics Engineering and Workshop Practice course in semester II

Dr Ramesh Kumar suggested introduction of Principles and Calculations in Chemical Engineering in Semester II itself to introduce the basic concepts of Chemical Engineering.

M Tech Biotechnology

Dr Jayshree Nellore recommended implementation of Advanced Genetic Engineering course theory and practical in the same semester to have a follow up. Dr Valli suggested that the Bioprocess lab experiments be included along with it, so as to make up with the number of credits required.

Industry 4.0 to be implemented as per Dr Elizabeth Rani suggestion.

Existing modules in 2015 regulations were modified with introduction of current topics and courses Advanced Molecular Biology and Genetic Engineering, Fermentation and Downstream processing, Enzyme and Protein Engineering to be implemented as per board suggestions.

Meeting ended with vote of thanks to the Chair.

External Member	**Signature**
Dr. Chirayu Padhiar	
Dr.Prathiban M	
Dr. Elizabeth Rani	
Internal Member	**Signature**
Dr. Jayshree Nellore	
Dr. Valli Nachiyar	
Dr. Ramesh kumar V	

HEAD OF THE DEPARTMENT
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Chennai-600 119

(Dr.Aruni Wilson)

SEEA1101	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To impart knowledge on the analysis of DC and AC Circuits.
- To gain knowledge about the working of electrical machines.
- To impart Knowledge on the operation of the basic electronic devices.

UNIT 1 D.C. CIRCUITS **9 Hrs.**

Electrical Quantities - Ohm's law - Kirchoff's laws -Resistance in series and parallel combinations - Current and Voltage division rules - Mesh analysis and Nodal analysis.

UNIT 2 A.C. CIRCUITS **9 Hrs.**

Sinusoidal functions - R.M.S and Average values for Sinusoidal waveform - Phasor representation - Sinusoidal excitationapplied to purely resistive, inductive and capacitive circuits - RL , RC and RLC series circuits - power and power factor - Introduction to three phase circuits with balanced load.

UNIT 3 INTRODUCTION TO MACHINES **9 Hrs.**

Construction and Principle of Operation of DC Generators - DC Motors - Single Phase Transformer - Single Phase Induction Motors - Stepper Motor.

UNIT 4 SEMICONDUCTOR DEVICES **9 Hrs.**

VI Characteristics of PN-junction diodes and Zener diodes, BJT and its configurations – input/output Characteristics, Junction Field Effect Transistor – Drain and Transfer Characteristics, MOSFET – Depletion type and Enhancement type, Uni Junction Transistors - Silicon Controlled Rectifiers.

UNIT 5 DIGITAL ELECTRONICS **9 Hrs.**

Number systems – Binary arithmetic - Boolean algebra, laws & theorems – Boolean Functions - Simplification of Boolean functions - Logic gates - Implementation of Boolean expressions using logic gate - Standard forms of Boolean expression.

MAX. 45 Hrs.

COURSE OUTCOMES; On completion of the course, student will be able to

CO1 - Analyze electrical circuits using Kirchoff's Laws.
CO2 - Compare the behaviour of R, L and C and their combinations in AC circuits.
CO3 - Describe the construction and working principle of DC and AC machines.
CO4 - Demonstrate the characteristics of various semi-conductor devices.
CO5 - Understand the concept of digital electronics.
CO6 - Recognize the importance of electronic devices.

TEXT / REFERENCE BOOKS

1. Mittle B.N. & Aravind Mittle, Basic Electrical Engineering, 2nd Edition, Tata McGraw Hill, 2011.
2. Theraja B.L., Fundamentals of Electrical Engineering and Electronics, 1st Edition, S.Chand & Co., 2009.
3. Smarajit Ghosh, Fundamentals of Electrical and Electronics Engineering, 2nd Edition, PHI Learning Pvt. Ltd, 2010.
4. Kothari D.P. and Nagarath I.J., Electrical Machines, 3rd Edition, Tata McGraw Hill Publishing Company Limited, 2006.
5. Sanjay Sharma, Electronic Devices and Circuits, 2nd Edition, S.K.Kataria & Sons, 2012.
6. John Bird, Electrical Circuit Theory and Technology, 4th Edition, Published by Taylor & Francis, 2010.

