No.	**Information of BioT - 31052 Bioprocess Engineering (2019-2010) 1st Semester**	
1.	Unit name:	**Bioprocess Engineering III**
2.	Code:	**BioT - 31052**
3.	Classification:	Core subject
4.	Credit value:	3.5
5.	Semester/Year Offered:	1/3
6.	Pre-requisite:	NA
7.	Mode of delivery:	Lectures and Discussions
8.	Assessment system and breakdown of marks:	Classwork, Tutorials
	Classwork, Tutorials	30%
	Mid-term exam	35%
	Final exam	35%
9.	Academic staff teaching unit:	Department of Biotechnology
10.	Course outcome of unit: After completion of this course, students will be able to: 1. Calculate the necessary amount of energy can be worked out for biochemical reaction 2. Apply the thermodynamic laws relevant to bioprocess engineering 3. Solve the problem encountered in real- life industries	
11.	Synopsis of unit: Biotechnology is a composite of life science and engineering knowledge which impart the knowhows to ensure the food security rather than the traditional methods and furnish the products of large scale biological processing and manipulation of biological metabolism.	
12.	Topics 1. Terminology Associated with energy balances 2. Types of energy to be included in energy balances 3. Energy balances without reaction	
13.	Main reference: David M. Himmelblau and James B. Riggs, "Basic Principles and Calculations in Chemical Engineering", 8th Edition. Prentice Hall International Series.	
14.	Additional references: - Pauline M.Doran, "Bioprocess Engineering Principles", Academic Press, An Imprint of Elsevier. - Richard M. Felder and Ronald W. Rousseau, "Elementary Principles of Chemical Processes", 3rd Edition, John Wiley and Sons, Inc.	

No.	Information of the subject	
1.	Unit name:	Biochemistry I
2.	Code:	Bio T 31012
3.	Classification:	Core subject
4.	Credit value:	3.5
5.	Semester/Year Offered:	1/3
6.	Pre-requisite:	Bio T 21011& Bio T 22011
7.	Mode of delivery:	Presentations, Lectures
8.	Assessment system and breakdown of marks:	Practical, Classwork, Exams
	Participation in Practical, Classwork and discussion	30%
	Mid-term exam	35%
	Final exam	35%
9.	Academic staff teaching unit:	Department of Biotechnology
10.	Course outcome of unit: After completion of this course, students will be able to 1. Understand the importance of high energy compounds, electron transport chain and apply basic principles of chemistry to biological systems and molecular biology 2. Explain biological mechanisms, such as the processes and control of bioenergetics and metabolism, as chemical reactions for synthesis of ATP under aerobic and anaerobic conditions 3. Describe the synthesis and breakdown of glycogen and how the processes are regulated 4. Acquire knowledge related to the role of TCA cycle in central carbon metabolism 5. Learn basic concepts of Bioenergetics, mechanisms of oxidative phosphorylation and substrate level phosphorylation.	
11.	Synopsis of unit: The course includes basic concepts of Bioenergetics by studying overview of metabolism, the provision of metabolic fuels and synthesis of ATP under aerobic and anaerobic conditions. This course also provides the basic principles of biochemistry in metabolism including the role of glycolysis and gluconeogenesis; the citric acid cycle and oxidative phosphorylation.	
12.	Topics 1. Introduction to Metabolism 2. Glucose Catabolism 3. Glycogen Metabolism and Gluconeogenesis 4. Citric Acid Cycle 5. Electron Transport and oxidative phosphorylation	
13.	Main reference: • Donald Voet, Judith G. Voet, Charlotte W. Pratt, '**Fundamentals of Biochemistry'**, 4th Edition, John Wiley & Sons, Inc.	
14.	Additional references: • David L. Nelson and Michael M. Cox, **'Principles of Biochemistry'**, 6th Edition, W. H. Freeman and Company, New York	

