Chhattisgarh Swami Vivekanand Technical University, Bhilai

SCHEME OF TEACHING & EXAMINATION

BE (Biotechnology) IV Semester

Sl. No.	Board of Study	Subject Code	Subject	Period per week			Scheme of Exam			Total Marks	Credit L+(T+P)/2
				L	T	P	ESE	CT	TA		
1	Chemical Engineering	318451(19)	Transport Process	4	1	-	80	20	20	120	5
2	Chemical Engineering	318452(19)	Thermodynamics and Biochemical Reaction Engineering	4	0	-	80	20	20	120	4
3	Biotechnology	318453(18)	Physiology	4	0	-	80	20	20	120	4
4	Biotechnology	318454(18)	Recombinant DNA technology	4	0	-	80	20	20	120	4
5	Biotechnology	318455(18)	Biochemistry	3	1	-	80	20	20	120	4
6	Biotechnology	318456(18)	Medical Biotechnology	3	1	-	80	20	20	120	4
7	Chemical Engineering	318461(19)	Transport Process Lab	-	-	3	40	-	20	60	2
8	Chemical Engineering	318462(19)	Thermodynamics and Biochemical Reaction Engineering Lab	-	-	3	40	-	20	60	2
9	Biotechnology	318463(18)	Recombinant DNA Technology Lab	-	-	3	40	-	20	60	2
10	Biotechnology	318464(18)	Biochemistry Lab	-	-	3	40	-	20	60	2
11	Humanities .	318465(46)	Health, hygiene and yoga	-	-	2	-	-	40	40	1
12			Library	-	-	1					
			TOTAL	**22**	**3**	**15**	**640**	**120**	**240**	**1000**	**34**

L: Lecture, T: Tutorial, P: Practical, ESE: End Semester Exam, CT: Class Test, TA: Teachers Assessment
Note (1): Duration of all theory papers will be of Three Hours.
Note (2): Industrial Training of six weeks is mandatory for B.E. student. It is to be completed in two parts. The first part will be in summer after IV sem. after which students have to submit a training report which will be evaluated by the college teachers during B.E. V SEM.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program:	**Bachelor of Engineering**		
Branch:	**Biotechnology**	Semester:	**IV**
Subject:	**Transport Process**	Code:	**318451(19)**
Total Theory Periods:	**40**	Total Tutorial Periods:	**10**
Class Tests:	**Two (Minimum)**	Assignments:	**Two (Minimum)**
ESE Duration:	**Three Hours**	**Maximum Marks: 80**	**Minimum Marks: 28**

Course Objectives:

To discuss and learn:

1. The fundamental connections between the conservation laws in heat, mass, and momentum in terms of vector and tensor fluxes.
2. How to formulate conservation statements in heat, mass, and momentum at multi scales from microscopic to macroscopic in both steady modes.
3. How to solve analytic linear partial differential equations including separation of variables, similarity solutions.
4. Classic transport solutions including rotating disks flow around spheres and in channels with heat and/or mass transfer occurring.

UNIT- I Introduction of transport processes, classification of transport processes mechanism of momentum transports; Newton's Law of viscosity, Newtonian fluids, pressure and temperature dependence on viscosity; Equations of continuity in rectangular, cylindrical and spherical coordinate; Equations of motion.

UNIT-II Laminar flow, Shell momentum balance, boundary conditions, flow of falling film, flow through circular tubes and annulus, flow through rectangular duct, adjacent flow of immiscible fluids between two parallel plates.

UNIT- III Introduction to heat transport: Fourier's Law of heat conduction, temperature and pressure; Dependence of thermal conductivity of gases and liquids, thermal conductivity of Solid, free and forced convection.

UNIT-IV Mechanism of energy transport: Shell energy balances, boundary conditions, heat conduction with an electrical heat source, heat conduction with viscous heat source, heat conduction with nuclear heat source, heat conduction through composite walls, conduction in cooling fins.

UNIT-V Mechanism of mass transport: Fick's Law of diffusion, temperature and pressure dependence of mass diffusivity; Shell mass balance, boundary conditions, diffusion through a stagnant gas film, diffusion into a falling liquid film, diffusion into a Solid Sphere, diffusion from a droplet in a quiescent gas.

