Uttarakhand Technical University, Dehradun
Scheme of Examination as per AICTE Flexible Curricula

Evaluation Scheme & Syllabus

for

B. Tech Second Year
(Bio Chemical Engineering)

W.E.F. Academic Session 2019-20

B Tech II Year
3rd and 4th SEMESTER

Bachelor of Technology (B. Tech.)
[Bio Chemical Engineering]

Uttarakhand Technical University, Dehradun

Uttarakhand Technical University,
B.Tech. II Year (Biochemical Engineering)
As per AICTE model curriculum
[W.E.F. Academics Session :2019-20]
Semester III

SEMESTER- III													
Sl. No.	**Subject**	**Subject**	**Periods**			**Evaluation Scheme**				**End Semester**		**Total**	**Credit**
	Codes		**L**	**T**	**P**	**CT**	**TA**	**Total**	**PS**	**TE**	**PE**		
1	BAST 302	Biology for Engineers	3	1	0	30	20	50		100		150	4
2	BCET 301	Energy and Environmental Engineering	3	1	0	30	20	50		100		150	4
3	BBCT 301	Microbiology	3	1	0	30	20	50		100		150	4
4	BBCT 302	Biochemistry	3	1	0	30	20	50		100		150	4
5	BBCT 303	Fluid Flow & Solid Handling	3	1	0	30	20	50		100		150	4
6	BBCP 301	Microbiology Lab	0	0	2				20		30	50	1
7	BBCP 302	Biochemistry Lab	0	0	2				20		30	50	1
8	BBCP 303	Fluid Mechanics Lab	0	0	2				20		30	50	1
9	BBCP 304	Internship Assessment	0	0	2				50			50	1
10	BBCP 305	Life Sciences Lab	0	0	2				20		30	50	1
		Total										1000	25
*The Mini Project or internship (3-4 weeks) conducted during summer break after II semester and will be assessed during III semester.													

Semester IV

SEMESTER- IV													
Sl. No.	**Subject**	**Subject**	**Periods**			**Evaluation Scheme**				**End Semester**		**Total**	**Credit**
	Codes		**L**	**T**	**P**	**CT**	**TA**	**Total**	**PS**	**TE**	**PE**		
1	BAST402	Instrumental Methods of Analysis	3	1	0	30	20	50		100		150	4
2	BBCT 401	Fermentation Biotechnology	3	1	0	30	20	50		100		150	4
3	BBCT 402	Mass Transfer Operations	3	1	0	30	20	50		100		150	4
4	BBCT 403	Basics in Thermodynamics and Process Calculations	3	1	0	30	20	50		100		150	4
5	BBCT 404	Instrumentation and Process control	3	1	0	30	20	50		100		150	4
6	BBCP 401	Fermentation lab	0	0	2				20		30	50	1
7	BBCP 402	Mass Transfer Operations Lab	0	0	2				20		30	50	1
8	BBCP 403	Instrumental Methods Lab	0	0	2				20		30	50	1
9	BBCP 404	MATLAB Practices	0	0	4				20		30	50	2
10	BCSP 408	Python Programming	0	0	2				20		30	50	1
11	BCST 408	Cyber Security	Non Credit Course										
		Total										**1000**	**26**

B. Tech. II Year (III Semester)

BAST 302: BIOLOGY FOR ENGINEERS **L T P 3 1 0**

Course Objectives:

- Students will understand the basic concept of Cell organelles and their function.
- Students will understand Classification of the living organisms Systematic and binomial system of nomenclature. Characteristics of living systems;, Prokaryotic and eukaryotic cell; Plant and animal cell.
- Student will understand the brief idea of transcription, translation and DNA replication.
- Student will understand classification on the basis of morphology, anatomy and functions.

Course Outcomes:

- Students will understand the classification of living organisms, cell organelles and their functions.
- An understanding of inheritance and role and processes of nucleic acids.
- Students will understand the importance of cell cycle, mitotic and meiotic cell division

Detail Content

UNIT I

Introduction to biology, Living systems-Characteristics and classification, Cell: the basic unit of life, Prokaryotic and Eukaryotic cell.

UNIT II

Macromolecules: DNA, RNA, Proteins, Brief idea of Replication, Transcription and Translation, the cellular basis of Immunity.

UNIT III

Mendelian inheritance, linkage, crossing over, Sex determination, genetic code, mutations.

UNIT IV

Cell growth: cell cycle, mitotic and meiotic cell division, cell metabolism, respiration, Photosynthesis.

UNIT V

Animal tissue: types,structure and functions; Plant tissue morphology, anatomy and functions of different parts of flowering plants.

Text Books:

1. Jeremy M. Berg, Jhon L. Tymoczko and Lubert Stryer," BioChemistry" W.H. Freeman and CO. Ltd, 6th Edition, 2006
2. Thyaga Rajan. S.,Selvamurugan N., Rajesh M.P., Nazeer R.A., Richard W. Thilagaraj, Barthi S., and Jaganthan, M.K.," Biology for Engineers", Tata Macgrow-Hill, New Delhi , 2012
3. P. K. Gupta. "Genetics-Classical to Modern" Rastogi Publication(2007).
4. Ajay Poul. "Text Book of Cell and Molecular Biology" Books and Allied(P) (2007).

