

Chhattisgarh Swami Vivekanand Technical University, Bhilai

SCHEME OF TEACHING & EXAMINATION VIII Sem BIOTECHNOLOGY

S.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	318731(19)	Unit Operation	4	1	-	80	20	20	120	5
2	Biotechnology	318732(18)	Immunotechnology	4	1	-	80	20	20	120	5
3	Biotechnology	318733(18)	Stem Cell in Health Care	4		-	80	20	20	120	4
4	Biotechnology	318734(18)	Pharmaceutical Biotechnology	3	1	-	80	20	20	120	4
5	Refer Table II		Professional Elective-II	4		-	80	20	20	120	4
6	Chemical Engineering	318761(19)	Unit Operation Lab	4	1	3	80	20	20	120	5
7	Biotechnology	318762(18)	Immunotechnology Lab	-	-	3	40	-	20	60	2
8	Biotechnology	318763(18)	Pharmaceutical Biotechnology Lab	-	-	3	40	-	20	60	2
9	Biotechnology	318764(18)	Minor Project	-	-	3	40	-	20	60	2
10	Management	318765(76)	Innovative and Entrepreneurial Skills	-	-	2	40	-	20	60	1
11	Humanities	318766(46)	Practical Training Evaluation / Library	-	-	2	-	-	40	40	1
			Total	23	4	16	640	120	240	1000	35

L: Lecture, T: Tutorial, P: Practical, ESE: End Semester Exam, CT: Class Test, TA: Teachers Assessment
 Note: Duration of all theory papers will be of Three Hours.

Professional Elective Table II

S.No	Board of Studies	Subject Code	Subject
1	Biotechnology	318741(18)	Oncology
2	Biotechnology	318742(18)	Drug Design and Drug Delivery
3	Biotechnology	318743(18)	Biofuel technology

Chhattisgarh Swami Vivekananda Technical University, Bilai

Name of program: **Bachelor of Engineering**
Branch: **Biotechnology** Semester: **VII**
Subject: **Unit Operations** 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 IV** Sedimentation: settling velocity, flocculation, Thickener, Thickener Design, Classifier. Filtration, filter media, filter aids, batch & continuous filtration, filtration equipment, filter press, leaf, cartridge, vacuum filter, rotary drum filters.
- UNIT V** Conveyers: Belt conveyer, Bucket Elevator, Flight conveyer, Apron conveyer, Screw conveyer, pneumatic conveying.

Text Books:

1. 'Unit Operations of Chem. Engg.' 5th ed. W. L. McCabe, J. C. Smith & Peter Harriott, McGraw Hill Pub.
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)**

Total Theory Periods: **40**

Total Tut Periods: **10**

Class test: **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 applied immunology.

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, Flurochromes; Staining techniques for live cell imaging and fixed cells; Flow cytometry: Instrumentation and applications.

UNIT V Experimental Animal Models, Cell-Culture Systems, Immunocapture polymerase chain reaction, Immunoaffinity chromatography, Antibody-based biosensors; Therapeutic antibodies: future uses of antibody technology; Microarrays: An Approach for Analyzing Patterns of Gene Expression.

Text Books:

1. Basic Immunology, A.K. Abbas and A.H. Lichtman, Saunders W.B. Company.
2. Essentials of immunology, (2004), Dr S.K Gupta, Arya Publications.

Reference Books:

1. Fundamentals of Immunology, W. Paul, Lippincott Williams and Wilkins.
2. Principles and techniques of Biochemistry and Molecular Biology- Wilson and Walker – Cambridge University Press.
3. Immunology: A Short Course, E. Benjamin, R. Coico and G. Sunshine, Wiley- Leiss Inc.
4. Immunology, Roitt, Mosby – Yearbook Inc.
5. Kuby Immunology, R.A. Goldsby, T.J. Kindt, and B.A. Osborne.

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 particular diseases.

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

Name of program: **Bachelors of Engineering**
Branch: **Biotechnology** Semester: **VII**
Subject: **Stem Cell in Health Care** Code: **318733(18)**
Total Theory Periods: **40** Total Tut Periods: Nil
Class test: **Two (Minimum)** Assignments: **Two (Minimum)**
ESE Duration: **Three hours** 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.
- UNITII** Embryonic development and embryonic stem cells; Cell cycle control and checkpoints; Blastocyst culture, Feeder free culture, Xenofree derivation; Cryopreservation, Cord blood banking,
- UNITIII** Stem cell and their differentiation; Primordial germ cells, Male germline; Trophoblast 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:

1. Essential of Stem Cell Biology, 2nd ed (2000) Robert Lanja, Academic Press.
2. Developmental Biology, Scott F. Gilbert (1997), Sinauer Associates

Reference Books:

1. Human Embryonic Stem Cells: An Introduction to the Science and Therapeutic Potential (2003) Ann A.Kiessling, Jones and Bartett.
2. Stem Cell Biology and Gene Therapy, 1st ed (1998) Peter J.Quesenberry, Willy-Less.
3. Stem cell Transplantation Biology Processes Therapy, (2006) A.D.Ho., R.Hoffiman, Willy-VCH.
4. Stem Cells (2006) C.S.Potten, Elsevier,
5. Hematology, William J. Williams, Ernest Beutler, Allan JU. Erslev, Marshall A., Lichtman
6. Molecular Biology of the Cell, 3rd ed, Bruce Alberts,
7. Stem Cell Biology (2001) Marshak, Cold Spring Harbar Symposium.
8. Signaling Networks and Cell Cycle Control (2000) J. Silvio Gutkind. Humana Press.