Text Books:

1. Transport Phenomena, Biron R. Bird, Warren E. Stewart, and Edwin Lightfoot.
2. Transport Processes and Unit Operations (1997) Christie J. Geankoplis, Prentice hall of India.

Reference Books:

1. Momentum and mass Transfer, Bennet C.O. and Meyer J.E.,
2. Introduction to Transprot Phenomena, William J.Thomson
3. Transport Process and Separation Process Principle, 4th Edition Christie John Geankopolish.

Course Outcomes:

Students will be able to:

1. Simplify the general equations of change for specific applications.
2. Analyze advanced transport problems in heat, mass, and momentum, both macroscopic and microscopic.
3. Formulate energy and mass balances in chemical processes.
4. Solve simple linear partial differential equations arising in transport problems.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program:	**Bachelor of Engineering**		
Branch:	**Biotechnology**	Semester:	**IV**
Subject:	**Thermodynamics and Biochemical Reaction Engineering**	Code:	**318452(19)**
Total Theory Periods:	**40**	Total Tutorial Periods:	**NIL**
Class Tests:	**Two (Minimum)**	Assignments:	**Two (Minimum)**
ESE Duration:	**Three Hours**	**Maximum Marks: 80**	**Minimum Marks: 28**

Course Objectives

1. To help the student master several advanced ideas in chemical reaction engineering and thermodynamics notably:
   - Complex chemical reaction mechanisms and kinetics.
   - Transport effects in multiphase reactive systems.
   - Advanced reactor design and stability, including consideration of the energy balance.
2. To enable the students able to design/analyze a variety of complex reacting systems in both traditional and nontraditional areas of chemical engineering and thermodynamics at the end of the course.

UNIT- I Thermodynamic functions: Laws of thermodynamics, thermodynamic equations, joule, Thompson effects, heat effects-standard heat of reactions, free energy of formation.

UNIT-II Chemical potential, fugacity, activity, activity coefficient, chemical reaction equilibrium; Standard free energy change, equilibrium conversion, Vant Hoff's Equation, Clausius Clapeyron Equation, Gibbs Duhem Equation.

UNIT- III Kinetics of homogenous reaction, Rate constant, Order (0^{th}, 1^{st}, 2^{nd}) and molecularity; Rate equation, Arrhenius equation, Activation energy; Parallel and series reaction; Reaction mechanics.

UNIT-IV Analysis of rate of Reaction; Deferential Method; Integral Method; Half Life Method; Fundamentals of Batch reactor(BFR); Plug Flow Reactor(PFR); Continuous Stirred Tank Reactor (CSTR).

UNIT-V Michaelis-Menten equation and its various modifications; Kinetics of substrate utilization, product formation and biomass production; Monod growth model and its various modifications, structured and unstructured kinetic rate models, thermal death rate kinetics of cells and spores.

Text Books:

1. Chemical Reaction Engineering, Octave Levenspiel.
2. Chemical Engg. Thermodynamics, J.M. Smith.

Reference Books:

1. Biochemical Engineering Fundamentals, James E. Bailey & David F. Ollis.
2. Chemical Engineering Thermodynamics, K.V.Narayanan
3. Theory Thermodynamics, Y.V.C.Rao
4. Engineering Thermodynamics , R.Yadav

Course Outcomes:

1. The introduction of the principles of Chemical Engineering, thermodynamics and illustration of their application to design of chemical process plants will enable the students to implicate the knowledge in making the industrial setup.
2. The content comprising of the fundamental laws of thermodynamics, the estimation of volumetric and key thermodynamic properties of real fluids and mixtures, solution thermodynamics, phase and chemical reaction equilibria will make the students efficient in solving the related problems.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program:	**Bachelor of Engineering**		
Branch:	**Biotechnology**	Semester:	**IV**
Subject:	**Physiology**	Code:	**318453(18)**
Total Theory Periods:	**40**	Total Tutorial Periods:	**NIL**
Class Tests:	**Two (Minimum)**	Assignments:	**Two (Minimum)**
ESE Duration:	**Three Hours**	**Maximum Marks: 80**	**Minimum Marks: 28**

Course Objectives

1. To make the students understand the functional principles of genetic, cellular and organ level and their use in plant and human physiology.
2. To make the students apply physiological principles for solving environmental health issues.

