Chhattisgarh Swami Vivekananda Technical University, Newai

Name of the Program: Bachelor of Technology
Semester: B.Tech – 4th **Branch: Biotechnology**
Subject: Bioprocess Engineering **Course Code: B018411(018)**
Total Marks in End Semester Exam: 100 **L: 3 T: 1 P: 0 Credits: 4**
Minimum number of Class Tests: 2

Course Objective(s):

- The Course Objective is to provide basic concepts of bioprocess engineering to the students.
- They will learn engineering principles that can be applied to processes involving cell or enzyme catalysts with applications in the industry.
- The students will learn the basics of bioreactor design and operation control that have been Applied to a variety of bioprocess industries.
- The objective of the course is to apply the principles of biochemical engineering in large scale cultivation of microorganism for production of important products.
- To apply the practical aspects of Industrial Biotechnology using bioprocessing.

UNIT-I Growth Kinetics

- Microbial growth kinetics, substrate utilization, and product formation kinetics, stoichiometry.
- Principles of enzyme catalysis, enzyme kinetics, immobilized enzymes.

UNIT-II Bioreactors

- Bioreactors- batch, fed-batch or continuous bioreactors, Immobilized cell systems.
- Solid-state fermentations, energy balance and mass transfer.
- Operation and control of bioreactors (aeration, agitation, heat transfer, scale-up and scale-down).

UNIT-III Raw Materials

- Raw material: availability, quality, processing and pretreatment of raw material.

UNIT-IV Induction of Microbes and Regulatory Mechanism

- Induction of microbes and regulatory mechanisms; Nutritional repression, carbon catabolite repression.
- Feedback inhibition and feedback repression.

UNIT-VIndustrial Application

- Bioprocesses for the production of antibiotics, proteins, polysaccharides, aroma etc.
- Instrumentation and monitoring, sterilization, process modeling, downstream processing.
- Plant/mammalian cell culture reactors, examples of industrial bioprocesses.

Text Books:

1. Michael Shuler, FikretKargi, Matthew DeLisa, Bioprocess Engineering: Basic Concepts, 3rd Edition
2. Pauline Doran, Bioprocess engineering principles
3. Colin Ratledge, Bjorn Kristiansen, Basic Biotechnology, 2nd Edition, Cambridge University Press, 2001.

Reference Books:

1. Roger Harrison et al., Bio separations Science and Engineering, Oxford University Press, 2003.
2. Bioreaction Engineering, Bioprocess Monitoring (Bioreaction Engineering) by KarlSchügerl.

Course Outcome:

After completion of course, student should be able to

- Learn the basics of bioprocess engineering.
- Understand the principle, design, and operation control of various types of bioreactors and their scale-up strategies.

Chhattisgarh Swami Vivekananda Technical University, Newai

Name of the Program: Bachelor of Technology
Semester: B.Tech – 4th **Branch: Biotechnology**
Subject: Immunology and Immunotechnology **Course Code: B018412(018)**
Total Marks in End Semester Exam: 100 **L: 3 T: 1 P: 0 Credits: 4**
Minimum number of Class Tests: 2

Course Objective(s):

- This course will introduce the students with basic principles of immunology.
- It also introduces the recent advancement in the field of adaptive immunity.
- To impact knowledge of antibody engineering in medical application and importance of immunogenetics.
- To make the student understand the mechanism of diseases development and its management in the body.
- To make them understand career development, its spread, genes responsible and importance of immune system in the body.

UNIT-I Overview of Immune System

- Overview of the immune system- Historical perspective, Innate and adaptive immunity, Hematopoiesis.
- Cells and organs of the immune system- Lymphoid cells: T cells & B cells, monocytes, phagocytes, mast cells and basophils
- Primary and secondary lymphoid organs; Interplay between cells.

UNIT-II Immune Checkpoints

- Immune checkpoints: PD1, CTLA4, TIM3 etc.
- Design of recombinant antibodies, Commercial production of polyclonal and monoclonal antibodies, Antibodies in diagnostics.
- Immuno-therapy in cancer, checkpoint therapy, Vaccine production, Plantimmunology.

