

**Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)**  
**Scheme of Teaching & Examination**

**BE IV Semester Biotechnology**

S.No	Board of Study	Subject Code	Subject	Period per week			Scheme of Exam Theory/Practical			Total Marks	Credit L+(T+P)/2
				L	T	P	ESE	CT	TA		
1	Biotechnology	318411(18)	Cellular And Molecular Biology	4	0	-	80	20	20	120	4
2	Biotechnology	318412(18)	Recombinant DNA Technology	4	0	-	80	20	20	120	4
3	Biotechnology	318413(18)	Food Biotechnology	3	1	-	80	20	20	120	4
4	Chem. Engg	318414(19)	Stoichiometric Calculations	3	1	-	80	20	20	120	4
5	Chem. Engg	318415(19)	Transport Processes	4	1	-	80	20	20	120	5
6	Chem. Engg	318416(19)	Thermodynamics and Biochemical Reaction Engineering	4	0	-	80	20	20	120	4
7	Biotechnology	318421(18)	Cellular And Molecular Biology Lab	-	-	3	40	-	20	60	2
8	Biotechnology	318422(18)	Recombinant DNA Technology Lab	-	-	3	40	-	20	60	2
9	Chem. Engg	318423(19)	Transport Processes Lab	-	-	3	40	-	20	60	2
10	Chem. Engg	318424(19)	Thermodynamics and Biochemical Reaction Engineering Lab	-	-	3	40	-	20	60	2
11	Humanities etc.	300425(46)	Health, Hygiene and Yoga	-	-	2	-	-	40	40	1
12			Library	-	-	1					
			Total	<b>22</b>	<b>3</b>	<b>15</b>	<b>640</b>	<b>120</b>	<b>240</b>	<b>1000</b>	<b>34</b>

L: Lecture, T: Tutorial, P: Practical, ESE: End Semester Exam, CT: Class Test, TA: Teachers Assesment

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 (C.G.)

**Semester : IV Semester B.E**

**Subject: Cellular and Molecular Biology**

Total Theory Periods: 40

Total Marks in End Semester Exam: 80

Minimum number of class test to be conducted: 2

**Branch: Biotechnology**

Code: 318411(18)

Total Tut Periods: Nil

**Unit 1:-** Cell structure, function of organelles, principle of membrane organization, membrane protein. Cell division- mitosis and meiosis. Cell cycle and its regulation. Cytoskeleton– various types and their functions.

[ No. of Periods – 8 ]

**Unit 2:-** Transport across cell membranes– passive and active transport, permease, sodium-potassium pump. ATP dependent proton pump, ion channel and electrical properties of membranes.

[ No. of Periods – 8 ]

**Unit 3:-** Signal Transduction– signal amplification, cyclic AMP, roll of inositol phosphate as messenger, roll of G-protein in signal transduction, role of  $Ca^{2+}$  ion in cell signaling. Enzyme linked cell surface receptors.

[ No. of Periods – 8 ]

**Unit 4:-** Gene Organization– split gene, overlapping gene, pseudogenes, transposons and retrotransposons, mechanism of RNA splicing, retrovirus, DNA methylation.

[ No. of Periods – 8 ]

**Unit 5:-** Genetic Transfer- conjugation, transduction, transformation. Multiple alleles and types of blood groups, antigens.

[ No. of Periods – 8 ]

## **Name of Text Books:**

1. Freifelder D. [ “Molecular Biology” ] Jones Barat Ielt Publishers Inc. 1987.
2. Gene VIII Benjamin Lewin .
3. Genome by T. A. Brown, John Wiley & Son’s, RD PTE Limitel .

## **Name of Reference Books:**

1. Cell & Molecular Biology “concepts & Experiments” Geratd Karp, John Wiley & Son’s.
2. The Cell- A molecular approach, Gn Cooper Asm Prers.
3. Cell and Molecular Biology by S. C. Rastogi
4. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology by P. S. Verma and V. K. Agrawal
5. Concepts in Molecular Biology by Rastogi *et al.*

# Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

**Semester : IV Semester B.E**

**Subject: Recombinant DNA Technology**

Total Theory Periods: 40

Total Marks in End Semester Exam: 80

Minimum number of class test to be conducted: 2

**Branch: Biotechnology**

Code: 318412(18)

Total Tut Periods: Nil

**Unit 1:-** 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 ligase, polymerases, etc.

[ No. of Periods – 8 ]

**Unit 2:-** Vectors- phasmids, phage vector- M13,  $\lambda$ , phasmids, cosmids, phagmid, Artificial chromosomes- BAC, YAC, MAC, Shuttle vector.

[ No. of Periods – 8 ]

**Unit 3:-** Gene Cloning – isolation of desired gene, preparation of rDNA and its integration into host cell, selection and screening of transformants.