BCET 402	Energy and Environmental Engineering	3L:1T:0P	4 Credits

Course Objectives:

The objective of this course is to apply knowledge of mathematics, science, technology and engineering appropriate to energy science and engineering degree discipline and to enhance the understanding of conventional and non-conventional energy sources and its relationship with the ecology and environment. More precisely the objectives are:

1. Use mathematical or experimental tools and techniques relevant to the energy and energy-related environmental disciplines along with an understanding of their processes and limitations.
2. Equip the students with knowledge and understanding of various possible mechanisms about renewable energy projects
3. To produce graduates strong in understanding on energy resources, technologies and systems, energy management fundamentals, and capable in innovative technological intervention towards the present and potential future energy.
4. To identify, formulate and solve energy and energy-related environmental problems by pursuing development of innovative technologies that can generate clean and sustainable energy to address energy scarcity and combat pollution and climate change.

Course Outcomes

1. Apply advanced level knowledge, techniques, skills and modern tools in the field of Energy and Environmental Engineering.
2. Distinguish the different energy generation systems and their environmental impacts.
3. Respond to global policy initiatives and meet the emerging challenges with sustainable technological solutions in the field of energy and environment.

Detailed Content

Unit I:

Introduction to Energy Science - Introduction to energy systems and resources; Introduction to Energy, sustainability & the environment, Global Energy Scenario: Role of energy in economic development. Indian Energy Scenario: Introduction to Energy resources & Consumption in India. Common terminologies

Unit II

Energy Sources - Overview of energy systems, sources, transformations, efficiency, and storage. Fossil fuels (coal, oil, oil-bearing shale and sands, coal gasification) - past, present & future, Remedies & alternatives for fossil fuels - biomass, wind, solar, nuclear, wave, tidal and hydrogen; Sun as Source of Energy, Availability of Solar Energy, Nature of Solar Energy, Solar Energy & Environment. Various Methods of using solar energy. Commercial and noncommercial forms of energy, Fossil fuels, Renewable sources including: Nuclear Energy, Hydel Energy, Storage of Hydrogen, Hydrogen Production, Hydrogen Energy Geothermal, Tide and Wave Energy, Bio-fuels in India.

Unit III

Energy Efficiency and Conservation - Introduction to clean energy technologies and its importance in sustainable development; Carbon footprint, energy consumption and sustainability; introduction to the economics of energy; How the economic system

determines production and consumption; linkages between economic and environmental outcomes; How future energy use can be influenced by economic, environmental, trade, and Research policy.

Unit IV

Energy & Environment - Environment**:** Introduction, Multidisciplinary nature of environmental studies- Definition, scope and importance, Need for public awareness. Ecosystem: Concept, Energy flow, Structure and function of an ecosystem. Food chains, food webs and ecological pyramids, Forest ecosystem, Grassland ecosystem, Desert ecosystem and Aquatic ecosystems, Ecological succession. Environmental Pollution: Definition, Cause, effects and control measures of - Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution and Nuclear hazards , solid waste Management.

Unit V

Environmental Protection and Ethics - Environmental Protection- Role of Government Initiatives by Non-governmental Organizations (NGO) Environmental Education. Ethics and moral values Objectives of ethics, Professional and Non- professional ethics Sustainable Development of the ecology and environment Codes of ethics and their limitations

Suggested reading material:

1. Schaeffer, John. 2007. Real Goods Solar Living Sourcebook: The Complete Guide to Renewable Energy Technologies and Sustainable Living (30th anniversary edition). Gaiam.
2. Boyle, Godfrey, Bob Everett, and Janet Ramage (eds.) 2004. Energy Systems and Sustainability: Power for a Sustainable Future. Oxford University Press, 619 pages (ISBN: 0-19-926179-2)
3. Energy Management Principles: C.B.Smith (Pergamon Press)
4. Renewable Sources of Energy and Conversion Systems: N.K.Bansal and M.K.Kleeman.
5. EnergyManagement: W.R.Murphy, G.Mckay (Butterworths)
6. Ristinen, Robert A. Kraushaar, Jack J. AKraushaar, Jack P. Ristinen, Robert A. (2006) Energy and the Environment, 2nd Edition, John Wiley
7. Ravindranath, N. H., & Hall, D. O. (1995). Biomass, energy and environment: a developing country perspective from India. Oxford University Press.
8. Popp, D., Newell, R. G., & Jaffe, A. B. (2010). Energy, the environment, and technological change. In Handbook of the Economics of Innovation (Vol. 2, pp. 873-937). North-Holland.

BBCT 301: MICROBIOLOGY **L T P 3 1 0**

Course Objectives:

- To understand the basic concepts of microbiology and its scope.
- To make the students aware of various types of microbes present around them.
- To impart the basic knowledge of handling techniques of microorganisms.
- To make the students well-versed in microbial ecology and food borne infections.
- To give the basic concepts of the immune System

Course Outcomes:

- An understanding of the fundamentals of microbiology and immunology.
- An understanding to develop pure culture techniques in vitro.
- An ability to apply the methods to control the contamination and handle the microbes.

Detailed Content

UNIT I

Introduction; aim and scope; Historical background, Morphology, Physiology, Nutrition, Growth and reproduction in bacteria, Methods of genetic recombination in bacteria: Transformation, Transduction, Conjugation

UNIT II

Ultrastructure, nutrition, reproduction and other characteristics of fungi and yeasts, Distinguishing features of actinomycetes, cyanobacteria and yeasts, Morphology, ultrastructure, nature and multiplication of viruses (plant, animal and bacteriophages)

UNIT III

Pure culture techniques – microbial culture media, Isolation of aerobic and anaerobic microbes, identification and maintenance of cultures, characteristics of pure culture, enumeration and staining techniques. Cultivation of viruses

UNIT IV

Physical and chemical methods of control of microorganisms; Microbial ecology, Bioremediation, incidences of microorganisms in soil, water, air and food, Brief idea of food borne infections.