UNIT-III Organ Transplantation and Vaccine

- 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-IV Immunological Techniques

- Immunological techniques: Immuno-diffusion assay, ELISA, Immuno-blotting, ELISPOT assay
- Immuno-Histochemistry, Flow Cytometry, FACS sorting, Immuno-precipitation.

UNIT-V Experimental Animal Models

- 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. Immunology introduction text book, 2nded (2005), NandiniShetty, new age international private Ltdpublishers.
3. Kuby Immunology by Thomas J. Kindt, Barbara A. Osborne, Richard Goldsby.

Reference Books:

1. Fundamentals of Immunology, W. Paul, Lippincott Williams and Wilkins
2. Immunology, W.L. Anderson, Fence Creek Publishing (Blackwell).
3. Immunology: A Short Course, E. Benjamin, R. Coico and G. Sunshine, Wiley-Leiss Inc.

Course Outcome:

After completion of course, student should be able to

- Gain knowledge about the immune system, cell types and its pathway. They will understand the role of the immune system in disease conditions.
- Gain knowledge about the generation of antibodies and the use of antibodies in analytics, diagnostics and therapy.

Chhattisgarh Swami Vivekananda Technical University, Newai

Name of the Program: Bachelor of Technology **Semester: B.Tech – 4th**
Branch: Biotechnology
Subject: Recombinant DNA Technology **Course Code: B018413(018)**
Total Marks in End Semester Exam: 100 **L: 3 T: 1 P: 0 Credits: 4**
Minimum number of Class Tests: 2

Course Objective(s):

- To make the students well acquainted with emerging field of Recombinant DNA technology, concepts, its applications and expertise in wet lab techniques in genetic engineering.
- It is intended to impart basic undergraduate-level knowledge inthe area of recombinant DNA technology.
- The student would be able to understand the working details of the cloning of a gene.
- They would also be able to assimilate recent research findings, advancement and development in the relevant subject.
- The use of virtual lab and computational tools would enable them to perform insilico cloning of the selected DNA.

UNIT-I Introduction

- 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 Vector

- Vectors: phage vector- M13, λ, phagemids, cosmids.
- Artificial chromosomes: BAC, YAC, MAC, Shuttle vector.
- Bacteriophage and other viral vectors.

UNIT-III Gene Cloning

- 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

- 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

- 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, Old & Primrose, (2001) Blackwell Scientific Publ.
2. Molecular Cloning, Sambrooket., 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, SmitaRastogi, Oxford University Press India.

Course Outcome:

After completion of course, student should be able to

- Gain knowledge about the use and applications ofrecombinant DNA technology in different sectors like health, agriculture, and theenvironment.
- Gain knowledge about the safety and ethical use of rDNAtechnology.

Chhattisgarh Swami Vivekananda Technical University, Newai

Name of the Program: Bachelor of Technology
Semester: B.Tech – 4th **Branch: Biotechnology**
Subject: Bioinformatics and Computational Biology **Course Code: B018414(018)**
Total Marks in End Semester Exam: 100 **L: 2 T: 1 P: Credits: 3**
Minimum number of Class Tests: 2

Course Objective(s):

- This course is beneficial for students to understand the principlesof analyzing biological data, building models and testing hypotheses using computerscience algorithms.
- It will also introduce information technology practices in the field ofbiotechnology.
- The course will provide a basic overview of various informationrepositories widely used in biological sciences; and tools for searching or querying thosedatabases.
- This course will build the foundation of sequence alignment techniques andfind evolutionary connections.
- It will help students to analyze mRNA expression data andgene annotations.

UNIT-I General Introduction

- To study bioinformatics and its applications.
- Biological databases and tools: Nucleotide sequence databases, Protein sequence, structural and functional databases, Patent database, in silico tools for rDNA technology.
- Database searching: BLAST and its types, Entrez, Ensembl-Biomart.

UNIT-II Sequence Alignment

- Pairwise Sequence alignment: Pairwise alignment, Dynamic programing, ScoringMatrices, Gaps.
- Multiple sequence alignment: Dynamic and heuristic methods, Relevance to inferencesabout evolution, introduction to molecular phylogeny.

