## Scheme of Teaching & Examination VII Sem. Biotechnology

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Board of Study</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Period per week</th>
<th>Scheme of Exam</th>
<th>Total Marks</th>
<th>Credit L+(T+P)/2</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Chemical Engineering</td>
<td>318731(19)</td>
<td>Unit Operation</td>
<td>4</td>
<td>1</td>
<td>80</td>
<td>20</td>
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<tr>
<td>2</td>
<td>Biotechnology</td>
<td>318732(18)</td>
<td>Immunotechnology</td>
<td>4</td>
<td>1</td>
<td>80</td>
<td>20</td>
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<tr>
<td>3</td>
<td>Biotechnology</td>
<td>318733(18)</td>
<td>Stem Cell in Health Care</td>
<td>4</td>
<td>-</td>
<td>80</td>
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<tr>
<td>4</td>
<td>Biotechnology</td>
<td>318734(18)</td>
<td>Pharmaceutical Biotechnology</td>
<td>4</td>
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<td>20</td>
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<tr>
<td>5</td>
<td>Refer Table II</td>
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<td>Professional Elective-II</td>
<td>4</td>
<td>-</td>
<td>80</td>
<td>20</td>
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<tr>
<td>6</td>
<td>Chemical Engineering</td>
<td>318761(19)</td>
<td>Unit Operation Lab</td>
<td>-</td>
<td>-</td>
<td>40</td>
<td>-</td>
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<tr>
<td>7</td>
<td>Biotechnology</td>
<td>318762(18)</td>
<td>Immunotechnology Lab</td>
<td>-</td>
<td>-</td>
<td>40</td>
<td>-</td>
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<td>8</td>
<td>Biotechnology</td>
<td>318763(18)</td>
<td>Pharmaceutical Biotechnology Lab</td>
<td>-</td>
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<td>9</td>
<td>Biotechnology</td>
<td>318764(18)</td>
<td>Minor Project</td>
<td>-</td>
<td>-</td>
<td>100</td>
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<tr>
<td>10</td>
<td>Management</td>
<td>318765(76)</td>
<td>Innovative and Entrepreneurial Skills</td>
<td>-</td>
<td>-</td>
<td>40</td>
<td>-</td>
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<tr>
<td>11</td>
<td>Humanities</td>
<td>318766(46)</td>
<td>Practical Training ** Evaluation / Library</td>
<td>-</td>
<td>-</td>
<td>40</td>
<td>-</td>
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|       |                      |                  | **Note:** Duration of all theory papers will be of Three Hours. **To be completed after VI semester and before the commencement of VII semester.**

### Professional Elective Table II

<table>
<thead>
<tr>
<th>S.No</th>
<th>Board of Studies</th>
<th>Subject Code</th>
<th>Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Biotechnology</td>
<td>318741(18)</td>
<td>Oncology</td>
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<tr>
<td>2</td>
<td>Biotechnology</td>
<td>318742(18)</td>
<td>Drug Design and Drug Delivery</td>
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<tr>
<td>3</td>
<td>Biotechnology</td>
<td>318743(18)</td>
<td>Biofuel technology</td>
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</table>
Chhattisgarh Swami Vivekananda Technical University, Bhilai

Name of program: Bachelor of Engineering
Branch: Biotechnology
Subject: Unit Operations
Semester: VII
Code: 318731(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 Objective:
1. To impart the knowledge of various unit operations used in industries.
2. To make them learn the application of different equipments in bioprocess industries.

UNIT I Solids, characteristics of solid particles, type of standard screen series. Screening and other separation methods: screen analysis, estimation of particle size, surface area and particle population based on screen analysis, ideal and actual screens, principles of elutriation, flotation, jigging, Cyclone separator, electrostatics, and magnetic separation processes.

UNIT II Size Reduction and Enlargement: crushers, grinders, disintegrates for coarse and intermediate & fine grinding, energy and power requirements, Rittinger’s, Kick’s and Bond’s Law, work index.

UNIT III Mixing and Agitation: Axial and radial flow impellers, prevention of vortex, Liquid- Liquid, Liquid-solid and Solid- Solid mixing operations and equipment, power consumption in agitated vessels mixing index


UNIT V Conveyers: Belt conveyer, Bucket Elevator, Flight conveyer, Apron conveyer, Screw conveyer, pneumatic conveying.