SMEA1102	ENGINEERING DRAWING	L	T	P	Credits	Total Marks
		1	0	4	3	100

COURSE OBJECTIVES

- To know the basics of Engineering Graphics.
- To make the student to possess the efficient drafting skill.
- To make the students to understand the importance of sectioning and concept of development.
- To learn about the orthographic and pictorial projections.

UNIT 1 LETTERING, DIMENSIONING AND GEOMETRICAL CONSTRUCTION 9 Hrs.

BIS - Lettering - Two systems of dimensioning - Dividing a straight line into any number of equal parts - Bisecting an angle and right angled triangle - Drawing a regular pentagon and hexagon given one side - Conic sections - ellipse, parabola, hyperbola by eccentricity method.

UNIT 2 PROJECTION OF POINTS AND LINES 9 Hrs.

Projection - Types of projection - Projection of points lying in four quadrants - Projection of lines (First angle projection only) - Projection of lines parallel and inclined to one or both the planes.

UNIT 3 PROJECTION OF SOLIDS 9 Hrs.

Projection of simple solids like prisms, pyramids, cylinder, cone with its axis perpendicular to HP, axis perpendicular to VP, axis inclined to HP.

UNIT 4 SECTION OF SOLIDS 9 Hrs.

Purpose of sectioning - Sectional views - Hatching - Section plane perpendicular to one plane and parallel to other plane - Section plane inclined to HP - Section plane inclined to VP - True shape of the section.

UNIT 5 DEVELOPMENT OF SURFACES AND ORTHOGRAPHIC PROJECTION 9 Hrs.

Need for development of surfaces - Types of development of surfaces - Development of pentagonal and hexagonal prisms - Development of cylinders - Development of pentagonal and hexagonal pyramids - Development of cones. Orthographic Projection- Free hand sketch –conversion of 3D into 2D.

Max.45 Hrs.

COURSE OUTCOMES On completion of the course, student will be able to

CO1 - Identify the national standards related to the Engineering drawing based on BIS and construct conic sections andpolygons.

CO2 - Draw orthographic projections of points, lines.

CO3 - Draw orthographic projections of solids

CO4 - Draw orthographic section of solids and improve the Students visualization skill to develop new products.

CO5 - Draw the development of surfaces and its applications in manufacturing industry.

CO6 - Draw the orthographic view of solids and learn to convert pictorial into orthographic projection.

TEXT / REFERENCE BOOKS

1. Engineering drawing practice for schools and colleges, SP 46 – 1988
2. Natarajan K.V., A Text Book of Engineering Graphics, Dhanalakshmi Publishers, 21st Edition, 2012.
3. Bhatt N.D., Engineering Drawing, Charotar Publishing House, 53rd Edition, 2014.
4. Venugopal K., Prabhu Raja V., Engineering Graphics, New Age International Publishers, 15th Edition, 2018.

SCHA1211	PRINCIPLES AND CALCULATIONS IN CHEMICALENGINEERING	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To develop skills of the Students in the area of Chemical Engineering which will be necessary for certainother course offered in the subsequent semesters.
- To expose the students to various unit operations so as to enable them to improve the design and operation of the bioprocess plant.

UNIT 1 INTRODUCTION TO CHEMICAL ENGINEERING **9 Hrs.**

Introduction to chemical engineering sciences and its role in the design & analysis of biological processes, overview of unit operations and processes in the chemical industry. Unit operations, schematic representations of unit operations, Fermentation Process (Ethanol), Agrochemical (Urea), Pharmaceutical (Penicillin). Unit process-alkylation, aromatization, calcination, chlorination, Trans-esterification.

UNIT 2 INTRODUCTION TO PROCESS CALCULATIONS **9 Hrs.**

Introduction to chemical engineering, concepts of units and conversion factors, fundamental and derived units, basic chemical calculations, mole, mass, molecular weight, introduction to dimensional analysis, dimensionless numbers, dimensional analysis.