UNIT- I **Introduction to Cell Physiology:** *Transport of substances through the cell membrane:* Osmosis, Diffusion and its types, Active transport (Sodium potassium pump) and Passive transport, Membrane potential, Measuring Membrane Potential, Action Potential, Electrocardiogram (ECG), Electromyography (EMG), Electroencephalography (EEG).

UNIT-II **System physiology- Plant (I):** *Photosynthesis:* Light harvesting complexes; mechanisms of electron transport; photoprotective mechanisms; CO_2 fixation-C3, C4 and CAM pathways. *Respiration and photorespiration*: Mitochondrial electron transport in plants, ATP synthesis, alternate oxidase, photorespiratory pathway. *Nitrogen metabolism:* Amino acid biosynthesis; Nitrate and ammonium assimilation,

UNIT- III **System physiology- Plant (II):** Plant hormones: Biosynthesis, storage, breakdown and transport, physiological effects and mechanisms of action. *Solute transport and photo assimilate translocation:* Uptake, transport and translocation of water, ions, solutes and macromolecules from soil: through cells, across membranes and through xylem and phloem; Transpiration; Mechanisms of loading and unloading of photo assimilates. *Secondary metabolites*: Biosynthesis of terpenes, phenols and nitrogenous compounds and their roles. *Stress physiology:* Responses of plants to biotic (pathogen and insects) and abiotic (water, temperature and salt) stresses.

UNIT-IV **System physiology- Animal (I):** *Blood and circulation:* Blood corpuscles, plasma function, blood volume, blood volume regulation, blood groups, hemoglobin, hemostasis. *Cardiovascular System:* Anatomy of heart structure, myogenic heart, specialized tissue, ECG – its principle and significance, cardiac cycle, heart as a pump, blood pressure, neural and chemical regulation of all above. *Respiratory system:* Transport of gases, exchange of gases, waste elimination, neural and chemical regulation of respiration. *Nervous system:* Neurons, action potential, neural control of muscle tone and posture. *Excretory system:* Physiology of excretion, kidney, urine formation, urine concentration, waste elimination, micturition, regulation of water balance, blood volume, blood pressure, electrolyte balance, acid-base balance.

UNIT-V **System physiology- Animal (II):** *Thermoregulation:* Comfort zone, body temperature: physical, chemical, neural regulation, acclimatization; Stress and adaptation. *Digestive system:* Digestion, absorption; Energy balance, BMR. Endocrine system – Endocrine glands, basic mechanism of hormone action, neuroendocrine regulation.

Text Books:

1. The Principles of Anatomy and Physiology 13th Edition, Gerard J. Tortora, Bryan H. Derrickson, John Wiley & Sons.
2. Anatomy and Physiology in health and illness, Anne Waugh, Allison Wynn Grant, Graeme Chambers, Janet S. Ross, Kathleen J.W. Wilson.

Reference Books:

1. Plant physiology by TAIZ and Zeiger 5th Edition, Sinnauer Associates.
2. Fundamentals of Plant Physiology, V.K. Jain, S. Chand.

Course Outcome:

1. At the end of the course, students will have sufficient systematic and comprehensive knowledge about basics of animal and plant physiology which will help them relate to the different physiological processes taking place in the cell and organisms.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program:	**Bachelor of Engineering**		
Branch:	**Biotechnology**	Semester:	**IV**
Subject:	**Recombinant DNA Technology**	Code:	**318454(18)**
Total Theory Periods:	**40**	Total Tutorial Periods:	**NIL**
Class Tests:	**Two (Minimum)**	Assignments:	**Two (Minimum)**
ESE Duration:	**Three Hours**	**Maximum Marks: 80**	**Minimum Marks: 28**

Course Objectives:

1. To make the students well acquainted with emerging field of biotechnology i.e. Recombinant DNA Technology as well as create understanding and expertise in wet lab techniques in genetic engineering**.**
2. To make the students well acquainted with concepts of r-DNA technology and its applications.