Text Books:
2. ‘Introduction to Chemical Engg.’, Badger & Banchero, McGraw Hill.

Reference Books:
1. ‘Unit operations’, Brown et al., John Wiley sons.
2. ‘Principles of unit operations’, A.S. Froust et. al., John Wiley and Sons.

Course Outcome:
1. After completion of the course students will be able to apply unit operations in chemical engineering as well as biotech engineering.
2. Students will be able to apply knowledge in bioprocess, industrial biotech, downstream processing etc.
Chhattisgarh Swami Vivekanand Technical University, Bhilai, (C.G)

Name of program: Bachelors of Engineering  
Branch: Biotechnology  
Subject: Immunotechnology  
Semester: VII  
Code: 318732(18)

<table>
<thead>
<tr>
<th>Total Theory Periods:</th>
<th>40</th>
<th>Total Tut Periods:</th>
<th>10</th>
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</thead>
<tbody>
<tr>
<td>Class test:</td>
<td>Two (Minimum)</td>
<td>Assignments:</td>
<td>Two (Minimum)</td>
</tr>
<tr>
<td>ESE Duration:</td>
<td>Three Hours</td>
<td>Maximum Marks:</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Minimum Marks:</td>
<td>28</td>
</tr>
</tbody>
</table>

Course Objectives:

1. To impart knowledge on the basic principles of applied immunology.
2. To educate the students the basic techniques related to immunotechnology.

UNIT I  
**Cytokines:** Properties of cytokines, Cytokine family, Cytokine related diseases; Immune responses to infectious diseases: Viral Infections, Bacterial Infections, Protozoan Diseases, Diseases Caused by Parasitic Worms (Helminthes), Emerging Infectious Diseases.

UNIT II  
**Organ Transplantation:** Immunologic Basis of Graft Rejection, Clinical Manifestations of Graft Rejection, General Immunosuppressive Therapy, Specific Immunosuppressive Therapy, Immune Tolerance to Allograft, Clinical Transplantation.

**Vaccines:** Active and Passive Immunization, Designing Vaccines for Active Immunization, Whole-Organism Vaccines, Purified Macromolecules as Vaccines, Recombinant-Vector Vaccines, DNA Vaccines, Multivalent Subunit Vaccines.

UNIT III  
**Cancer and the immune system:** Origin and Terminology Malignant Transformation of Cells Oncogenes and Cancer Induction Tumors of the Immune System, Tumor Antigens, Immune Response to Tumors, Tumor Evasion of the Immune System Cancer Immunotherapy.

UNIT IV  
Antigen-Antibody interaction: affinity, cross reactivity, specificity, epitope mapping; Immuno assays: RIA, ELISA, Western blotting, ELISPOT assay, immunofluorescence, Agglutination and Precipitation reaction; CD nomenclature, Identification of immune Cells; Principle of Immunofluorescence Microscopy, Fluorochromes; Staining techniques for live cell imaging and fixed cells; Flow cytometry: Instrumentation and applications.

UNIT V  

Text Books:


Reference Books:

1. Fundamentals of Immunology, W. Paul, Lippincott Williams and Wilkins.
3. Immunology: A Short Course, E. Benjamin, R. Coico and G. Sunshine, Wiley- Leiss Inc.
4. Immunology, Roitt, Mosby – Yearbook Inc.

Course Outcome:

1. At the end of the course, students will have sufficient systematic and comprehensive knowledge about basics of Immunology which will help them relate to the different immunological processes taking place in the cell and how antigens trigger the immune system.
2. Knowledge of immunology will also help the students to understand diseases and course of treatment.
Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

Name of program: Bachelors of Engineering
Branch: Biotechnology
Subject: Stem Cell in Health Care
Semester: VII
Code: 318733(18)
Total Theory Periods: 40
Class test: Two (Minimum)
ESE Duration: Three hours
Total Tut Periods: Nil
Assignments: Two (Minimum)
Maximum Marks: 80 Minimum Marks: 28

Course Objectives:
1. To give the students a clear understanding about stem cell and their derivation and preservation
2. To enable them to apply its uses in therapy.

UNIT I
Introduction to stem cells, Classification, Sources, Potency, Induction of pluripotency; Stem cell patterning and fate mapping of stem cells.