UNIT-III Phylogenetic Analysis

- Phylogenetic analysis: Introduction, Types of Phylogenetic Trees, Methods and Applications, Bootstrap.
- Genome informatics: Genome sequencing technologies and analysis methods; transcription factor regulation and motif finding.

UNIT-IV Computational Epigenetics

- Computational Epigenetics: Epigenetics and its role in transcription regulation, development, and diseases.
- Genomic variations and its associations: Linking genes, variations and diseases.
- Introduction to biomarkers and personalized medicine.
- Network biology and human diseases: Genome-wide association studies of human diseases, Genome editing tools and applications to human diseases.

UNIT-V Machine Learning

- Machine learning: Classification, Regression, SVM, Decision Trees, Artificial Neural Networks, Big Data in Biology.
- Molecular modeling (Homology and Ab initio) and validation (Pro check, verify 3D etc). Docking, Molecular dynamics.
- Energy calculations, Classical and semi-classical calculations, Quantum mechanical approaches.

Text Books:

1. Jonathan Pevsner. Bioinformatics and Functional Genomics, 2nd Edition. ISBN: 978-0 470-08585-1.
2. Greg Gibson and Spencer V. Muse. A Primer of Genome Science, Third Edition. ISBN:978-0-87893-309-9.
3. Essential Bioinformatics, Jin Xiong, Cambridge University Press; 1st edition 2006.

Reference Books:

1. Bioinformatics: methods and applications, S. C. Rastogi, PHI learning; 4th edition, 2013.
2. The Dictionary of Genomics, Transcriptomics and Proteomics, Günter Kahl, WilleyVCH, 2015.

Course Outcome:

After completion of course, student should be able to

- Perform computational analyses of biological sequences, genome-wide studies and relate the results to core principles of biology; use computational methods to help execute a biological research plan.
- Browse or retrieve gene, protein sequences and related information from biological databases; learn to align sequences using dot matrices, dynamic programming and heuristic approach.

Chhattisgarh Swami Vivekananda Technical University, Newai

Name of the Program: Bachelor of Technology
Semester: B.Tech – 4th **Branch: Biotechnology**
Subject: Environmental Biotechnology **Course Code: B018415(018)**
Total Marks in End Semester Exam: 100 **L: 2 T: P: Credits: 2**
Minimum number of Class Tests: 2

Course Objective(s):

- Solve various engineering problems applying ecosystem to produce eco – friendlyproducts.
- Use relevant air and noise control method to solve domestic and industrial problems.
- Use relevant water and soil control method to solve domestic and industrial problems.
- To recognize relevant energy sources required for domestic and industrialapplications.
- Solve local solid and e-waste problems.

UNIT-I Ecosystem

- Structure of ecosystem, Biotic & Abiotic components.
- Food chain and food web.
- Aquatic (Lentic and Lotic) and terrestrial ecosystem.
- Carbon, Nitrogen, Sulphur, Phosphorus cycle.
- Global warming -Causes, effects, process, Green House Effect, Ozone depletion.

UNIT-II Air and Noise Pollution

- Definition of pollution and pollutant, Natural and man-made sources of airpollution (Refrigerants, I.C., Boiler).
- Air Pollutants: Types, Particulate Pollutants: Effects and control (Bag filter,Cyclone separator, Electrostatic Precipitator).
- Gaseous Pollution Control: Absorber, Catalytic Converter, Effects of air pollutiondue to Refrigerants, I.C., Boiler.
- Noise pollution: sources of pollution, measurement of pollution level, Effects ofNoise pollution, Noise pollution (Regulation and Control) Rules, 2000.

UNIT-III Water and Soil Pollution

- Sources of water pollution, Types of water pollutants, Characteristics of water pollutants Turbidity, pH, total suspended solids, total solids BOD and COD:Definition, calculation.
- Wastewater Treatment: Primary methods: sedimentation, froth floatation, Secondary methods: Activated sludge treatment, Trickling filter, Bioreactor, Tertiary Method: Membrane separation technology, RO (reverse osmosis).
- Causes, Effects and Preventive measures of Soil Pollution: Causes-Excessive use of Fertilizers, Pesticides and Insecticides, Irrigation, E-Waste.