UNIT 3 MATERIAL BALANCES WITHOUT CHEMICAL REACTIONS **9 Hrs.**

Material balance without chemical reaction – Distillation, Evaporation, Crystallization, Absorption, Drying, membrane operations and Mixing.

UNIT 4 MATERIAL BALANCES WITH CHEMICAL REACTIONS **9 Hrs.**

Material Balance with chemical reaction-limiting reactant, excess reactant, conversion and selectivity. Recycle, purge andbypass operations.

UNIT 5 ENERGY BALANCE AND COMBUSTION **9 Hrs.**

Introduction to thermophysics and thermo chemistry, heat capacities of solid, liquid and gases at constant pressure and volume, evaluation of enthalpy, standard heat of reaction, standard heat of combustion and standard heat of formation.

Max.45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Understanding the flow sheets of any process and symbols in unit operations and processes.
CO2 - Learn the basic definitions, units, unit systems
CO3 - Analyzing and converting the values from one-unit system to other unit system
CO4 - Understanding the material balance calculations for with and without reaction.
CO5 - Understanding the energy balance calculations for various reactions.
CO6 - Material and Energy balance calculations for combined process equipment.

SMEA2201	WORKSHOP PRACTICE	L	T	P	Credits	Total Marks
		0	0	4	2	100

COUSE OBJECTIVE

- To provide the students with hands on experience on different trades of engineering like Plumbing work, fitting, carpentry, Foundry, welding and sheet metal.

SUGGESTED LIST OF EXPERIMENTS

Plumbing Works

(a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, and elbows in household fittings.
(b) Study of pipe connections requirements for pumps and turbines.
(c) Preparation of plumbing line sketches for water supply and sewage works.
(d) Hands-on-exercise:
Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
(e) Demonstration of plumbing requirements of high-rise buildings.

CARPENTRY

Handling of carpentry tools, A practice in marking, sawing planning and chiseling to size. Making simple joints such as half- lap, dove-tail and mortise and tenon joints.
Use of modern materials such as plywood, chip board, novapan, laminated sheet (Demonstration only)

FITTING

Use of fitting tools-practice in marketing, fitting to size and drilling-making of simple mating and profiles such as V, Square, Dove-tail, Half-round joints.

WELDING

i. Electric Arc Welding
   a) Study on Edge preparation techniques for Arc welding
   b) List of Welding Exercises
      1. Lap Joint 2. Butt Joint 3. Fillet Joint 4. Tee Joint 5. V Joint 6. Corner Joint
ii. Study on gas welding and gas cutting
iii. Study on TIG & MIG welding

FOUNDRY

i. Sand testing - Grain fineness - Permeability test.
ii. Study on Pattern Allowances
iii. Preparation of green sand moulding
   1. Flanges 2. Glands 3. Bush 4. Dumbbell
iv. Metal casting technique (Demonstration only)

SHEET METAL

Tools and equipment– practice.
Making rectangular tray, hopper, scoop, etc.
Mini project - Fabrication of a small cabinet, dust bin, etc.

Courses introduced in M Tech Biotechnology

SBTA5201	ADVANCED MOLECULAR BIOLOGY AND GENETIC ENGINEERING	L	T	P	C	Total marks
		3	*	0	3	100

Course Objectives

- The course provided a deep insight on to the various techniques involved in manipulation of DNA for its exhaustive use in the field of gene characterization, modification, cloning and transgenesis.

Unit 1 Introduction To Genetic Engineering And Cloning Strategies **9 hours**

Milestones in genetic engineering. Special molecular tools used in genetic engineering. Preparation of DNA: Isolation and purification of DNA and genes, modification of cut ends and ligation of transgene. Gene transfer techniques: physical, Chemical and biological methods. Integrative DNA transfer- Agrobacterium Ti and Ri plasmids, Protoplast fusion and organelle engineering. Expression and Characterization of transgene: genomic level, transcript level and translational level.