[ No. of Periods – 8 ]

**Unit 4:-** Gene Library- cDNA preparation, cDNA library, genomic DNA library. Amplification of gene library, difference between cDNA Library and genomic library.

[ No. of Periods – 8 ]

**Unit 5:-** Preparation and application of molecular probes, DNA probes, RNA probes, radioactive and non-radioactive labelling of DNA. Methods of gene transfer- natural and artificial.

[ No. of Periods – 8 ]

## **Name of Text Books:**

1. Principals of gene Cloning By Old & Primrose
2. Molecular Cloning By Sambrook et al

## **Name of Reference Books:**

1. Gene Cloning & DNA Analysis “An Introduction” By T.A. Brown.
2. From Gene to genomes “Concepts & Application of DNA Technology” By J.W. Dale & M.V. Schartz.
3. Biotechnology by B. D. Singh, Kalyani Publishers

# Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

**Semester : IV Semester B.E**

**Subject: Food Biotechnology**

Total Theory Periods: 30

Total Marks in End Semester Exam: 80

Minimum number of class test to be conducted: 2

**Branch: Biotechnology**

Code: 318413(18)

Total Tut Periods: 10

**Unit 1:-** Role and significance of micro-organism in food. Intrinsic and extrinsic parameters of food that affect microbial growth. Micro-organisms in fresh meat and poultry, processed meat, sea food. Food spoilage.

[ No. of Periods – 6+2]

**Unit 2:-** Brewing, malting, mashing, use of hops in beer industries, primary and secondary fermentation. Beer, wine and distillation spirit. Cheese production , various dairy products. Vinegar and Soya sauce production.

[ No. of Periods – 6+2]

**Unit 3:-** Food Preservation– using irradiation, characteristics radiations of interest in food preservation. Principles underlying the destruction of microorganisms by irradiation. Food preservation using various temperature means, chemical preservatives used in food preservation.

[ No. of Periods – 6+2]

**Unit 4:-** Use of enzyme in food industry, use of lactase in dairy industry, enzymes in fruit juice and brewing industries. Microbial Biomass (Mushroom – *Agaricus bisporus*, *pleurotus species*, *Volvarrilla spp.*).

[ No. of Periods – 6+2]

**Unit 5:-** Single cell protein– microorganisms, substrates used, production of SCP, biomass recovery. Nutritional and safety evaluation. Advantages of SCP.

[ No. of Periods – 6+2]

## **Name of Text Books:**

1. Biotechnology by B.D. Singh, Kalyani Publishers.
2. Food Microbiology – fundamentals & frontiers by M.P. Doyle, L.R. Beuchal & Thorna J. Montville(2001) A.S.M. Press.

## **Name of Reference Books:**

1. Modern food microbiology by M.J. James, C.B.S. publishers & publishers 1987.
2. Basic food microbiology “by J.B. Gorge C.B.S. Publishers & Distributers “1987.
3. Food Microbiology by M. R. Adams and M. O. Moss

# Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

**Semester : IV Semester B.E**  
**Subject: Stoichiometric Calculations**  
Total Theory Periods: 30  
Total Marks in End Semester Exam: 80  
Minimum number of class test to be conducted: 2

**Branch: Biotechnology**  
Code: 318414(19)  
Total Tut Periods: 10

**Unit 1:-** Unit and its conversion, Normality, Molality, Molarity, PVT behaviors, Gas laws, Partial pressure and pure component volume methods. Limiting and excess reactant.

[ No. of Periods – 6+2]

**Unit 2:-** Humidity and Saturation: Percentage Humidity, Relative Humidity, Molal Humidity, Cox Chart. Crystallization.

[ No. of Periods – 6+2]

**Unit 3:-** Combustion calculations- fuel and flue gas analysis, air fuel ratio, theoretical oxygen, percentage excess air, limiting and excess reactant.

[ No. of Periods – 6+2]

**Unit 4:-** Material balance involving physical changes, chemical changes and biochemical reactions, chemical reactions, Recycle, bypass and purge operations.

[ No. of Periods – 6+2]

**Unit 5:-** Energy Balance calculations: Thermo physics: Heat capacity calculations, Enthalpy changes of chemical and biochemical reactions, Dissolution and Laws of Thermo chemistry. Effect of pressure and temperature on heat of reactions.