UNIT- I Fundamentals of genetics and mutation**:** Nonsense, misses and point mutations, frame shift mutations, physical, chemical and biological mutagens and transposons; Basic concepts of Genetic Engineering– isolation, identification and characterization of DNA; Plasmids and its uses; Tools of genetic engineering: cloning vectors, restriction enzymes, modifying enzymes- DNA lipase, polymerases, etc.

UNIT-II Vectors: plasmids, phage vector- M13, λ, phagemids, cosmids, artificial chromosomes: BAC, YAC, MAC, Shuttle vector, bacteriophage and other viral vectors.

UNIT- III Gene Cloning: isolation of desired gene, preparation of r-DNA and its integration into host cell, selection and screening of transformants; DNA sequencing; Polymerase chain reactions; DNA fingerprinting; Southern and northern blotting; In-situ hybridization; RAPD; RFLP; Site-directed mutagenesis; Gene transfer technologies, methods of gene transfer- natural and artificial; Gene therapy.

UNIT-IV Gene Library- c-DNA preparation, c-DNA library, genomic DNA library, amplification of gene library, difference between c-DNA Library and genomic library; Gene isolation; Gene cloning; Expression of cloned gene; Transposons and gene targeting; DNA labeling Preparation and application of molecular probes, DNA probes, RNA probes, radioactive and non-radioactive labeling of DNA.

UNIT-V Plasmid expression vectors-general features, promoters used in expression vectors: cloning of genes in correct reading frame in expression vector: purification of recombinant protein using Histidine tag, GST tag, chitin binding domain and intein: Codon use in different organisms, codon usage database, codon optimization to increase the expression of recombinant protein.

Text Books:

1. Principles of Gene Cloning By Old & Primrose, (2001) Blackwell Scientific Publ.
2. Molecular Cloning By Sambrook *et., al* (1989) Cold Spring Harbor Press, Cold Spring Harbor, NY.
3. Molecular biology and genetic engineering Ist Edition, P.K.Gupta, Rastogi publications.

Reference Books:

1. Gene Cloning & DNA Analysis "An Introduction" T.A. Brown, (2001) Blackwell Publishing Ltd,
2. From Gene to genomes "Concepts & Application of DNA Technology", (2012) J.W. Dale & M.V. Schartz, John Wiely and Sons Ltd.
3. Biotechnology, B. D. Singh, Kalyani Publishers.
4. Genetic engineering, Smita Rastogi, Oxford University Press India.

Course Outcomes:

1. Students will have expertise in the basic molecular techniques with hands-on experience in the techniques.
2. Theoretical as well as experimental knowledge will help in better application of the principles behind the techniques.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program:	**Bachelor of Engineering**		
Branch:	**Biotechnology**	Semester:	**IV**
Subject:	**Biochemistry**	Code:	**318455(18)**
Total Theory Periods:	**30**	Total Tutorial Periods:	**10**
Class Tests:	**Two (Minimum)**	Assignments:	**Two (Minimum)**
ESE Duration:	**Three Hours**	**Maximum Marks: 80**	**Minimum Marks: 28**

Course Objectives:

1. To impart knowledge on the basic principles of bio-chemistry.
2. To make the students conversant with structures and properties of Carbohydrates, proteins, lipids and nucleic acids nutrition aspects and metabolic regulation.

UNIT- I **Introduction to Biomolecules and Structures & Properties of carbohydrates and Proteins**: Basic principles of organic chemistry; Biomolecules-nature, importance and their conformation; Weak inter-molecular interactions in bio-macromolecules. *Biological building block molecules:* Carbohydrates: Classification, structure, function and their derivatives, aldoses and ketoses, reducing properties, cyclic structure formation. Proteins & Amino acids: Classification, structure and function of proteins and amino acids, acidic and basic properties, isoelectric points, D and L classification, essential amino acids, test for proteins; Conformation of proteins: Ramachandran plot, structure of proteins, domains, motif and folds.