Unit 2 Advanced Molecular Biology Techniques- I **9 hours**

Hybridization techniques: Southern, Northern, Western, South western and North western. PCR Techniques: Different types including real time (syber green and Taqman chemistry).DNA fingerprinting: basic genetic principle. Single locus and multilocus DNA fingerprinting: Variable Number of Tandem repeats (VNTRs) Minisatellite sequences, Short Tandom Repeats (STRs) Micro Satellite Sequences, RFLP, RAPD, ISSR, AFLP. Genome mapping: Direct mapping, indirect mapping.

Unit 3 Advanced Molacular Biology Techniques II **9 hours**

DNA sequencing; Maxam and Gilbert chemical degradation method, Sanger and Coulson's enzymatic chain termination method, Next generation sequencing, Pyrosequencing, High throughput sequencingDNA foot printing, Chromosome Walking, Chromosome Jumping. Techniques for differential gene expression: DDRT and SSH. Isolation of genes and full length cDNA: 5' and 3' RACE basic technique and comparison with RLM RACE. Gene Silencing Techniques; Antisence RNA technology, Micro RNA- ShRNA, siRNA, technology; Construction of siRNA vectors. Site directed mutagenesis.

Unit 4 Genetically Modified Organisms **9 hours**

Application of genetic engineering in food (golden rice and other improved nutrictional qualities), agriculture (herbicide resistance, salt/draught tolerance, insect resistance (Bt. protein), designer flowers), aquaculture (giant salmon), medicine (xenotransplantation and gene therapy), industry and environment (plants as bioreactors, vaccines, plantibodies, bioplastics and oil eating bacteria). Engineering novel traits in plants by antisense technology and RNAi technology, Creation of Transgenic plants- Seed terminator technology. Transgenic animals- Gene therapy. Transgenic microbes: Genetic manipulation of microorganisms. Transgenic organisms and Metabolic Engineering. Site direct mutagenesis.

Unit 5 Hazards And Impact Of GMOs **9 hours**

Negative impacts of genetic engineering and Present controversies on genetically modified organisms (GMOs). Biosafety Considerations: Biological risks, ethical issues, economic issues, legal issues. Biosafety regulations, norms for the release of genetically engineered organisms.

Total Number of Lectures: 45

SBTA5203	FERMENTATION AND DOWNSTREAM PROCESSING	L	T	P	C	Total marks
		3	*	0	3	100

Course Objectives:

- To understand and improve the knowledge on fermentation technology, growth kinetics, fermenter contro process and various downstream process techniques.

Unit 1 Introduction To Fermentation Process **9 hours**

The range of fermentation processes – Bacteria and fungi ilsolation techniques, Strain, culture collection management Inoculum preparation, Scale up of the inoculum for Bacteria and fungi – Sterilization, Batch and Continuous sterilizatior of medium, Filter sterilization, Aseptic operation.

Unit 2 Microbial Growth Kinetics **9 hours**

Bacterial growth kinetics,monod model, primary and secondary metabolites. Continuous culture, Comparasion o Continuous Batch and continuous culture. Design of a fermenter – ancillary equipment fermenter / Bioreactor types.

Unit 3 Instrumentation And Control **9 hours**

Fermentation control systems – manual and automatic control in fermentation processes. Architecture of Fermentatior systems, temperature measurement and control, flow measurement and control, pressure measurement and control measurement of pH and dissolved oxygen and concentration sensors, Computer applications in fermentatior technology. Artificial neural network.

Unit 4 Downstream Processing **9 hours**

Separation and recovery of fermented products- sedimentation, foam separation, precipitation, filtration, centrifugation flocculation, coagulation- cell disruption –physical and chemical methods, liquid - liquid extraction - solvent recovery, two phase aqueous extraction, supercritical fluid extraction.

Unit 5 Purification Processes **9 hours**

Membrane separation processes, crystallization, drying, whole broth processing, Chromatography - Adsorption Chromatography, gel permeation, Affinity Chromatography, High performance liquid. Chromatography. Lyophilization.