No.	Course Information	
1.	Unit name:	Microbiology III
2.	Code:	BioT 31022
3.	Classification:	Core subject
4.	Credit value:	3.5
5.	Semester/Year Offered:	1/3
6.	Pre-requisite:	BioT 21022& BioT 22022
7.	Mode of delivery:	Presentations, Lectures
8.	Assessment system and breakdown of marks:	Tutorial
	Tutorial	30%
	Mid-term exam	35%
	Final exam	35%
9.	Academic staff teaching unit:	Department of Biotechnology
10.	Course outcome of unit: After completion of this course, students will be able to 1. to understand the transmission route of infectious agents and barriers to this pathogens 2. to describe the human infectious diseases caused by pathogen, viruses, and fungal and algae 3. to develop skills in methods of isolating microbes, culturing microbes, examining the morphology of microbes 4. to explain the control of microorganisms by chemical and physical methods 5. to describe antimicrobial agents and antibiotic susceptibility tests 6. to develop skill in laboratory procedures and safety	
11.	Synopsis of unit: The course will cover the important aspect of microbial genus that contains human pathogens. In course study, human microbial disease, physical and chemical methods to control the microorganisms would be studied. This course will cover antimicrobial agents for industrial, commercial, environmental, pharmaceutical and medical applications. This course introduces students to the basic principles and concepts in mechanics. This course will cover a strong background of various types of microorganisms; include microbe diversity, metabolism type-based classification, factors that determine the growth and their control techniques, microbial ecology and biotechnological aspects of microbes.	
12.	Topics 1. Human microbial disease 2. Infectious diseases 3. Bacterial diseases in humans 4. Viral diseases in humans 5. The Control of Microorganisms 6. Antimicrobial Agents 7. Membrane Transport	
13.	Main reference: • Stuart Hogg , ‘‘Essential Microbiology’’, 2005 , The University of Glamorgan, UK	
14.	Additional references: • Glazer, AN & Nikaido, H. 2007. ‘Microbial Biotechnology’: Fundamentals	

	of Applied Microbiology (2nd Edition). Cambridge University Press • Harley, Prescott, "Laboratory Exercise in Microbiology, 5th Edition", The McGraw-Hill Companies, 2002. • Harley, Prescott, Klein, "Microbiology, 5th Edition", The McGraw-Hill Companies, 2002.

No	Information of the subject	
1	Unit name:	Analytical Chemistry
2	Code:	BioT31032
3	Classification:	Core subject
4	Credit value:	3
5	Semester/ Year Offered:	1/3
6	Pre-requisite:	BioT 21031 &BioT21032 Organic chemistry I &II
7	Mode of delivery:	Explain, Drawing, computer application, Practical, Quiz, Discussion
8	Assessment system and breakdown of marks:	Fill in the blanks, Multiple choice, short questions, short notes, practical
	Fill in the blanks, Multiple choice, short questions, Short notes	70%
	practical results, practical exam, Animation and viva test	30%
9	Academic staff teaching unit:	Department of Biotechnology
10	Course outcome of unit: After completion of this course, students will be able To analyze results data by standard deviation, chart and graph of standardization methods To analyze pH, Complexation and Solubility of acid-base reactions at equilibrium To apply Solvent Extraction, Solid Phase Extraction and different chromatography methods	
11	Synopsis of unit: Analytical chemistry subject is requirefor specialist and disciplined approach by their broad scope. The major areas of application are fundamental research Product,development product quality control,monitoring and control of pollutants,assay,medical and clinical studies. Scientific and commercial colleagues, customers and other interested parties, discuss together with on-site visits can greatly assist in the choice of method and the interpretation of analytical data thereby minimizing the expenditure of time, effort and money.From the chapters2**.**The Assessment of Analytical Data, 3. pH, Complexation and Solubility Equilibria, and 4. Separation Techniquesstudies will give and provide a basic understanding of the principles, instrumentation and applications of chemical analysis as it is currently practiced.	
12	Topic: **1. Introduction** The Scope of Analytical Chemistry	