UNIT V

An introduction to Immunology; innate and acquired immunity, Various cells and organs involved in immune response, Nature of antigens, epitopes and haptens, Structure and classes of antibody.

Text Books:

1. Microbiology by M.J. Pelczar, Jr. E.C.S. Chan and N.R. Krieg, 5th Ed. , TMH Book Company.
2. Foundation in Microbiology", Kathleen Talaro & Arthur Talaro, W.C.B. Wm. C. Brown Publishers (1994).
3. Prescott's Microbiology 10th edition, willey Sherwood Woolverton
4. Kube Immunology 6th edition by Kindt, Goldsby, Osborne, W.H.Freeman and Company, New York

BBCT 302: BIOCHEMISTRY **L T P 3 1 0**

Course Objectives:

- Student will understand the way in which proteins are synthesized from monomeric amino acids and will be able to analyze basic enzyme kinetics.
- Student will be able to get the understanding of structure and functions the nucleic acids.
- Student will be able to get the complete understanding of catabolism & anabolism of the biomolecules and bioenergetics.
- Student will understand the mechanism of transport channels.
- The student will be able to comprehend protein and nucleic acid biosynthesis and signaling of cells.

Course Outcomes:

- The ability to understand the structure, biosynthesis, action mechanism & regulation of biomolecules.
- Enzyme inhibition study will enhance the knowledge of metabolic regulations.
- The understanding of generation and utilization of energy in the cellular catabolic system.
- Study of lipid structure and functions will help in understanding the transport of different solutes across the cellular membrane.
- Study of anabolic pathways of protein and nucleic acids will enhance the understanding of interaction between different biomolecules.

Detailed Content

UNIT-I

Overview of Structure and function of biomolecules; carbohydrates, proteins, lipids and nucleic acids. Amino acids and their polymerization into proteins, 1^0, 2^0, 3^0, and 4^0 level of protein structure. Protein sequencing methods. Enzymes and their action mechanism, development of single substrate and single enzyme molecule reaction kinetics and its inhibition.

UNIT-II

Nucleic acids and their polymerization, DNA structure, Packing of DNA and DNA sequencing. Electrophoretic analysis of DNA.

UNIT-III

Carbohydrates, their structure and polymerization. Major anabolic and catabolic pathways of carbohydrate metabolism and their regulation: Glycolysis, TCA cycle, Pentose Phosphate Pathway, Galactose metabolism, Electron Transport and Oxidative Phosphorylation, Gluconeogenesis. Typical
metabolic pathways of microbes: Entner- Duodoroff pathway, Glyoxilate cycle, Phosphoketolate Pathway.

UNIT-IV

Lipids and membrane formation. Biological membranes and transport across them: passive, facultative and active transport. Lipid metabolism; transport and oxidation of fatty acids in animal tissues, glycerol metabolism, biosynthesis of fatty acids and triacylglycerol.

UNIT-V

Nucleic acid metabolism; mechanism and biosynthesis of DNA and RNA. Protein metabolism; outlines of amino acid metabolism and their significance. Signal peptides, and

Vitamins.

Text Books:

1. “Biochemistry”, Lubert Stryer, W.H. Freemen & Co., New York.

References:

1. “Principles of Biochemistry”, A.L. Lehninger, D.L. Neston, N.M. Cox, CBS Publishers & Distributors.
2. “General Biochemistry”, J.H. Weil, New Age International (PLD).

BBCT 303: FLUID FLOW AND SOLID HANDLING **L T P 3 1 0**

Course Objectives:

- Students will be able to understand the basic concepts of fluid and solid properties and their handling.
- Students will be able to understand the transportation of fluids by pump, compressor etc.
- Student will be able to understand the different types of fluid flow and energy equations
- Students will be able to understand flow measurement using different flow measurement devices.

Course Outcomes:

- An understanding of realistic approach towards fluid properties and empirical relations.
- An understanding for use of flow measurement devices like venturimeter, orifice meter, rotameter, etc.
- An understanding of various pumping and compressing operations of fluids for industrial process.
- An understanding on applying energy equations for fluid flow.

Detailed Content

UNIT I

Introduction, Types of fluids: Newtonian & non-Newtonian fluids, Compressible & incompressible fluids, Properties of fluids: Viscosity, Density, Surface Tension, and Capillarity. Fluid statics: Pascal's law for pressure at a point in a fluid, Variation of pressure in a Static fluid, Absolute pressure, gauge pressure & vacuum, Pressure measurement.

UNIT II

Fluid flow: Steady & unsteady flows, Uniform & non-uniform flows, Laminar & turbulent flows, Compressible & incompressible flows. Continuity Equation, Discharge, Reynolds number, Bernoulli's theorem, Bernoulli's equation, Pipe fittings. Minor energy losses in pipe flow: Loss of head due to sudden enlargement, Loss of head due to sudden contraction, Loss of head at the entrance of a pipe, Loss of head at the exit of pipe, Loss of head in various pipe fittings. Flow in open channels: Introduction, Comparison between open channel and pipe flow.

UNIT III

Flow Measurements: Construction and working of Orifice meter, Venturimeter, Rotameter, Pitot tube and Elbow meter, Comparison between Orifice meter and Venturimeter. Introduction to orifices and mouthpieces.