Total Number of Lectures: 45

Course outcomes:

CO1: To introduce basic knowledge on fermentation process.
CO2: To discuss about various types medium sterilization.
CO3: To understand instrument and control system.
CO4: Understand the knowledge of various primary isolation techniques.
CO5: Evaluate an appropriate technique for novel downstream processing and its applications
CO6: Compare diverse biomolecules technique and principle of various chromatography techniques and its resolution

SBTA5202	ENZYME AND PROTEIN ENGINEERING	L	T	P	C	Total marks
		3	*	0	3	100

Course Objectives

- To make Students learn structural and functional relationships in proteins and altering their structure in order to function 'better'. To provide basic knowledge of enzyme technology and use of enzymes as tools in industry, agriculture and medicine

Unit 1 Protein Stability And Folding **9 hours**

Overview of protein structure, Higher level structure, Protein stability, Mechanism of protein folding (types, level, thermodynamics, Anfinsen's dogma &Levinthol paradox& kinetics), Folding Rate, Molten globule; Techniques for studying of protein folding; Location and functions of Molecular chaperones, chaperonin and co-chaperons, HSP chaperone system in Ecoli& Human; Proteasomes and proteosome mediated protein degradation; Protein folding errors: Alzheimer's, prions and Mad Cow (BSE, CJD), Cystic Fibrosis and cancer. Polyketides and non-ribosomal peptides

Unit 2 Enzymes And Applications **9 hours**

Production and purification of crude enzyme extracts from plant, animal and microbial sources; methods of characterization of enzymes; development of enzymatic assays. Techniques for Immobilization of enzymes and Overview of applications of immobilized enzyme system .Abzymes and their applications Enzyme electrodes, biosensors and their applications in industry, healthcare and environment, ELISA, EMIT

Unit 3 Protein Engineering **9 hours**

Introduction to steps of Protein design and Engineering, protein splicing and its application; Solid phase peptide synthesis, Production of Novel Proteins; Random and site directed mutagenesis, Methods for Expressing Recombinant Proteins; Characterization of Proteins structure: Crystallography and X-Ray Diffraction, Spectroscopy (UV-VIS, NMR and Fluorescence Spectroscopy) and Calorimetric Methods.

Unit 4 Computational Methods In Protein Engineering **9 hours**

Non canonical aminoacids in protein science and engineering, Fidelity mechanisms of the aminoacyl-tRNAsynthetases, engineering with unnatural amino acid analogs, choice of protein scaffold for protein engineering, Application of molecular modeling and structure predictions to protein engineering, mechanical calculations and geometry optimization, De novo protein design, Energy status of a protein molecule. protein databases,

Unit 5 Applications Of Protein Engineering **9 hours**

Alterations of substrate specificity and stereoslectivety of lipases and esterases, cofactor and substrate engineering for metabolic engineering and gene therapy, Combinational manipulation of polyketides and non ribosomal peptides; structure based engineering of PHA synthase enzymes and monomer supplying enzymes, Bioengineering of sequence repetitive polypetides, application of protein folding to design new drug

Total Number of Lectures: 45

SCCA9501	INDUSTRY 4.0	L	T	P	C	Total Marks
		3	0	0	2	100

UNIT 1 TRANSFORMING TECHNOLOGIES IN BIOENGINEERING **7 Hrs.**

Establishment of smart biotechnology factory, Artificial intelligence in Bioprocess technology, Omics – Big data analysis through automation, 3D bio printing for tissue engineering. Simulation tools, RSM and Box model. Cyber physical system based telemedicine, diagnosis and therapeutics through real time biosensors. Bionanotechnology. Intellectual Property rights (IPR): Case Studies.