	The Function of Analytical Chemistry Analytical Problems and Their Solution The Nature of Analytical Methods Trends in Analytical Methods and Procedures Glossary of Terms **2. The Assessment of Analytical Data** 2.1 Definitions and Basic Concepts 2.2 The Nature and Origin of Errors 2.3 The Evaluation of Results and Methods The Reliability of Measurements The Analysis of Data TheApplication of Statistical Tests Limits of DetectionQuality Control Chart Standardization of Analytical Methods Chemometrics. Problems **3. pH, Complexation and Solubility Equilibria** 3.1 Chemical Reactions in Solution Equilibrium Constants Kinetic Factors in Equilibria 3.2 Solvents in Analytical Chemistry Ionizing Solvents. Non-ionizing Solvents 3.3 Acid–baseEquilibria Weak Acid and Weak Base Equilibria Buffers and pH Control The pH of Salt Solutions 3.4 ComplexationEquilibria The Formation of Complexes in Solution The Chelate Effect 3.5 Solubility Equilibria Solubility Products Problems **4. Separation Techniques** 4.1 Solvent Extraction Efficiency of Extraction. Selectivity of Extraction Extraction Systems. Extraction of Uncharged Metal Chelates Methods of Extraction Applications of Solvent Extraction 4.2 Solid Phase Extraction Solid Phase Sorbents Solid Phase Extraction Formats AutomatedSolid Phase Extraction Solid Phase Micro extraction Applications of SPE and SPME 4.3 Chromatography 4.3.1 Gas Chromatography 4.3.2 High Performance Liquid Chromatography 4.3.3 Supercritical Fluid Chromatography.

	4.3.4 Thin-layer Chromatography. 4.3.5 Ion-exchange Chromatography 4.3.6 Size Exclusion Chromatography 4.4 Electrophoresis Factors Affecting Ionic Migration Effect of TemperaturepH and Ionic Strength Electro-osmosisSupporting Medium Detection of Separated Components Applications of Traditional Zone Electrophoresis High-performance Capillary Electrophoresis Capillary Electro chromatography Applications of Capillary Electro chromatography Problems
14	Main references: **Principles and Practice of Analytical Chemistry,** Fifth Edition**,** F.W. FifieldKingston Universityand**,** D. Kealey**,** University of Surrey.
5	Additional references: MODERN ANALYTICAL CHEMISTRY

No.	Information of the subject	
1.	Unit name:	Genetic Engineering I
2.	Code:	BioT31042
3.	Classification:	Core subject
4.	Credit value:	3.5
5.	Semester/Year Offered:	1/2
6.	Pre-requisite:	BioT 21041 and BioT 22041
7.	Mode of delivery:	Presentations, Lectures
8.	Assessment system and breakdown of marks:	Practical, Classwork
	Practical	15%
	Active participation in Classwork and discussion	15%
	Mid-term exam	35%
	Final exam	35%
9.	Academic staff teaching unit:	Department of Biotechnology
10.	Course outcome of unit: After completion of this course, students will be able to 1. Describe the general principles Gene cloningand recombinantDNA identification. 2. Understand the cloning vectors for *E.coli* that involve the use of recombinant DNA technology 3. Explain the essential enzymes that involve the use of recombinant DNA technology 4. Exhibit advanced knowledge in a specialized field of molecular and cell biology 5. Recognize safe laboratory practices and perform basic molecular biology techniques 6. Understand and apply the principles and techniques of molecular biology which prepares students for further education and/or employment in teaching, basic research, or the health professions.	
11.	Synopsis of unit: Genetic engineering – the process of purposefully altering an organism's DNA – has been used to create powerful research tools and model organisms, and has also seen many agricultural applications. However, in order to engineer traits to tackle complex agricultural problems such as stress tolerance, or to realize the promise of gene therapy for treating human diseases, further advances in the field are still needed. Important considerations include the safe and efficient delivery of genetic constructs into cells or organisms, and the establishment of the desired modification in an organism's genome with the least "off-target" effects.	
12.	Topics 1. Introduction	

	2. Introducing molecular biology 3. Working with nucleic acids 4. The tools of the trade 5. Host cells and vectors 6. Cloning strategies 7. The polymerase chain reaction 8. Selection, screening, and analysis of recombinants 9. Bioinformatics
13.	Main reference: • Desmond S.T. Nicholl, "An Introduction to Genetic Engineering", 3rd edition, Cambridge
14.	Additional references: • Watson. Baker. Bell. Gann. Levine. Losick" Molecular Biology of the Gene", 7th Edition • William S. Klug, Michael R. Cummings, Charlotte A. Spencer, Michael A. Palladino. "Concepts of Genetics", 10th Edition, Pearson • T.A. Brown, "Gene Cloning and DNA Analysis, An Introduction", 6th Edition, Wiley-Blackwell