[ No. of Periods – 6+2]

## **Name of Text Books:**

1. Bhatt and Vora, 'Stoichiometry', McGraw Hill Publications
2. Hougen and Watson, "Chemical Process Principles Part – I Material and Energy Balance 2<sup>nd</sup> Edition

## **Name of Reference Books:**

1. K A Gavhane, Unit operations, Nirali publication
2. Himmelblau, basic principles and calculations in Chemical engineering, Prentice Hall
3. Ghoshal, Sanyal, Dutta, Introduction to chemical engineering

# Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

**Semester : IV Semester B.E**  
**Subject: Transport Processes**

Total Theory Periods: 40

Total Marks in End Semester Exam: 80

Minimum number of class test to be conducted: 2

**Branch: Biotechnology**

Code: 318415(19)

Total Tut Periods: 10

**Unit 1:-** Mechanism of momentum transport: Newton's Law of viscosity, Newtonian fluids, pressure and temperature dependence on viscosity. Theory of viscosity of liquids. Velocity distribution in 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, couette flow.

[ No. of Periods – 8+2]

**Unit 2:-** Equations of continuity in rectangular, cylindrical and spherical coordinate, Equations of motion, tangential annular flow and shape of cylindrical surface vortex depth.

[ No. of Periods – 8+2]

**Unit 3:-** Mechanism of energy transport: Fourier's Law of heat conduction, temperature and pressure dependence of thermal conductivity of gases and liquids. Thermal conductivity of solids. Temperature distribution in solids and in laminar flow - 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, forced convection and free convection.

[ No. of Periods – 8+2]

**Unit 4:-** Mechanism of mass transport : Fick's Law of diffusion, temperature and pressure dependence of mass diffusivity. Theory of ordinary diffusion in gases at low density. Theory of ordinary diffusion in liquids. Concentration distribution in solids and in laminar flow-shell mass balance, boundary conditions, diffusion through a stagnant gas film, Diffusion with heterogeneous chemical reaction. Diffusion into a falling liquid film.

[ No. of Periods – 8+2]

## **Name of Text Books:**

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

## **Name of Reference Books:**

1. Bennet C.O. and Meyer J.E., "Momentum and mass Transfer"
2. Sission and Pitts "Introduction to Transprot Phenomena"
3. J.C.Slattery, “ Momentum, Energy and Mass Transfer in continuum , Kruger Publishing Company

# Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

**Semester : IV Semester B.E**  
**Subject: Thermodynamics and Biochemical**  
**Reaction Engineering**

**Branch: Biotechnology**  
Code: 318416(19)  
Total Tut Periods: 10

Total Theory Periods: 30

Total Marks in End Semester Exam: 80

Minimum number of class test to be conducted: 2

**Unit 1:-** Thermodynamic functions, Laws of thermodynamics, Heat effects-standard heat of reaction, free energy of formation, choice Raouilts Law and Henry's Law, Fluid phase equilibrium.

[ No. of Periods – 6+2]

**Unit 2-** Chemical potential, fugacity, activity, activity coefficient, chemical reaction equilibria, standard free energy change, equilibrium conversion, Vant Hoff's Eq. Clausius Clapeyron Eq: Gibbs Duhem Eq. Application of thermodynamics on Bimolecular.

[ No. of Periods – 6+2]

**Unit 3:-** Kinetics of homogenous reactions, reaction mechanism, temperature dependency, at constant, interpretation of batch kinetic data.

[ No. of Periods – 6+2]

**Unit 4:-** Kinetics of enzyme catalyzed reactions in free and immobilized states, choice Michaelis-Menten equation and its various modifications. Effects of external mass transfer immobilized enzyme systems, analysis if intraparticle diffusion and reactions.

[ No. of Periods – 6+2]

**Unit 5:-** 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.

[ No. of Periods – 6+2]

## **Name of Text Books:**

1. Chemical Reaction Engineering : Octave Levenspiel
2. Chemical Reaction Engineering : Fogler

## **Name of Reference Books:**

1. Chemical Engg. Thermodynamics : J.M. Smith
2. Thermodynamics : Glass Stone
3. Bio-chemical Reaction Engg: J.M. Coulson & Richarder vol-3

# **Chhattisgarh Swami Vivekanand Technical University, Bilai (C.G.)**

**Semester: IV<sup>th</sup> Semester B.E**

**Subject: Cellular And Molecular Biology Lab**

Total Practical Periods: 30.

Total Marks in End Semester Exam: 40

**Branch: Biotechnology**

Practical Code: 318421(18)

## **Experiments to be performed (Minimum 10 experiments)**

1. Study of cell division in root tip/onion bud.
2. Study of leaf structure by section cutting
3. Study of stem structure by section cutting
4. Measurement of cell size by ocular Microbiology.
5. Study of unicellular organisms in pond water.
6. Hanging drop method for studying motility of microorganisms from sewage water
7. Determination of Leukocyte Cell.
8. R.B.C. Counting.
9. W.B.C. Counting.
10. Isolation of DNA from onion Cell.
11. Study of different type of fungal and bacterial cell.