UNIT-IV Renewable Energy Source

- Solar Energy: Basics of Solar energy. Flat plate collector (Liquid & Air). Theory of flat plate collector. Importance of coating. Advanced collector. Solar pond. Solar water heater, solar dryer. Solar stills.

- Biomass: Overview of biomass as an energy source. Thermal characteristics of biomass as fuel. Anaerobic digestion. Biogas production mechanism. Utilization and storage of biogas.
- Wind energy: Current status and future prospects of wind energy. Wind energy in India. Environmental benefits and problem of wind energy.
- New Energy Sources: Need of new sources. Different types of new energy sources. Applications of (Hydrogen energy, Ocean energy resources, Tidal energy conversion.) Concept, origin and power plants of geothermal energy.

UNIT-V Solid Waste Management, ISO 14000 & Environmental Management

- Bioremediation
- Solid waste generation- Sources and characteristics of: Municipal solid waste, Ewaste, biomedical waste.
- Metallic wastes and Non-Metallic wastes (lubricants, plastics, rubber) from industries. Collection and disposal: MSW (3R, principles, energy recovery, sanitary landfill), Hazardous waste.
- Air quality act 2004, air pollution control act 1981 and water pollution and controlact1996. Structure and role of Central and state pollution control board.
- Concept of Carbon Credit, Carbon Footprint.
- Environmental management in fabrication industry.
- ISO14000: Implementation in industries, Benefits.
- Environmental monitoring bio reporter, biomarker and biosensor Technology.

Text Books:

1. S.C. Sharma & M.P. Poonia, Environmental Studies, Khanna Publishing House, NewDelhi.
2. C.N. R. Rao, Understanding Chemistry, Universities Press (India) Pvt. Ltd., 2011.
3. Arceivala, Soli Asolekar, Shyam, Waste Water Treatment for Pollution Control andReuse, Mc-Graw Hill Education India Pvt. Ltd., New York, 2007, ISBN:978-07-062099-
4. Nazaroff, William, Cohen, Lisa, Environmental Engineering Science, Willy, New York,2000, ISBN 10: 0471144940.

Reference Books:

1. O.P. Gupta, Elements of Environmental Pollution Control, Khanna Publishing House,New Delhi
2. Rao, C. S., Environmental Pollution Control and Engineering, New Age InternationalPublication, 2007, ISBN: 81-224-1835-X.
3. Rao, M. N.Rao, H.V.N, Air Pollution, Tata Mc-Graw Hill Publication, New delhi, 1988,ISBN: 0-07- 451871-8.
4. Frank Kreith, Jan F. Kreider, Principles of Solar Engineering, McGraw-Hill, New York;1978, ISBN: 9780070354760.

Course Outcome:

After completion of course, student should be able to

- Understand the ecosystem and terminology and solve various engineering problems applying ecosystem knowledge to produce eco – friendly products.
- Understand the suitable air, water, soil, extent of noise pollution, and control measures and acts.

Chhattisgarh Swami Vivekanand Technical University, Newai

Name of the Program: Bachelor of Technology
Semester: B.Tech – 4th **Branch: Biotechnology**
Subject: Immunology and Immunotechnology (Lab) **Course Code: B018421(018)**
Total Marks in End Semester Exam: 40 **L: 0 T: 0 P: 2 Credits: 1**

List of Experiments:

1. Western blotting.
2. Isolation and microscopic visualization of T-cells and B-cells.
3. Use a commercially available immune diagnostic strip tests.
4. Immuno-precipitation of a protein from cell lysate using antibody.
5. Determination of binding affinity of antigen-antibody complex.
6. Demonstration of ELISA.
7. Demonstration of FACS.
8. Perform Rocket electrophoresis to quantitate antigen concentration.
9. Perform counter current immunoelectrophoresis.
10. Purification of immunoglobulin from blood serum by column chromatography.

Equipments/Machines/Instruments/Tools/Software Required:

- Microscope
- Balance (500 g – 0.1 g)
- Balance (200g - 0.1 mg)
- Table top Centrifuge
- Electrophoresis Chamber
- Column
- 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.KubyImmunology, Thomas J. Kindt, Barbara A. Osborne, Richard Goldsby.
2. Principles of Microbiology and Immunology, Harper and Row.
3. Introduction to Medical Immunology, Gabriel Virella.