UNIT-II **Structures & Properties of Lipids and Nucleic Acids**: *Lipids:* Classification, structure and function of lipids and fatty acids, saturated and unsaturated fatty acids, lipoproteins and their functions, significance of cholesterol. *Nucleic Acids:* Components of nucleic acids, classification and structure of Nucleosides and nucleotides, function of nucleic acids: carrier of chemical energy of cell, nucleic acid analogs; Watson and Crick model of DNA, difference between DNA and RNA. Conformation of nucleic acids (helix (A, B, Z), types of RNA, secondary structure of RNA, enzyme factor, regulatory molecules

UNIT- III **Metabolism of carbohydrates and proteins:** *Carbohydrate Metabolism:* nutrition, digestion and absorption Glycolysis, Krebs cycle and Electron Transport System, Gluconeogenesis, Glycogenesis, HMP shunt; Calculation of ATP production during Glycolysis and TCA cycle.*Protein Metabolism:* Catabolism of protein, synthesis of amino acids (Leucine and tryptophan), conversion of amino acids to stabilized products, Urea cycle; Regulation of levels of high energy compounds and reducing equivalents in the cell.

UNIT-IV **Metabolism of lipids and nucleotides and vitamins**: *Lipid Metabolism:* Synthesis and breakdown of fatty acids, cholesterol metabolism. *Nucleotide metabolism:* Synthesis and breakdown of purine and pyrimidine Nucleotides. Vitamins: Definition and classification of vitamins, Structure and function, Abnormalities related to vitamin deficiency.

UNIT-V **Applied Biochemistry:** Plasma proteins and their importance in medical biochemistry, homeostasis and thrombosis, metabolism of xenobiotics, Use of isozymes to diagnose tissue damage, clinical uses of liposomes, anticancer drugs

Text Books:

1. Fundamentals of Biochemistry by U Satyanarayan, New Central Book Agency.
2. Fundamentals of Biochemistry by Jain and Jain, S. Chand Group.

Reference Books:

1. Lehninger's Principles of Biochemistry, David L. Nelson and Michael M. Cox, Macmillan Worth publisher.
2. Lubert Stryer, Biochemistry (2000) 4th Edition, WH. Freeman and company.
3. Voet and Voet, Biochemistry (1995) 2nd Edition, John Wiley and Sons Inc.

Course Outcome:

1. At the end of the course, students will have sufficient systematic and comprehensive knowledge about basics of biomolecules which will help them relate to the different metabolic processes taking place in the cell and how inanimate chemicals cause life.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program:	**Bachelor of Engineering**		
Branch:	**Biotechnology**	Semester:	**IV**
Subject:	**Medical Biotechnology**	Code:	**318456(18)**
Total Theory Periods:	**30**	Total Tutorial Periods:	**10**
Class Tests:	**Two (Minimum)**	Assignments:	**Two (Minimum)**
ESE Duration:	**Three Hours**	**Maximum Marks: 80**	**Minimum Marks: 28**

Course Objectives:

1. To make the students understand about human genetics, disorders and diseases associated.
2. To familiarize the students with diagnostic techniques used in medicine.
3. To make the students aware with ethical issues associated with techniques in human genetics

UNIT- I **Introduction:** Human genetics (types of diseases: Chromosomal disorders, Numerical disorders e.g. trisomies & monosomies, Structural disorders e.g. deletions, duplications, translocations & inversions, chromosomal instability syndromes; Gene controlled diseases: Autosomal and X-linked disorders, mitochondrial disorders), inheritance pattern, general study of causes of genetic disorders.

UNIT-II **Diseases and their causes:** Genetic diseases: Huntington's Disease, Myotonic muscular dystrophy, sickle cell anaemia, cystic fibrosis, Duchenne muscular dystrophy, hemophilia, phenylketoneurea, Familial Hypercholesterolemia, Congenital hypothyroidism, Tay-Sachs, Alzheimer, Parkinsonism, Mongolism, Cri-du-chat, Edwards syndrome, Turner's syndrome, klinefelter's syndrome, down's syndrome, cleft palate.
Cancer and oncogenes: Types of Cancer, properties of cancer, genetic basis of cancer; Oncogenes: Tumor suppressor genes function and mechanism of action of pRB and p53.

UNIT- III **Diagnosis:** Gene testing (prenatal, new born screening, carrier detection screening, predictive and presymptomatic testing, forensic testing) Immunodiagnostics for pregnancy: Diagnosis using protein and enzyme markers, monoclonal antibodies, invasive techniques : Amniocentesis, Chorionic Villi Sampling (CVS), non-invasive techniques : ultrasonography, X-ray, maternal serum and fetal cells in maternal blood, microarray technology- genomic and c - DNA arrays, probe, biosensors, FISH cytogenetics.