UNIT IV

Transportation of fluids: Pump classification, Construction and working of Centrifugal pump: Impeller, Casing, Suction and delivery pipes, Suction head, Delivery head, Static head, Manometric head, Efficiencies of centrifugal pump. Multistage centrifugal pumps for high heads and high discharge. Priming of centrifugal pump. Cavitation, Precautions against cavitation, Effects of cavitation. NPSH. Construction and working of Reciprocating pump: Classification, Single acting Reciprocating pump, Double acting Reciprocating pump, Slip and Negative slip of Reciprocating pump, Air vessels, Comparison between Centrifugal pump and Reciprocating pump. Introduction to gas-moving machinery: Fan, Blower and Compressor.

UNIT V

Solids and Their Handling: Properties of solids, Screening, Industrial screening equipments. Determination of particle size, Screen analysis, Size reduction of solids, Stages of reduction, Operating variables, Intermediate and fine size reduction, Power requirement and mechanism. Power driven machines: Crushers, grinders and conveyors.

Text Books:

1. McCabe Smith; "*Unit Operations in Chemical Engineering"*, McGraw Hill

References:

1. Fox, R.A. & McDonald, *"Introduction to Fluid Mechanics*", 5th ed: John Wiley (1998).
2. Kumar D.S. *"Fluid Mechanics"*, S.K. Katria and Sons, Delhi (1998.)
3. Foust A. S. et.al., *"Principles of Unit Operations"* John Wiley

BBCP 301: MICROBIOLOGY LAB **L T P 0 0 2**

Course Objectives:

- Enable the students to understand the basic concepts involved in the isolation, staining and enumeration of microorganisms.
- Impart the proper handling experience of microorganisms.
- Provide the complete practical experience on microbiological methods.

Course Outcomes:

- To understand the source of microbes and their role in biotechnology.
- To get the knowledge of microbial diversity classification and morphology.
- To know the visualization of microbes by microscopes.
- To get a basic knowledge of the microbial nutrition and growth.

Experiments

1. Microscopy : Use & care of microscope,
2. Examination of prepared slides and wet mounts of bacteria, yeast, molds.
3. Micrometry: Measurement of microbial cells.
4. Culture techniques: Culture media preparation.
5. Staining techniques: Simple staining, Gram staining.
6. Enumeration techniques: Microscopic count using haemocytometer.
7. Turbidity measurement as direct expression of growth.
8. Isolation of microorganisms by streak plate method.
9. Isolation by serial dilution method.
10. Microbiological examination of water: Coliform counts.
11. Isolation and cultivation of anaerobic microorganism.

BBCP 302: BIOCHEMISTRY LAB **L T P 0 0 2**

Course objectives:

- Students will perform buffer preparation for different experiments.
- Students will perform analysis for identification and estimation of biomolecules.
- Students will perform extraction of lipids.
- Students will perform separation techniques for biomolecules like paper chromatography and isoelectric precipitation.

Course Outcomes:

- An ability to analyze estimation of biomolecules.
- An ability to use extraction and separation techniques for biomolecules.

Experements

1. Preparation of different buffer solution.
2. Identification of carbohydrates, reducing and nonreducing sugars, monosaccharides and polysaccharides.
3. Estimation of total carbohydrates by Anthrone method.
4. Estimation of reducing sugar by DNS method.
5. Identification of proteins.
6. Estimation of proteins.
7. Estimation of oil in oilseeds.
8. Extraction of Lipids.
9. Estimation of nucleic acids.
10. Isoelectric precipitation.
11. Separation of amino acids by paper chromatography.
12. To determine the kinetic properties (Km and Vmax values) of an enzyme
13. To check the time linearity of an enzymatic reaction.

BBCP 303: FLUID MECHANICS LAB **L T P 0 0 3**

Course Objectives:

- Students will be able to understand the basic concepts of Bernoulli's theorem and its applications.
- Students will be able to understand the workings of fluid flow measurement devices.
- Students will be able to understand the workings of fluid transportation devices.
- Students will be able to understand the basic concepts of laminar flow and turbulent flow of fluids.

Course Outcomes

- An understanding of fluid flow measurement.
- An understanding for working of fluid transportation devices.
- Understanding of use of biomass as the product.
- Knowledge about Bernoulli's theorem and its applications.
- An understanding for determination of laminar flow and turbulent flow during various fluid flow operations.

Experements

1. Characteristic curves of centrifugal pumps.
2. Verification of Bernoulli's equation for flow process.
3. Measurement of flow by venturi meter, Orifice meter etc.
4. Measurement of flow by rotameter, V-notch.
5. Measurement of losses in various fittings and valves.
6. Measurement of losses due to contraction and expansion.
7. Verification of laminar/ turbulent flow regime in a flow process

BBCP305 : LIFE SCIENCES LAB **L T P 0 0 2**

Course Objective

1. To understand different type of life forms
2. To understand the basic concepts of biology.

Course Outcomes

1. Students would be able to understand functions and parts of animals and plants.
2. Students would be able to understand processes as photosynthesis, mitosis and meiosis.
3. Students would be able to develop concept about different microorganisms.