Chhattisgarh Swami Vivekanand Technical University, Newai

Name of the Program: Bachelor of Technology
Semester: B.Tech – 4th **Branch: Biotechnology**
Subject: Bioinformatics and Computational Biology (Lab) **Course Code: B018422(018)**
Total Marks in End Semester Exam: 40 **L: 0 T: 0 P: 2 Credits: 1**

List of Experiments:

1. Accessing databases from NCBI.
2. Extracting protein and nucleotide sequences from NCBI.
3. Similarity search using BLAST.
4. Pairwise sequence alignment.
5. Multiple sequence alignment.
6. Conserved domain analysis.
7. Construction of Phylogenetic trees.
8. Identifying various regions around genes using Genome browsers.
9. Browsing genetic variation databases such as dbSNP, ClinVar.
10. Basic machine learning using WEKA tool.

Resource

1. https://www.ncbi.nlm.nih.gov/
2. https://blast.ncbi.nlm.nih.gov/Blast.cgi
3. https://www.uniprot.org
4. http://www.ensembl.org
5. https://www.cs.waikato.ac.nz/ml/weka/
6. https://www.genome.jp/tools-bin/clustalw
7. https://www.ebi.ac.uk/Tools/msa/clustalo/
8. https://genome.ucsc.edu/
9. https://www.ncbi.nlm.nih.gov/snp/
10. https://www.ncbi.nlm.nih.gov/clinvar/
11. https://swissmodel.expasy.org/
12. https://npsa-prabi.ibcp.fr/cgi-bin/npsa_automat.pl?page=/NPSA/npsa_sopma.html
13. http://pearl.cs.pusan.ac.kr/phylodraw/

Chhattisgarh Swami Vivekanand Technical University, Newai

Name of the Program: Bachelor of Technology
Semester: B.Tech – 4th **Branch: Biotechnology**
Subject: Recombinant DNA Technology (Lab) **Course Code: B018423(018)**
Total Marks in End Semester Exam: 40 **L: 0 T: 0 P: 2 Credits: 1**

List of Experiments:

1. Isolation of DNA from Plant Cell by CTAB method.
2. Electrophoresis of DNA.
3. Estimation of DNA by Diphenyl method.
4. Isolation of RNA from yeast cell.
5. Preparation of competent cells,
6. Transformation of the selected plasmid (high copy number),
7. Isolation of the plasmid from bacterial culture (alkali lysis methods),
8. Restriction digestion of the plasmids and analysis using DNA gel and extraction ofPlasmid DNA from the gel using glass wool methods.
9. PCR amplification and ligation.
10. Selection of transformed E. coli and validation of cloning

Equipments/Machines/Instruments/Tools/Software Required:

- Microscope
- Mortar Pestle
- Balance (500 g – 0.1 g)
- Balance (200g - 0.1 mg)
- Table top Centrifuge
- Electrophoresis Chamber
- PCR
- Microfuge
- Micropipettes (200 µl – 1000 µl), (20 µl - 200 µl), (1 µl – 20 µl).
- Hot air Oven
- UV -Vis spectrometer
- Vortex shaker
- UV Transilluminator

Recommended Books:

1. Molecular Cloning By Sambrooket., 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 Vivekananda Technical University, Newai

Name of the Program: Bachelor of Technology
Semester: B.Tech – 4th **Branch: Biotechnology**
Subject: Virtual Lab **Course Code: B018424(018)**
Total Marks in End Semester Exam: 40 **L: 0 T: 0 P: 2 Credits:**
1Minimum number of Class Tests: 2

Course Objective(s):

- It is intended to impart basic undergraduate-level knowledge in the area of general Biological Techniques.
- Students would be able to understand the biochemical test of Microorganism and organism physiology.
- It augurs understanding the molecular techniques and the immunology techniques.
- To make the students conversant with structures of cell organelles and properties of Carbohydrates, proteins, lipids and nucleic acids.
- The virtual background of biochemical systems helps to interpret the results of laboratory experiments.