UNIT-IV **Therapy:** Gene Knockouts /silencing, gene disruption-p53, immunological (MAb, vaccines); Gene therapy for non-inheritable diseases: somatic cell gene therapy and germ line gene therapy; Stem cell therapy; Radiotherapy; Chemotherapy; Enzyme therapy.

UNIT-V **Ethical issues in medicine:** *In vitro* fertilization, surrogate therapy; Prenatal sex determination; Genetic counseling; Germline gene therapy; IPR, patenting; Human transgene.

Text Books:

1. Medical Biotechnology, Albert Sasson (2006), United Nations Publications
2. Medical Biotechnology, S. N. Jognand (2000), Himalaya Publication

Reference Books:

1. Human Molecular Genetics 3rd Edition Tom Strachan and A.P.Read, Garland science pulications.
2. A textbook of Genetics (2010), 3rd Edition, S.S.Randhawa, PV books, www.pvbooks.com.
3. Molecular Biology of the Gene (2007) 6th Edition , James Watson, T.A.Baker, S.P.Bell, A.Gann, M.Lenin, R.Losick, Benjamin Cummings Publication.
4. Biotechnology and Biopharmaceuticals (2003), Rodney J.Y. Ho and milo Gilbaldi, Wiley John & sons.
5. Biotechnology Demystified Sharon Walker (2006) Mc Graw Hill Publication.
6. The Cell, Geoffrey MCooper and Robert E. Hausman.
7. Molecular Cell Biology, H. Lodish, A. Berk, S.L.Zipursky, P. Matsudaira, D. Baltimore, J. Darnell.
8. Kuby, RA Goldsby, Thomas J. Kindt, Barbara, A. Osborne.
9. Biochemistry – Lubert Stryer.
10. Lehninger's Principles of Biochemistry- David L Nelson & Michael M Cox.

Course Outcome:

1. The students will gain knowledge of human genetics and molecular mechanisms of the diseases using which they can apply the concepts in research related works.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program:	**Bachelor of Engineering**		
Branch:	**Biotechnology**	Semester:	**IV**
Subject:	**Transport Process Laboratory**	Code:	**318461(19)**
Total Lab Periods:	**36**	Batch Size:	**15**
Maximum Marks:	**40**	Minimum Marks:	**20**

List of Experiments: *(At least Ten experiments are to be performed by each student)*

1. To determine heat transfer coefficient of pin fin extended surfaces heat transport
2. To determine all heat transfer forces convection apparatus.
3. To determine over all heat transfer coefficient of double pipe heat exchanges.
4. To determine over all heat transfer coefficient of shell and tube heat excluder.
5. To determine coefficient of discharge of venturi and orifice.
6. To calibrate given rotameter.
7. Study of sudden expansion and sudden contraction and determine expansion and contraction losses.
8. To determine Reynolds number of flowing fluid and draw fiction factor curve.
9. To determine discharge coefficient of weir notch.
10. To determine pressure drop in packed bed apparatus.
11. To determine fluidiction coefficient of fluidized bed.
12. To determine diffusivity in forced diffusion system.
13. Study of humidifier.
14. Study of spray dryer
15. Determine the heat transfer coefficient for heat flow through composite wall.

Equipments/Machines/Instruments/Tools/Software Required:

- Pin fin Apparatus
- Shell and tube heat exchanger
- Sudden expansion and sudden contraction arrangement
- Fluidized bed.
- Spray dryer.
- Humidifier

Recommended Books:

1. Transport Phenomena, Biron R. Bird, Warren E. Stewart, and Edwin 2.Lightfoot.
2. Transport Processes and Unit Operations (1997) Christie J. Geankoplis, Prentice hall of India.
3. Perry's Chemical Engineers Handbook, Eighth Edition, Don Green, Robert Perry.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program:	**Bachelor of Engineering**		
Branch:	**Biotechnology**	Semester:	**IV**
Subject:	**Thermodynamics & Biochemical Reaction Engineering Laboratory**	Code:	**318462(19)**
Total Lab Periods:	**36**	Batch Size:	**15**
Maximum Marks:	**40**	Minimum Marks:	**20**