Experements

1- To study the Prokaryotic cells such as algae, Blue green algae, fungi, bacteria.
2- To study animal cells through prepared slides.
3- To study Plant cells, stem, root, ovary through prepared slides.
4- To study the parts of flower.
5- Study of dicot and monocot seeds.
6- Study of Mitosis and meiosis.
7- Study of Stomata in leaves.
8- Germinate seeds to observe how plants grow from seeds.
9- Light is necessary for Photosynthesis.
10- Study that leaves prepare starch by the process of Photosynthesis.
11- Carbondi oxide is released during Respiration.
12- Reaction between an acid and a base to show the process of neutrilization.

B. Tech. II year, IV Semester

BAST 402: INSTRUMENTAL METHODS OF ANALYSIS **L T P 3 1 0**

Course Objectives:

- Understand the basic principles of spectroscopy, microscopy, chromatography and electrophoresis.
- Understand the working of equipments used in spectroscopy, microscopy, chromatography and electrophoresis and their trouble-shooting.
- Application of immunological techniques of analysis.

Course Outcomes:

- Fundamental knowledge and understanding of different spectroscopy techniques and their application
- Apply the microscopy and centrifugal techniques for different observations and differentiate between centrifuges
- Understand the basic of chromatography techniques and principles of different chromatography techniques.
- Able to apply electrophoresis, immunological & related techniques to different analysis

Detailed Content

UNIT I

Spectroscopy

Interaction of Electromagnetic radiation with matter: Overview of Electromagnetic spectrum; physical phenomenon: Absorption, Resonance fluorescence, Emission, Refraction, Diffraction, Scattering, Raman Scattering, Resonance Raman Scattering, Beer-Lambert Laws. UV-Vis spectrophotometer: Principle, Instrumentation, working and Application Atomic spectroscopy: Principles and application of Atomic Absorption / Emission Spectrometer. Mass Spectroscopy, MALDI. Basics of IR and NMR and their application in biotechnology and Basics of X-Ray diffraction analysis and their application in biotechnology

UNIT II

Advance Microscopy methods and Centrifugation. Differential interference contrast microscopy. Electron microscopy: TEM and SEM, Atomic force microscopy and confocal scanning laser microscopy Centrifugation: Theory of centrifugation and sedimentation, use and design of different types of rotors Types of centrifuges, Preparative and analytical centrifugation.

UNIT III

Chromatography :Basic Theory of Chromatography, Plate and Rate Theory and HETP, Introduction to key terms: retention time, retardation factor(Rf), elution, Capacity factor, peak shapes, bard broadenings, column Efficiency and resolution, selectivity, normal and reverse phase chromatography, stationary and Mobile phase, Detection and elution of solute. Introduction of Planar Chromatography (Paper Chromatography, TLC), GLC and HPLC. Adsorption chromatography- Hydroxyapatite chromatography and hydrophobic chromatography.

UNIT IV

Electrophoresis : Theory of electrophoresis, electrophoresis of protein-PAGE,SDS PAGE,

Agarose electrophoresis of nucleic acid, Isoelectric focusing of protein, Pulse field gel electrophoresis and western blotting.

UNIT V

Immunological Techniques: Immunodiffusion, Immunoelectrophoresis Techniques, ELISA, RIA, Fluorescence Activated Cell Sorter.

Text Books:

1. Wilson, K, Walker, J.: Principles and Techniques of Practical Biochemistry. 5th Ed. - Cambridge University Press,. Cambridge 1999.

References:

1. Handbook of Analytical Techniques Published Online: 2008. Helmut Günzler, Alex Williams. Wiley Interscience
2. Fundamentals of Analytical Chemistry by Douglas A. Skoog, Donald M. West, F. James Holler, Stanley R. Crouch, Publisher: Brooks Cole.

BBCT 401: FERMENTATION AND INDUSTRIAL BIOTECHNOLOGY L T P 3 1 0

Course Objectives:

- Students will be able to understand the fermenter, its parts, basic operation and maintenance.
- Students will be able to understand the commercial production of alcoholic beverages.
- Students will be able to comprehend the antibiotics and glycerol production processes.
- Students will get an idea of drug discovery process and the way vaccines are developed.
- Students will be able to understand the microbial production of vitamins, industrial enzymes as well as biomass as a Commercial product.

Course Outcomes:

- An understanding of fermentation fundamentals including working of a fermenter.
- An understanding of production processes, their control parameters and process flow chart.
- An understanding of variety of production processes of alcoholic beverages.
- An understanding of microbial production of antibiotics and glycerol.
- The ability to understand drug discovery process and the way vaccines are developed.
- The understanding of commercial production of vitamins, industrial enzymes as well as biomass.

Detailed Content

UNIT-I

Fundamentals of microbial fermentation processes: basic design of fermenter, its parts and preparatory operations: Cleaning in Place (CIP) and Steam in Place (SIP).

UNIT-II

Alcoholic fermentation and developments, Beer production: Malting and brewing; Wine manufacturing and properties of other distilled liquors.

UNIT-III

Antibiotics: general properties and classification; Production of Penicillin, streptomycin and tetracycline. Glycerol fermentation. Microbial production of citric acid and vinegar.

UNIT-IV

Drug discovery process - Drug Target Identification, Target Validation, Lead Compound Identification, Lead Optimization, Pre-clinical and Clinical development. Vaccines: fundamentals of immune response– natural and adaptive, antigen and antibody, types of vaccines, their mechanism and production strategies.

UNIT-V

Vitamin production through fermentation:Vitamin B12, Riboflavin.

Biomass as a fermentation product: Baker's yeast and Biofertilizers. Commercial enzymes production: Amylase and Protease.

Text Books:

1. "Industrial Microbiology", S.C. Prescott and C.G. Dunn, McGraw-Hill Book Company, Inc. New York.