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, Bilai (C.G.)

Name of program: **Bachelors of Engineering**
Branch: **Biotechnology** Semester: **VII**
Subject: **Pharmaceutical Biotechnology** Code: **318734(18)**
Total Theory Periods: **30** Total Tut Periods: **10**
Class test: **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 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

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 II 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:

1. Pharmaceutical Biotechnology, S.P. Vyas and V. K. Dixit, CBS publication and Distribution.
2. Essentials of medical pharmacology, K.D. Tripathi, JAYPEE publications.

Reference Books:

1. Pharmaceutical Microbiology, 7th ed, Hugo Russell's Black Well Publication.
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.
4. Essentials of Pharmacotherapeutics, F.S.K. Barar, S. Chand Publication.
5. Text book of industrial pharmacy by S R Hiremath, Orient Black Swan publication.

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**

Semester: **VII**

Subject: **Oncology** Code: **318741(18)**

Total Theory Periods: **40**

Total Tut Periods: **NIL**

Class test: **Two (Minimum)**

Assignments: **Two (Minimum)**

ESE Duration: **Three hours**

Maximum Marks: **80**

Minimum Marks: **28**

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:

1. Genetic basis of Cancer^{1st} ed (2003) C.B.Powar, Himalaya Publishing House.
2. Introduction to Cancer Biology (2010) Momna Hejmadi and Ventus Publishing Aps,

Reference Books:

1. Signaling Networks and Cell Cycle Control (2000) J. Silvio Gutkind. Humana Press.
2. Cancer biology (2002) Raymond w Jim Cassidy, Donald Bissett, Roy AJ Spence OBE, Oxford University Press,
3. Tumor immunology and cancer vaccines (2005) Samir n. Khleif, Steven T. Rosen, by Kluwer Academic Publishers
4. Harrison's Principles Of Internal Medicine 17thed, Anthony S. Fauci, Dennis L. Kasper, Eugene Braunwald , Mcgraw-Hill Companies, Inc
5. Robbin's Basic Pathology 8th ed (2007) Kumar Abbas Fausto and Mitchell ed, Elsevier 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, Bhilai (C.G.)

Name of program: **Bachelors of Engineering**

Branch: **Biotechnology**

Semester: **VII**

Subject: **Drug Design and Drug Delivery**

Code: **318742(18)**

Total Theory Periods: **40**

Total Tut Periods:

Class test: **Two (Minimum)**

Assignments: **Two (Minimum)**

ESE Duration: **Three hours**

Maximum 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:

1. Physicochemical Principles of Pharmacy, A.T. Florence and D. Attwood, Macmillan Press Ltd, England.
2. Pharmaceutical Dosages Forms and Drug Delivery Systems, 6th ed, H. C. Ansel, N. G. Popovich and L. V. Allen, Williams & Wilkins.

Reference Books:

1. A Textbook of Drug Design and Development, 2nd ed, Harwood Academic Publishes.
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**

Total Theory Periods: **40**

Class test: **Two (Minimum)**

ESE Duration: **Three hours Maximum Marks: 80 Minimum Marks: 28**

Semester: **VII**

Code: **318743(18)**

Total Tut Periods: **NIL**

Assignments: **Two (Minimum)**

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. .

UNIT V Microbial Fuel Cells: Biochemical Basis; Fuel Cell Design: Anode & Cathode Compartment, Microbial Cultures; MFC Performance Methods: Substrate, & Biomass Measurements, Basic Power Calculations: Power Density, Single-Chamber vs Two-Chamber Designs; Wastewater Treatment Effectiveness.

Text books:

1. Biofuels Engineering Process Technology (2007) Caye M. Drapcho, N.P. Nhuan and T. H. Walker. Mc Graw Hill Publishers, New York.
2. Biofuels – Methods and Protocols (Methods in Molecular Biology Series) (2007) Jonathan R.M, Humana Press, New York.

Reference Books:

1. Biofuels Advances in Biochemical Engineering/Biotechnology Series (2007) , Lisbeth Olsson ed, Springer-Verlag Publishers, Berlin.

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.
14. Study of Conveyors.
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:

1. Unit Operations of Chemical Engineering, 5th ed McCabe W. L., Smith J. C. & Harriott Peter, McGraw Hill Publication.
2. Introduction to Chemical Engineering, 1st ed Badger & Banchoff, McGraw Hill.

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

Name of program: **Bachelor of Engineering**

Branch: **Biotechnology**

Subject: **Immunotechnology Lab**

Total Lab Periods: **3 6**

Maximum Marks: **40**

Semester: **VII**

Code:**318762(18)**

Batch Size: **15**

Minimum Marks: **20**

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 immunoelectrophoresis.
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:

1. An Introduction to Practical Biotechnology, 1st ed, (2006), S. Harisha, Laxmi Publications (P) Ltd. New Delhi.
2. Refer to theory books as required.

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

Name of program: **Bachelor of Engineering**
Branch: **Pharmaceutical Biotechnology Lab**
Total Lab Periods: **3 6**
Maximum Marks: **40**

Code:**318763(18)**

Batch Size: **15**
Minimum Marks: **20**

List of Experiments:

1. 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:

1. Pharmaceutical Biotechnology, S.P. Vyas and V. K. Dixit, CBS publication and Distribution.
2. Pharmaceutics-I, A.K.Gupta and V.K.Jain, CBS Publishers and Distributers, New Delhi.