UNIT II
Embryonic development and embryonic stem cells; Cell cycle control and checkpoints; Blastocyst culture, Feeder free culture, Xenofree derivation; Cryopreservation, Cord blood banking,

UNIT III
Stem cell and their differentiation; Primodial germ cells, Male germline; Trophoblat stem cells; Embryonal carcinoma cells as embryonic stem cells.

UNIT IV
Hematopoiesis and Hematopoietic stem cells, Lymphoid cell differentiation and maturation, Neural stem cells, Hepatic stem cells, Pancreatic stem cells, Epidermal stem cells, Hemangioblast, Mesenchymal stem cells in human adult bone marrow, Injury repair, Bone Regeneration.

UNIT V
Therapeutic cloning, Somatic Cell Nuclear Transfer, IVF, Stem cell transplantation; Ethical considerations, religious consideration; Pre- clinical regulatory consideration and patient advocacy stem cell preservation and banking.

Text Books:
2. Developmental Biology, Scott F. Gilbert (1997), Sinauer Associates

Reference Books:
5. Hematology, William J. Williams, Ernest Beutler, Allan JU. Erslev, Marshall A., Lichtman
6. Molecular Biology of the Cell, 3rd ed, Bruce Alberts,

Course Outcome:
1. The course will help the students to spread awareness about preservation of stem cells via cord blood banking and germ cell preservation in the society.
2. This will also enlighten them with various therapeutic interventions and innovative ideas towards many medical conditions, transplantation etc.
Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

Name of program: Bachelors of Engineering
Branch: Biotechnology
Subject: Pharmaceutical Biotechnology
Total Theory Periods: 30
Class test: Two (Minimum)
ESE Duration: Three hours

SEMESTER VII

Course Objectives:
1. To impart knowledge on the basic principles of pharmaceutical science and Biotechnology.
2. To make the students conversant with different technique fermentation, r-DNA, and gene therapy and how biotechnological technique are applicable in Pharmaceutical science especially in drugs discovery and production.

UNIT I
Historical prospective of Pharmaceutical biotechnology, biotechnology and industry; GMP Compliance and biopharmaceutical facilities; Introduction to different dosage forms and formulations;

UNIT II
Pharmacology; Dose determination; Route of drug administration; ADME of drugs.

UNIT III
Current trends in Vaccines; Microbial transformation for production of important pharmaceuticals like steroids etc; Brief description of r-DNA technology;

UNIT IV
Production of Pharmaceuticals: through fermentation technology, genetically engineered cells (some novel proteins, hormones, and interferon), production of antibiotics (penicillin, tetracycline and streptomycin).

UNIT V
Drug discovery and development; Principles of targeted drug delivery system; Delivery consideration of biotechnological products: delivery methods of peptides and proteins and related barriers; Drug delivery system in gene therapy.

Text Books:
2. Essentials of medical pharmacology, K.D. Tripathi, JAYPEE publications.

Reference Books:
2. Industrial microbiology, L.E. Casida JR, New age International (P) limited publication.
3. Introduction to Biopharmaceutics and pharmacokinetics, Dr. H.P. Tipnis, Nirali Prakashan Publications.

Course Outcome:
1. At the end of the course, students will have sufficient systematic and comprehensive knowledge about drug, dosage form, formulation, pharmaceutical science and biotechnology originated medicines and their important application.
2. Knowledge about drugs will also help the student to understand different drug delivery systems and their effect.
Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

Name of program: Bachelors of Engineering  
Branch: Biotechnology  
Subject: Oncology  
Total Theory Periods: 40  
Class test: Two (Minimum)  
ESE Duration: Three hours  
Total Tut Periods: NIL  
Assignments: Two (Minimum)

Name:  
Semester: VII  
Code: 318741(18)

Course Objectives:
1. To make them understand the basic cellular and molecular biology of cancer.
2. To make the students aware of causes of cancer and give them knowledge of diagnosis and therapy.

UNIT I  
Cancer: definition, hallmarks of cancer: description; Molecular and cell biology of cancer; Types of cancers.

UNIT II  
Cell cycle: regulation and checkpoints; Tumor suppressor genes and oncogenes; Signal transduction: receptors and pathways; Cancer and stem cells.

UNIT III  
Causes of cancer: genetics, diet, mutagens and their mode of action, viruses; tumor-immune system interaction.