References:

1. "Industrial Microbiology", L.E. Casida Jr. Wiley Eastern Ltd.
2. "Microbial Technology", Vol.II, H.J. Peppler and D. Perlman, Academic Press, New York.

L T P 3 1 0

BBCT 402 MASS TRANSFER OPERATIONS

Course Objectives:

- Students will understand the basic concepts of mass transfer, diffusion and related theories.
- Students will be able to understand basic concepts of distillation and its methods.
- Students will be able to understand drying, humidification and dehumidification and their mechanisms.
- Students will be able to understand liquid- liquid Extraction.

Course Outcomes:

- An understanding of basic concepts of mass transfer in different unit operations.
- An ability to apply mass transfer equations in designing mass transfer equipments like cooling tower, dryers etc.

Detailed Content

UNIT I

Basic principles of mass transfer: Introduction and classification of mass transfer operations, Molecular and turbulent diffusion, Fick's law of diffusion, molecular diffusion and diffusivity of gases and liquids, Mass transfer theories.

UNIT II

Distillation: Entrainment, pressure drops, flooding, transfer coefficients and relative volatility. Macabe Thiele and Ponchon method for binary component distillation of azeotropes. Flash vaporization and Steam distillation. Extractive distillation.

UNIT III

Humidification and Dehumidification: Fundamental concept of humidification, definition and derivations of relationships related to humidity, Dehumidification and water cooling, wet bulb temperature, adiabatic and non-adiabatic operation, evaporative cooling, classification and design of cooling towers.

UNIT IV

Liquid- liquid Extraction: Cocurrent and countercurrent operations in single and multistage solvent extraction, triangular diagrams.

UNIT V

Drying: Solid-gas equilibria, definitions of moisture contents, types of batch and continuous dryers, rate of batch drying, time of drying, mechanism of batch drying, continuous drying.

Text Books:

1. Treybal, R "Mass Transfer Operations", 3rd ed. New York: McGraw-Hill, (1980).

References:

1. Foust A. S. et.al., "Principles of Unit Operations" John Wiley (1980).
2. Sherwood T. K., Pigford R. L.. "Mass Transfer" McGraw Hill (1975).
3. McCabe Smith; "Unit Operations in Chemical Engineering", McGraw Hill.

BBCT 403: Fundamentals of Thermodynamics and Process Calculations L T P 3 1 0

Course Objectives:

- Students will be able to understand the basic concepts of Thermodynamics.
- Students will understand the use of ideal gas laws and vapor pressures, solubility and heat capacity Data.
- Students will be able to understand material balances for typical processes.
- Students will understand industrial applications of stoichiometry and composition relations.
- Student will be able to understand the types of fuels and their industrial applications.

Course Outcomes

- An ability to relate thermodynamic principles in biochemical processes.
- An ability to apply material balances for various unit operations like distillation, crystallizations, etc.
- An ability to use ideal gas laws and working of vapor pressure calculation.
- An ability to control the combustion of fuels.

Detailed Content

UNIT I

System, Surroundings, Energy, Macroscopic, Microscopic Viewpoint, Thermodynamic Equilibrium,First Law of Thermodynamics,Second Law of Thermodynamics,Energy Reservoirs, Heat Engine, Heat Pump, Entropy, Reversible Process, Irreversible Process, Carnot Cycle,Gibbs free energy,Third Law of thermodynamics

UNIT II

Process calculations: Systems of units. Stoichiometry and composition relations. Material balances, the use of ideal gas laws and vapour pressure, solubility and heat capacity data.

UNIT III

Humidity and solvent recovery. Material balance for various unit operations like absorption, distillation, crystallization etc.

UNIT IV

Thermochemistry and energy balances. Material and energy balances for typical processes.

UNIT V

Fuels: Origin, chemical composition, classification, storage, and general uses of industrial fuels. Types of solid fuels, Introduction to biofuels. calorific values of fuels, Types of gaseous fuels, Types of liquid fuels, petroleum and its distillation products, coal tar and its distillation products.

Text Books:

1. Hougan D. A., Watson K.M. and Ragatz R. A. “Chemical Process principles”, Asia Publishing House.
2. “Introduction to Chemical Engineering Thermodynamics”; J. M. Smith and H.C. Van Ness; McGraw-Hill Book Company, New York.

References:

1. Himmelblau, D.M. "Basic Principles and Calculations in Chemical Engineering ", 6th ed. Prentice Hall (1996).
2. Felder, R.M. & Rousseau, R.W. "Elementary Principles of Chemical Processes ", 3rd edition. John Wiley.(1999).
3. Bhatt., B.I. and Vora S.M. & quot;Stoichiometry " IInd edition, Tata McGraw Hill (1984)

BBCT 404: INSTRUMENTATION & PROCESS CONTROL L T P 3 1 0

Course Objectives:

- Students will be able to understand the working of different types of measuring instruments.
- Students will be able to understand the control of various process variables.
- Students will be able to understand process control algorithms.

Course Outcomes

- An understanding of different parameters of the process by different measuring instruments.
- An understanding of the principle of the transfer functions.
- An understanding of various control loop components needed in process control applications.

Detailed Content

UNIT I

Elements of measurement, functions and general classifications of measuring instruments. Indicating and recording type of instruments. Elements of measuring instruments, static and dynamic characteristics of measuring instruments.

UNIT II

Principle of operation, construction and application of important industrial instruments for the measurement of temperature, flow, liquid level, DO, pH and composition.