UNIT-I Microbiology Virtual Lab

- Voges-Proskauer test, Triple Sugar Iron Agar Test, Urease Test, Catalase and Coagulase Test, Bacterial Growth Curve, Motility Test.
- Differential and Cytological Staining Techniques, Slide Technique Culture for Fungi Antibiotic Susceptibility Testing.

UNIT-II Cell Biology Virtual Lab

- Isolation of Chloroplast, Isolation of Endoplasmic Reticulum, Cell Organization and Sub Cellular Structure Studies
- Basics of Plant Tissue Culture, Mitosis in Onion Root Tips.
- Lignin Staining, Cell Attachment, Maintenance of Mammalian Cell Line.

UNIT-III Biochemistry Virtual Lab

- Estimation of Blood Glucose by Glucose Oxidase Method.
- Qualitative Analysis of Carbohydrates, Qualitative Analysis of Amino Acid.
- Quantitative Estimation of Amino Acids by Ninhydrin.
- Isoelectric Precipitation of Proteins Casein from Milk.

UNIT-IV Immunology Virtual Lab

- Blood Grouping Experiment, Latex Agglutination.
- Purification of IgG Antibodies with Ammonium Sulphate.
- Purification of IgG Antibodies using Affinity Chromatography.
- Ouchterlony Double Diffusion –Titration, Ouchterlony Double Diffusion – Patterns.

UNIT-V Molecular Biology Virtual Lab

- Agarose Gel Electrophoresis (AGE), Extraction of DNA from Agarose gel.

- Plasmid Isolation, Restriction Digestion, Ligation, Preparation of Competent Cell.
- Transformation of the Host Cells, Electroblotting.
- Polyacrylamide Gel Electrophoresis, Polymerase Chain Reaction (PCR).

Text Books:

1. Lehninger's Principles of Biochemistry, David L. Nelson and Michael M. Cox, Macmillan Worth publisher.
2. Prescott's Microbiology, Willey, Sherwood and Woolverton.
3. Molecular Cell Biology, 8th edition (2016) by Harvey Lodish, Arnold Berk, Chris A. Kaiser, Monty Krieger, Anthony Bretscher, HiddePloegh, Angelika Amon and Kelsey C. Martin

Reference Books:

1. Experiments in Microbiology, Plant Pathology and Biotechnology, K. R. Aneja, New Age International.
2. Practical Microbiology- Principles and Techniques Vinita Kale and Kishore Bhusari.
3. http://mbvi-au.vlabs.ac.in/
4. Todd and Howards Mason – Text Book of Biochemistry (2004) 4th Edition.

Course Outcome:

After completion of course, student should be able to

- Understand biochemical assay of microorganism and comprehensive knowledge of biomolecules, Nucleic acid and Cell organelles.
- Good group of knowledge about the biochemical basis of cellular function, Immunological techniques and organism biochemistry.

Chhattisgarh Swami Vivekananda Technical University, Newai

Name of the Program: Bachelor of Technology
Semester: B.Tech – 4th **Branch: Biotechnology**
Subject: Indian Culture and Constitution of India **Course Code: B000406(046)**
Total Marks in End Semester Exam: **L: T: P: 2 Credits:**
Minimum number of Class Tests: 2

UNIT-I The Constitution - Introduction

- The History of the Making of the Indian Constitution
- Preamble and the Basic Structure, and its interpretation
- Fundamental Rights and Duties and their interpretation
- State Policy Principles

UNIT-II Union Government

- Structure of the Indian Union
- President – Role and Power
- Prime Minister and Council of Ministers
- LokSabha and RajyaSabha

UNIT-III State Government

- Governor – Role and Power
- Chief Minister and Council of Ministers
- State Secretariat

UNIT-IVLocal Administration

- District Administration
- Municipal Corporation
- ZilaPanchayat

UNIT-VElection Commission

- Role and Functioning
- Chief Election Commissioner
- State Election Commission

Text Books:

1. Ethics and Politics of the IndianConstitution, RajeevBhargava, Oxford University Press, NewDelhi, 2008.
2. The Constitution of India, B.L. Fadia, SahityaBhawan; New edition(2017).