UNIT IV  
Organ specificity and associated genes; Detection, characterization and identification; Staging and grading, diagnosis.

UNIT V  
Therapy: surgery, chemotherapy, radiotherapy, hormone therapy, antioxidant treatment, gene targeted therapy, drug resistance, cancer prevention, stem cell therapy, vaccines and Hybridoma technology.

Text Books:

Reference Books:
4. Harrison's Principles Of Internal Medicine 17thed, Anthony S. Fauci, Dennis L. Kasper, Eugene Braunwald , Mecraw-Hill Companies, Inc

Course Outcome:
1. The course will help the students to be aware of causes of cancer and spread awareness in the society.
2. This will also enlighten them with various therapeutic interventions and innovative ideas towards cancer research.
Chhattisgarh Swami Vivekanand Technical University, Bilai (C.G.)

Name of program: **Bachelors of Engineering**  
Branch: Biotechnology  
Subject: Drug Design and Drug Delivery  
Total Theory Periods: 40  
Class test: Two (Minimum)  
ESE Duration: Three hours  

Semester: VII  
Code: 318742(18)  
Assignments: Two (Minimum)  

Total Tut Periods:  
Marks: 80  
Minimum Marks: 28

**Course Objectives:**

1. To explain about the concept of drug delivery system and function and basics of formulation methods  
2. To integrate the dynamic discipline of modern drug delivery system in various fields like Pharmaceutical Biotechnology, Recombinant Technology, Drug designing etc.

**UNIT I**  
**Introduction to properties of drugs:** Rationale of sustained/ controlled drug delivery; Pharmacokinetic properties of drug, Physicochemical Properties of drugs: activity of drug solutions; Osmotic properties of drug solutions; Ionization of drugs in solution.

**UNIT II**  
**Formulation Method:** Preparation and formulation of drug, suppositories, ointments, bases, emulsions, lotion, suspension; Prodrugs: definition and concept of the prodrug; types of polymers in CDD: biodegradable and natural polymers, their biocompatibility; Nano shells.

**UNIT III**  
**Drug stability:** Chemical decomposition of drug; Kinetics of decomposition in solution; Decomposition in the solid phase; Factors affecting drug stability.

**UNIT IV**  
**Drug Metabolism and Targeting:** Oxidation, reduction, hydrolysis, conjugation; Need for developing new drugs: procedure followed in drug designing and drug targeting; Molecular modification of lead compounds; Soft drugs; QSAR; Active site determination of enzymes; Design of enzyme inhibitors.

**UNIT V**  
**Drug Delivery system:** Conventional drug dosage form : Oral DDS, Mucosal DDS, Transdermal DDS, Parenteral DDS, Ocular DDS, Dental DDS; Sustained release drug dosage form; Controlled release rate programmed drug delivery system; Target release drug delivery system; Activation model of drug delivery system.

**Text Books:**


**Reference Books:**

2. Prodrugs, Topical and Ocular Drug Delivery, K. B. Sloan ed Marcel Dekker Inc.

**Course Outcome:**

1. The student will be able to understand the importance of drug delivery system in medicine and biotechnology.  
2. This will help to critically evaluate a delivery system with respect to research.
Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

Name of programs: Bachelors of Engineering
Branch: Biotechnology
Subject: Biofuel Technology

Course Objectives:
1. To impart knowledge about the biofuels and its sources
2. To make the students aware of energy conservation and its protection.

UNIT I Overview and introduction of Biofuels, Biofuel production; Energy, use & efficiency; Alternative sources of energy; Overview of bioenergy systems from resource, conversion technologies to final product; Bioenergy conversion technologies; Evaluation of current and future R&D needs; legal framework to support sustainable development and increased use of biofuels; government policies and programs with regard to biofuels and investment opportunities worldwide.

UNIT II Bioethanol and Biohydrogen Process Technology for Bioethanol production using Sugar; Starch and Lignocellulosic Feedstocks; Selection of micro-organisms and feedstock; Associated Unit Operations; Determination of Bioethanol yield; Recovery of Bioethanol; Recent Advances; Process Production of hydrogen from photosynthesis; production of hydrogen by fermentative bacteria.