UNIT III

Introduction to Process control systems, Regulator & Servo control, Feed Forward & Feed backward control, Negative & Positive Feedback Control, variables & Physical Elements of a Control system, Physical, Block & Signal Flow Diagram. Use of Laplace & Inverse Laplace Transformation is study of Process Dynamics.

UNIT IV

Dynamic Modeling of a Process, Dynamic behavior of First order systems and First order systems in series. Dynamic behavior of second & higher order system for various kind of inputs, Linearization of nonlinear system, Transportation & Transfer Lag.

UNIT V

Modes of control action, Controllers & Final control Elements, Reduction of Block & Signal Flow Diagrams, Closed loop transfer function and response of closed loop control system for various type of control actions.

Text books:

1. Process system Analysis & Control, D.R. Coughanoowr, McGraw Hill Publication.

Reference Books :

1. Process Control. Peter Harriot, Tata McGraw Hill.
2. Process control, Staphno polies, Prentic Hall India Ltd.

BBCP 401: FERMENTATION LAB **L T P 0 0 2**

Course Objectives:

- Students will be able to understand the fermenter, its parts, basic operation and maintenance.
- Students will be able to understand the commercial production of alcoholic beverages.
- Students will be able to comprehend the antibiotics and glycerol production processes.
- Students will get an idea of drug discovery process and the way vaccines are developed.
- Students will be able to understand the microbial production of vitamins, industrial enzymes as well as biomass as a commercial product.

Course Outcomes:

- An understanding of fermentation fundamentals including working of a fermenter. An understanding of production processes, their control parameters and process flow chart.
- An understanding of variety of production processes of alcoholic beverages.
- An understanding of microbial production of antibiotics and glycerol.
- The ability to understand drug discovery process and the way vaccines are developed.
- The understanding of commercial production of vitamins, industrial enzymes as well as biomass.

Experements

1. Analysis of molasses.
2. Preparation of malt and determination of diastatic power.
3. Determination of fermentation efficiency of yeast for batch production of ethanol.
4. Effect of substrate concentration on biomass yield for baker's yeast production and its characterization.
5. Fermentation efficiency for vinegar production.
6. Citric acid production by (a) solid state and (b) submerged fermentation.
7. Microbial production of enzymes by (a) solid state and (b) submerged fermentation.
8. Analysis of finished products (rectified sprit, beer etc.).

BBCP 402: MASS TRANSFER OPERATIONS LAB **L T P 0 0 2**

Course Objective

- This course is designed to introduce a basic study of the phenomena of mass transfer.
- To develop methodologies for solving a wide variety of practical engineering problems.
- To provide useful information concerning the performance and design of particular systems and processes.

Course Outcomes

- Account for the consequence of mass transfer in analysis of engineering systems.
- Analyze problem and develop confidence in handling the mass transfer equipment used in chemical process industries.
- Develop experimental skills.
- Work in team and develop interpersonal skills.
- Develop skills for technical writing

Experiments

1. Determination of diffusivity of acetone in air.
2. Determination of mass transfer coefficient in an agitated vessel.
3. Determination of mass transfer coefficient for steady state surface evaporation of water at different temperatures.
4. Determination of mass transfer coefficient in a wetted wall column.
5. Determination of T-x-y diagram for a binary batch distillation.
6. Verification of Rayleigh equation in a binary batch distillation process.
7. Verification of steam distillation equations.
8. Determination of ternary curve for the system acetic acid-water-carbon tetrachloride.
9. Determination of distribution coefficient of a solute in two immiscible liquids.
10. Solid-Liquid extraction – Soxhlet's experiment.
11. Liquid - liquid extraction in packed bed.
12. Determination of adsorption kinetics and isotherm at solid-liquid interface.
13. Determination of the rate of drying in a tray dryer.
14. Estimation of efficiency of the fluidized bed dryer

BBCP 403: INSTRUMENTAL METHODS OF ANALYSIS LAB L T P 0 0 2

Course Objectives:

- To provide a basic knowledge of the working principle of instruments
- Applications of instruments from the perspective of engineers

Course Outcomes:

- To understand the fundamentals of instruments and their different mode of applications.
- To know the principle, working concept and its applications.
- To find the various laboratory work based on instruments.
- To know the different types of instruments based on various parameters.
- To get a basic knowledge of equipment and their role in biological systems in relevant industries.

Experiments

1. Computation of components of given percentage solution and preparation of solution, molar solution, normal solution and stock solution.
2. Determination of the pH of a given sample and prepare a solution of specific pH using pH meter.
3. Determination of maximum absorption spectra of solutions (potassium dichromate, potassium permanganate and protein) solution.
4. Determination of chlorophyll content of a given sample
5. Isolation of cell organelles by sucrose gradient method
6. Isolation of cellular organelles by differential centrifugation
7. Use of paper chromatography for separation of plant pigments
8. Use of thin-layer chromatography for amino acid (TLC)
9. Electrophoresis of proteins by SDS-PAGE
10. Demonstration of Sterilization of solution by filtration
11. Demonstration of Dialysis
12. Demonstration of immunodiffusion technique

BCSP 406: MATALB PRACTICES **L T P 0 0 4**

Course Objectives:

1. The course is intended to assist undergraduates in learning the basics of programming in general and programming MATLAB in particular.
2. Basics of programming in MATLAB will be covered, with the goal of having students become comfortable enough to continue learning MATLAB and other programming languages on their own.