List of Experiments: *(At least Ten experiments are to be performed by each student)*

1. Study of kinetics of Irreversible reaction in Batch Reactor
2. Study of kinetics of irreversible reaction in isothermal PFR.
3. Study of kinetics of irreversible reaction in Adiabatic Reactor.
4. Study of kinetics of irreversible reaction in CSTR.
5. Estimation of Carbohydrate
6. Estimation of Protein
7. Determination of Iodine value of fat
8. Determination of Saponification value of fat
9. Identification of given sample (Carbohydrate, Protein, Fat)
10. Separation of amino acid by paper chromatography.
11. Isolation of amylase producing organism
12. To determine heat of reaction for given reaction system.

Equipments/Machines/Instruments/Tools/Software Required:

- Batch Reactor
- Plug Flow Reactor (PFR)
- Adiabatic Reactor
- Mixed Flow Reactor (MFR)
- Heterogeneous Catalytic Reactor
- Biochemical Reactor

Recommended Books:

1. Biochemical Engineering Fundamentals, James E. Bailey & David F. Ollis.
2. Chemical Engineering Thermodynamics, K.V.Narayanan
3. Perry's Chemical Engineers Handbook, Eighth Edition, Don Green, Robert Perry.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program:	**Bachelor of Engineering**		
Branch:	**Biotechnology**	Semester:	**IV**
Subject:	**Recombinant DNA Technology Laboratory**	Code:	**318463(18)**
Total Lab Periods:	**36**	Batch Size:	**15**
Maximum Marks:	**40**	Minimum Marks:	**20**

List of Experiments: *(At least Ten experiments are to be performed by each student)*

1. Isolation of DNA from plant cell by CTAB method.
2. Isolation of DNA from onion cell.
3. Electrophoresis of DNA from plant/onion cell.
4. Isolation of RNA from yeast cell.
5. Estimation of DNA by Diphenyl method.
6. Estimation of RNA by orcinol method.
7. Total Genomic DNA extraction (Kit).
8. Plasmid Conjugation (Kit).
9. Isolation of DNA from Blood (Kit).
10. Silver Staining of DNA isolated from plant/Animal (Kit).
11. DNA Ligation (Kit).
12. Restriction Digestion (Kit).
13. Experiments to perform amplification of DNA
14. Transfer of DNA/Protein from Gel to nitrocellulose membrane by western blotting.

Equipments/Machines/Instruments/Tools/Software Required:

- Refrigerated Micro-Ultracentrifuge
- Gel Electrophoresis Apparatus
- Oven
- Incubator
- UV Transilluminator
- Micropipette
- PCR Machine
- Western Blotting Apparatus
- Gel Rocker
- –20 Refrigerator

Recommended Books:

1. Molecular Cloning By Sambrook *et., al* (1989) Cold Spring Harbor Press, Cold Spring Harbor, NY.
2. An Introduction to Practical Biotechnology, S. Harisha, Laxmi Publications (P) Ltd. New Delhi.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program:	**Bachelor of Engineering**		
Branch:	**Biotechnology**	Semester:	**IV**
Subject:	**Biochemistry Laboratory**	Code:	**318464(18)**
Total Lab Periods:	**36**	Batch Size:	**15**
Maximum Marks:	**40**	Minimum Marks:	**20**

List of Experiments: *(At least Ten experiments are to be performed by each student)*

1. Lab equipment orientation.
2. Qualitative tests for carbohydrates – distinguishing reducing from non-reducing sugars and keto from aldo sugars.
3. Quantitative method for amino acid estimation using ninhydrin – distinguishing amino from amino acid.
4. Protein estimation by Biuret method.
5. Protein estimation by Bradford method.
6. Total Carbohydrate estimation by Anthrone method.
7. Extraction of lipids and analysis by TLC.
8. Estimation of nucleic acids by DPA method.
9. Enzymatic assay of phosphatase from potato.
10. Enzymatic assay of amylase from *Aspergillus niger* extract
11. Separation of amino acids by paper chromatography.