## **List of Equipments/Machine Required:**

1. Microscope
2. Micrometer (Ocular and stage)
3. Haemocytometer
4. Ultra-centrifuge

## **Recommended Books:**

1. Experimental Microbiology, Plant Pathology and Biotechnology by K. R. Aneja
2. Refer books mentioned in theory syllabus

# **Chhattisgarh Swami Vivekanand Technical University, Bilai (C.G.)**

**Semester: IV<sup>th</sup> Semester B.E**

**Subject: Recombinant DNA Technology Lab**

Total Practical Periods: 30.

Total Marks in End Semester Exam: 40

**Branch: Biotechnology**

Practical Code: 318422(18)

## **Experiments to be performed (minimum 10 experiments)**

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.

## **List of Equipments/Machine Required:**

1. Refrigerated Micro-Ultracentrifuge
2. Gel Electrophoresis Apparatus
3. Oven
4. Incubator
5. UV Transilluminator
6. Micropipette
7. PCR Machine
8. Western Blotting Apparatus
9. Gel Rocker
10. -20 Refrigerator

## **Recommended Books:**

1. Gene Cloning by T A Brown
2. Refer books mentioned in theory syllabus

# **Chhattisgarh Swami Vivekanand Technical University, Bilai (C.G.)**

**Semester : IV Semester B.E**

**Branch: Biotechnology**

**Subject: Transport Processes Lab**

Practical Code: 318423(19)

Total Practical Periods: 30.

Total Marks in End Semester Exam: 40

## **Experiments to be performed (minimum 10 experiments)**

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 exchanger.
4. To determine over all heat transfer coefficient of shell and tube heat exchanger.
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 friction factor curve.
9. To determine discharge coefficient of weir notch.
10. To determine pressure drop in packed bed apparatus.
11. To determine fluidization 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.

## **List of Equipments/Machine Required:**

1. Pin fin Apparatus
2. Shell and tube heat exchanger
3. Sudden expansion and sudden contraction arrangement
4. Fluidized bed.
5. Spray dryer.
6. Humidifier

## **Recommended Books:**

1. McCabe and Smith, Unit Operation of Chemical Engg
2. Coulson and Richardson, Chemical Engineering, vol 1.
3. Treyball, Mass Transfer Operation

# Chhattisgarh Swami Vivekanand Technical University, Bilai (C.G.)

**Semester : IV Semester B.E**

**Branch: Biotechnology**

**Subject: Thermodynamics and Biochemical  
Reaction Engineering Lab**

Practical Code: 318424(19)

Total Practical Periods: 30.

Total Marks in End Semester Exam: 40

## **Experiments to be performed (minimum 10 experiments)**

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

## **List of Equipments/Machine Required:**

1. Batch Reactor
2. Plug Flow Reactor (PFR)
3. Adiabatic Reactor
4. Mixed Flow Reactor (MFR)
5. Heterogeneous Catalytic Reactor
6. Biochemical Reactor
7. Photochemical Reactor
8. Spectrophotometer (UV-VIS)
9. Hot Air Oven
10. Electronic Balance Dhona
11. pH meter

## **Recommended Books:**

1. O. Levenspiel "Chemical Reaction Engg.:"
2. H. Scott Fogler "Chemical Reaction Engg."
3. Balley & Ollis, Bio-Chemical Engg. Fundamentals, Mc-Graw hill Publication
4. B. D. Singh, Bio- Technology, Kalyani Publication

# Chhattisgarh Swami Vivekanand Technical University, Bilai (C.G.)

Semester : IV Sem.

Subject : **HEALTH, HYGIENE & YOGA**

No. of Periods : 2 pds/week

Total Marks in End Semester Exam. : NIL

Minimum number of class tests to be conducted: Two

Branch: Common for all branches

Code : 300425 (46)

Tutorial Periods : NIL

Teacher's Assessment: 40 Marks

## UNIT- I

**HEALTH & HYGIENE:** Concept of health, Physical health and mental 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 undereating, 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, Accupressure, Accupuncture, 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 stomach 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  $\frac{1}{4} = kVd\frac{1}{2}$  Concentration on breath, Japa  $\frac{1}{4}ti\frac{1}{2}$  Ajapajap  $\frac{1}{4}vtikti\frac{1}{2}$  internal silence  $\frac{1}{4}vUrekSZu\frac{1}{2}$  visualization in mental sky  $\frac{1}{4}fpnkdk'k /kkj.kk\frac{1}{2}$  Concentration on point of light  $\frac{1}{4}T;ksfr /;ku\frac{1}{2}$  Concentration on feeling  $\frac{1}{4}Hkko /;ku\frac{1}{2}$  Concentration on figure  $\frac{1}{4}ew\dot{U}kZ /;ku\frac{1}{2}$

## REFERENCES

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