Course Outcomes:

At the end of the course, students will be able to

1. Use MATLAB for programming purposes
2. Learn and explore MATLAB further on their own
3. Use this learning experience to learn other programming languages.

MODULE 1: INTRODUCTION

Data types and variables: Introduction to MATLAB, Data Types, Inter-conversion of Data types, MATLAB Variables, Keywords and Constant, Session Command. *MATLAB Operators and Operations:* Operators (Arithmetic, Relational, Logical, Bitwise), Set Operations, Operator Precedence, Mathematical Functions.

MODULE 2: PROGRAMMING IN MATLAB

Script and Function: Decision Making, Loops, branches, Functions, Working on Script File (Creating, Saving and Executing), MATLAB I/O, Formatted I/O Method.

MODULE 3: ARRAYS AND GRAPHICS

Matrices and Arrays: Introduction to Matrices, Operations on Arrays/Matrices, Manipulations of Arrays/Matrices, Expansion of Matrix Size, Reduction of Matrices/Arrays order,

Graphics: Introduction to plot, Basic 2-D Plots (Style options, Labels, Axis control, etc.), specialized 2-D Plots, drawing multiple plots. Using MATLAB for fractals and chaos and Conway game of life

MODULE 4: FILE HANDLING AND DEBUGGING

File Handling: Introduction to file handling, working on files, accessing of Text File, Saving/ Loading MATLAB Variables, reading data without opening file, reading and writing Excel.

Debugging: Introduction to debugging, Break points, debugger, stepping, watching variable values, debugging commands.

REFERENCES:

1. Delores M. Etter, David C. Kuncicky, Holly Moore, "*Introduction to MATLAB 7.0*", Pearson, 2013.
2. Rudra Pratap, "*Getting Started with MATLAB*", OXFORD University Press, 2010.
3. Agam Kumar Tyagi, "*MATLAB and Simulink for Engineers*", University Press, 2012.

WEB REFERENCES

https://ocw.mit.edu/courses/mathematics/18-s997-introduction-to-matlab-programming- fall-2011/syllabus/

BCSP-408	Computer Workshop (Python Programming)	0L:0T:2P	1 credit

1. Installation & working with IDE
2. How to declare and use variables and operators
3. Programming using Basic Libraries (Numpy, Pandas, SK Learn etc)
4. To write a Python program to print HELLO INDIA.
5. To write a Python program that takes in command line arguments as input and print the number of arguments.
6. To write a Python program find the division of student.
7. To write a program implements Fibonacci series.
8. To write a Python program for factorial.
9. To write a Python program to use of functions.
10. To write a Python program to implement list.
11. To write a Python program to implement tuples.
12. To write a Python program Insertion sort.
13. To write a Python program merge sort.
14. To write a Python program first n prime numbers.
15. Implementation of Data Science concepts using Python

BCST 408	Cyber Security	Non- Credit Course

Course Objectives:

1. Understand the basic concept of Cyber Security.
2. Understand the basic concept of Viruses.
3. Understand the basic concept of Digital Attacks.
4. Understand the basic concept of Phishing.
5. Understand the basic concept of Cyber Law.

Course Outcomes:

After the completion of this course the student will able to:

1. Know about various attacks and viruses in cyber systems
2. Know about how to prevent digital attacks
3. Know about how to prevent Phishing Attacks
4. Know about how to do secure transactions

Detailed Content

UNIT-1

Introduction to information systems, Types of information Systems, Development of Information Systems, Introduction to information security, Need for Information security, Threats to Information Systems, Information Assurance, Cyber Security, and Security Risk Analysis.

UNIT-2

Application security (Database, E-mail and Internet), Data Security Considerations-Backups, Archival Storage and Disposal of Data, Security Technology-Firewall and VPNs, Intrusion Detection, Access Control.

Security Threats -Viruses, Worms, Trojan Horse, Bombs, Trapdoors, Spoofs, E-mail viruses, Macro viruses, Malicious Software, Network and Denial of Services Attack, Security Threats to E-Commerce- Electronic Payment System, e- Cash, Credit/Debit Cards. Digital Signature, public Key Cryptography.

UNIT-3

Developing Secure Information Systems, Application Development Security, Information Security

Governance & Risk Management, Security Architecture & Design Security Issues in Hardware, Data Storage & Downloadable Devices, Physical Security of IT Assets,

Access Control, CCTV and intrusion Detection Systems, Backup Security Measures.

UNIT-4

Security Policies, Why Policies should be developed, WWW policies, Email Security policies, Policy Review Process-Corporate Policies-Sample Security Policies, Publishing and Notification Requirement of the Policies.

Information Security Standards-ISO, IT Act, Copyright Act, Patent Law, IPR. Cyber Laws in India; IT Act 2000 Provisions, Intellectual Property Law: Copy Right Law, Software License, Semiconductor Law and Patent Law.

References:

1. Charles P. Pfleeger, Shari Lawerance Pfleeger, "Analysing Computer Security ", Pearson Education India.
2. V.K. Pachghare, "Cryptography and information Security", PHI Learning Private Limited, Delhi India.

3. 3.Dr. Surya Prakash Tripathi, Ritendra Goyal, Praveen kumar Shukla ,"Introduction to Information Security and Cyber Law" Willey Dreamtech Press.
4. Schou, Shoemaker, " Information Assurance for the Enterprise", Tata McGraw Hill. 5. CHANDER, HARISH," Cyber Laws And It Protection " , PHI Learning Private Limited ,Delhi ,India