Equipments/Machines/Instruments/Tools/Software Required:

- pH meter
- Colorimeter
- Water bath
- Balance (500 g – 0.1 g)
- Balance (200g - 0.1 mg)
- Table top Centrifuge
- Microfuge
- Micropipettes (200 µl – 1000 µl), (20 µl - 200 µl), (1 µl – 20 µl).
- Hot air Oven
- UV – Vis spectrometer
- Vortex shaker
- Magnetic Stirrer
- Fume hood
- Bunsen Burner

Recommended Books:

1. . Experiments in Microbiology, Plant Pathology and Biotechnology, K. R. Aneja, New Age International
2. An Introduction to Practical Biotechnology, S. Harisha, Laxmi Publications (P) Ltd. New Delhi.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program:	**Bachelor of Engineering**		
Branch:	**Biotechnology**	Semester:	**IV**
Subject:	**Health, Hygiene & Yoga**	Code:	**318465(46)**
No. Of Periods:	**2 Periods/Week**	Total Tutorial Periods:	**NIL**
Maximum Marks:	**40**	**Minimum Marks:**	**24**

Course Objectives:

1. To provide understanding the importance of health.
2. To provide insight into the hygiene aspect & quality of life.
3. To study the concepts of various medical therapy.
4. To practice the various yogasans.
5. To provide knowledge about common diseases and its cure through yagasans and pranayam.
6. To develop concentration through various methods.

UNIT- I **HEALTH & HYGIENE:** Concept of health, Physical health and mentall health and wellbeing and how to achieve these, longevity and how to achieve it, concept and common rules of hygiene, cleanliness and its relation with hygiene; Overeating and underrating, amount of food intake required, intermittent fasting; adequate physical labour, sleep; consumption of junk fast food vs nutritious food; fruits, vegetables cereals and qualities of each of these.

UNIT-II **INTRODUCTORY KNOWLEDGE OF COMMON STREAMS OF MEDICINAL CURE:** History, development, basic concepts, modes of operation of Alopathy, Ayurved, Homoeopathy, Biochemic, Unani, Siddha, Accurpressure, Accupunture, Naturopathy, Yogic and Herbal system of medicines, Introduction of Anatomy and Physiology concerned.

UNIT- III **YOGASANS:** Meaning and concept of Yoga, Yogasans and its mode of operation, How to perform Yogasans, Common Yogasans with their benefits, such as, Padahastasan, Sarvangasan, Dhanurasan, Chakrasan, Bhujangasan, Paschimottasan, Gomukhasan, Mayurasan, Matsyasan, Matsyendrasan, Pawanmuktasan, Vajrasan, Shalabhasan, Sinhasan, Shashankasan, Surya Namaskar, Halasan, Janushirasan, Utshep Mudra.

UNIT-IV **YOGASANS FOR COMMON DISEASES:** From Yogic Materia Medica with symptoms, causes, asans and herbal treatment.

- **Modern silent killers:** High blood pressure, diabetes and cancer, causes and cure; Common health problems due to stomache disorders, such as, indigestion, acidity, dycentry, piles and fissures, artheritis, its causes, prevention and cure.
- **Asans for relaxation:** Shavasan, Makarasan, Matsyakridasan, Shashankasan.
- **Asans to increase memory and blood supply to brain:** Shirsh padasan, Shashankasan.
- **Asans for eye sight:** Tratak, Neti Kriya .
- **Pranayam:** Definition and types: Nadi Shodhan, Bhastrik, Shitakari, Bhramari useful for students.

UNIT-V **CONCENTRATION:** Concentration of mind and how to achieve it. Tratak (त्राटक), Concentration on breath, Japa (जप), Ajapajap (अजपाजप), internal silence (अन्तर्मौन), visualization in mental sky (चिदाकाश धारणा), Concentration on point of light (ज्योति ध्यान), Concentration on feeling (भाव ध्यान), Concentration on figure (मूर्त्त ध्यान).

Text Books:

Health, Hygiene & Yoga, Dr P B Deshmukh, Gyan Book Pvt Ltd. New Delhi.

Reference Books:

(1) Yogic Materia Medica
(2) Asan, Pranayam and Bandh.