UNIT III Production of Biodiesel: Aspects of Biodiesel Production: Sources and processing of biodiesel (fatty acid methyl ester); nature of lipids, especially fatty acids and triglycerides; Sources and characteristics of lipids for use as biodiesel feedstock and conversion of feedstock into biodiesel (transesterification); Use of vegetable oil and waste vegetable oil; Engineering, economics and environmental issues of biodiesel; Components and operation of a biodiesel processing system; Standards for biodiesel quality, use of biodiesel.

UNIT IV Biomethane, Formation of biomethane or biogas from landfill, energy crops, and manure; Hydrolysis; Anaerobic digestion; Methanogenesis (acetoclastic, hydrogenotrophic), rates of methane formation; One and two stage fermentation; Thermal depolymerization.


Text books:

Reference Books:

Course Outcome:
1. Students will be able to analyze the future prospects of biofuel.
2. Students will be able to apply the knowledge in production of biofuel and energy conservation.
Chhattisgarh Swami Vivekananda Technical University, Bhilai

Name of program: Bachelor of Engineering
Branch: Biotechnology     Semester: VII
Subject: Unit Operations Lab     Code: 318761(19)
Total Lab Periods: 36
Batch Size: 15
Maximum Marks: 40     Minimum Marks: 20

List of Experiments:
1. Determination of size distribution of a sample of particulate solid by sieve analysis and to evaluate the average particle diameter.
2. Determination of size distribution of a sample of particulate solid by sieve analysis and to evaluate the average particle diameter (by cumulative method).
3. Determination of size distribution of the product of laboratory rod mill.
4. Determination of size distribution of the product of laboratory ball mill.
5. To evaluate the overall effectiveness of given screen.
6. Determination of power required in size reduction and to evaluate the Rittinger’s constant in respect of laboratory rod mill and ball mill.
7. Determination of degree of mixing of a given binary solid system in Tumbler Mixer.
8. Determination of size distribution in a mass of fine solids by the method of decantation.
9. To study the settling characteristics of the given slurry.
10. Determination of power required for crushing in roll crusher.
11. Study of separation of two liquids in laboratory centrifuge.
12. Determination of filtration time required for a given slurry using filter press for constant rate filtration.
13. Determination of the size of a Thickener for given slurry.
15. Study the separation efficiency of a cyclone separator.

Requirements:
1. Ball Mill
2. Rod Mill
3. Pot Mill
4. Roll Crusher
5. Centrifuge

Recommended Books:
2. Introduction to Chemical Engineering, 1st ed Badger &Banchero, McGraw Hill.
List of experiments

1. Perform Widal test by slide agglutination.
2. Perform Widal test by using tube agglutination method.
3. Perform Rocket electrophoresis to quantitate antigen concentration.
4. Perform slide agglutination for detection of Syphilis.
5. Perform counter current immunoelctrophoresis.
6. Purification of immunoglobulin from blood serum by column chromatography.
7. Antibody labeling.
8. Separation of blood protein by paper electrophoresis.
9. Separation of blood proteins by SDS-PAGE.
10. Indirect ELISA (Antibody capture ELISA).

Requirements:

1. pH meter
2. Colorimeter
3. Water bath
4. Balance (500 g – 0.1 g)
5. Balance (200g - 0.1 mg)
6. Table top Centrifuge
7. Microfuge
8. Micropipettes 200 μl – 1000 μl, 20 μl - 200 μl; 1 μl – 20 μl
9. Hot air Oven
10. UV – Vis spectrometer
11. Vortex shaker
12. Magnetic Stirrer
13. Electrophoresis equipment

Reference:

2. Refer to theory books as required.
Name of program: **Bachelor of Engineering**  
Branch: **Pharmaceutical Biotechnology Lab**  
Code: **318763(18)**  
Total Lab Periods: **36**  
Maximum Marks: **40**  
Batch Size: **15**  
Minimum Marks: **20**  

**List of Experiments:**

1. Preparation of simple syrup and medicated syrup.
2. Preparation of compressed tablets.
3. Preparation of mouth washes and gargles.
4. Preparation of lotion, vanishing cream and vanishing cream.
5. Preparation of liposome.
6. Preparation of non staining iodine ointment.
7. Preparation of pastes.
8. Production of antibiotics through fermentation.
9. Study the technique of gene therapy.
10. Study the different types of vaccines.

**Requirements:**

1. Soxhlet distillatory
2. Fermenter
3. Heating mantel

**Reference Books:**