UNIT 2 ADVANCEMENTS IN SUSTAINABLE BUILT ENVIRONMENT **7 Hrs.**

Introduction – Technological developments in Architectural, Engineering and Construction (AEC) - Building Information Modelling (BIM) using Cloud computing technology and Internet of things (IoT) – Unmanned Aerial Vehicles, sensors – Additive manufacturing in construction – Concrete 3D printing - Materials used - Lightweight and functionally graded structures - Net Zero Energy buildings, Bioswales, Biofiltration pond, Ecosan systems- Recent developments in Waste water Management, Air pollution control, waste disposal - Integration of energy, water and environmental systems for a sustainable development- Emerging Technologies: Robot Highway- Vertical farming - Intellectual Property rights: Case studies

UNIT 3 SMART MANUFACTURING **8 Hrs.**

Smart factories and interconnection, Smart Manufacturing – automation systems, Additive Manufacturing, Smart grids, Micro Electro Mechanical Systems (MEMS), Stealth technology, Metal Finishing, Self propelled vehicles, e mobility, Green fuels, drones – unmanned aerial vehicles(UAVs), aerodynamics. Robotic Automation and Collaborative Robots – Augmented reality and haptics, engineering cybernetics and artificial intelligence (AI), Disruptive Technologies – Frugal Innovations –Emerging Technologies - Autonomous Robots, Swam Robot, Modular Robotics, Space craft, Intellectual Property Rights (IPR): Case Studies.

UNIT 4 SMART WORLD **8 Hrs.**

Smart Sensors and IIOT, Smart grid, Hybrid renewable energy systems, Electronics in Smart city, Integration of Sensors in Robots and Artificial Intelligence, 5G Technology, Communication protocols, Human-Machine Interaction, Virtual Reality, Quantum Computing: Changing trends in transistor technology: Processor, Emerging Trends: Deep Space, Swarm Robots, Cyborg, Geofencing, Pervasive Computing, Intellectual Property Rights- Case Studies.

UNIT 5 CYBER PHYSICAL SYSTEMS **8Hrs.**

Introduction to Cyber Physical Systems (CPS), Architecture of CPS, Data science and technology for CPS, Prototypes of CPS, Emerging applications in CPS including social space, crowd sourcing, healthcare and human computer interactions, Industrial Artificial Intelligence, Deep Learning, Gamification, Networking systems for CPS applications, Wearable cyber physical systems and applications, Domain applications of CPS: Agriculture, Infrastructure, Disaster management, Energy, Transportation, Intellectual Property Rights (IPR) : Case Studies.

Max. 45 Hours

SBTA6201	GENETIC ENGINEERING AND BIOPROCESS LABORATORY	L	T	P	C	Total marks
		0	0	4	2	100

Course Objective:

- The objectives of this course are to provide students with the experimental knowledge of genetic engineering and Bioprocess

Genetic Engineering List of Experiments

1. Isolation of genomic DNA from leaf samples - CTAB Precipitation method
2. Estimation of DNA / RNA by UV spectrophotometry
3. Restriction digestion of DNA
4. Construction of restriction map - plasmids
5. DNA ligation
6. Polymerase Chain Reaction - Amplification of DNA of interest/ RAPD
7. Purification of PCR products- gel elution
8. Southern blotting / Western blotting / northern blotting
9. Cloning of PCR products (competitive cell preparation, CaCl2 transformation, blue - white screening of transformants.

Bioprocess Engineering List Of Experiments

1. Isolation of Industrial important microorganism.
2. Medium Design by Plackett Burman Model.
3. Evaluation of microbial growth rate by Monod model
4. Preparation of Immobilization beads.
5. Cell disruption – sonication
6. Evaluation of rate of Filtration
7. TLC
8. Salting out
9. Dialysis
10. Colum chromatography
11. Lyophilization

Course Outcomes:

CO1: Students should be able to gain hands-on-experience on development of an ability to design and conduct genetic engineering and bioprocess experiments

CO2: To analyze and interpret data

CO3: To apply the laboratory skills to solve genetic engineering and bioprocess engineering problems

CO4: Graduates perform competently in genetic engineering and bioprocess industries

CO5: Development of research aptitude and technical skills to secure a job in genetic engineering and bioprocess engineering labs

CO6: To evolve novel analytical methods in bioprocess for Biotechnology industries.