

# **SCHEME**

**Bachelor of Science in Biotechnology (Hons.)**

**Faculty of Sciences**

**Department of Biotechnology**



**Study and Evaluation Scheme  
of**

**B.Sc. (Hons.) Biotechnology**

(Applicable w.e.f. Academic Session 2018 to till revised)

**Duration of Course: 03 year  
Mode of Examination: Semester**

**SWAMI VIVEKANAND  
UNIVERSITY, SIRONJA, SAGAR,  
(M.P.)**



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**BCS Chairman**

# **SCHEME**

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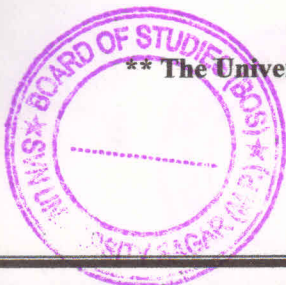
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## B.Sc. Biotechnology (Hons.)

### Course Contents (FIRST SEMESTER)

Paper Code	Course Title	Credits
BSCBT-101	FRONTIERS IN BIOTECHNOLOGY	4(3-1-0)

#### OBJECTIVE

To inculcate deep understanding of current frontier applications of biotechnology.

#### THEORY

##### Unit I

Artificial Seed- Definition, Techniques, factors affecting, applications limitations, Germplasm preservation- Introduction, principle, Long term storage, factors affecting, short/medium storage techniques, applications, limitations, GM Crops - Herbicide resistance, bacterial, fungal, virus, insect resistance, GM Foods, ethical and social aspects. Concept of Intellectual property right (IPR) and protection (IPP), patenting of Biological material. Molecular farming.

##### Unit II

Biofertilizers and Biopesticide: Biofertilizers – Definition, Principle, advantages. Mass production and field application – Rhizobium, Azotobacter, Azospirillum, Acetobacter, Azolla, Cyanobacteria, PSB, VAM. Green manure and compost, Biopesticide – Principles and applications of Bacterial, fungal, viral, Plant origin biopesticides.

##### Unit III

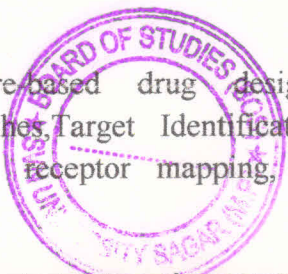
Application of r-DNA Technology: Production of transgenic-knockout mice. In medicines – Insulin and Somatostatin, Gene Silencing- Introduction, Principle of Si-RNA and Si-RNA technology, Modern DNA based molecular markers. Gene therapy: Types- Somatic, Germ line, Augmentation. Gene therapy strategies for cancer.

##### Unit IV

Forensic medicine: Preparation of DNA sample, Approaches of DNA analysis Public health: Epidemiology, Diagnosis of infectious diseases, Detection of genetic diseases, Diagnosis of cancer.

##### Unit V

Structure-based drug designing: Introduction, Structure-based drug designing approaches, Target Identification and Validation, homology modelling and protein folding, receptor mapping, active site analysis, pharmacophore mapping and Grid maps.



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## PRACTICAL EXERCISE\*

(\*Practicals are conducted as Biotechnology Lab with separate credits (02 credits))

1. Safety aspects and precautions to be taken in Biotechnology Laboratory.
2. Preparation of reagents, stock solutions and buffers for plant DNA isolation.
3. Study of Labware used for isolation of DNA.
4. Isolation of genomic DNA from plant tissues by CTAB method.
5. Purification of crude DNA samples.

## SUGGESTED READINGS

- *Practical Microbiology* by: K.R. Aneja
- *Gupta, P. K. (1996). Elements of Biotechnology, Rastogi and Co., Meerut.*
- *Henry, R. J. (1997). Practical Applications of Plant Molecular Biology,*
- *Pharmaceutical Biotechnology – S. P. Vyas, V. K. Dixit*
- *Biotchnology – B. D. Singh*
- *Fundamentals of agriculture biotechnology – S. S. Purohit*
- *Text Book of Biotechnology – Dr. H. K. Das*
- *Molecular Biotechnology – Principles and applications of Recombinant DNA : Glick*



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Paper Code	Course Title	Credits
BSCBT-102	BIO-INSTRUMENTATION	4(3-1-0)

## OBJECTIVE

The subject Instrumentation is designed for under graduate students of biotechnology for understanding of basic principle, techniques and applications of different instruments used in their laboratory for analytical and separation purpose

## THEORY

### Unit I

Centrifugation: Principle, Types of centrifugation, Analytical and Ultra centrifugation, Rotors and its types, Application of centrifugation.

### Unit II

Microscopy: history, principles and types. Bright field, dark field, phase contrast, fluorescent microscopy, scanning and transmission electron microscopy.

### Unit III

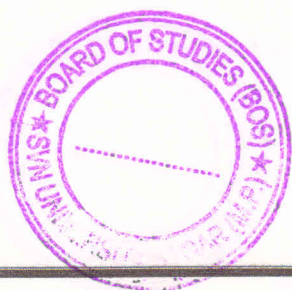
Chromatography: Principle, working and applications of partition, adsorption and affinity chromatography, Paper chromatography, thin layer chromatography, gel filtration chromatography, ion exchange chromatography

### Unit IV

Spectrum and their Types, wave length range of electromagnetic radiation. Spectroscopy: basic principle, principles and applications of colorimetry and visible spectroscopy, Principles and applications of Infrared and U.V. spectroscopy, Atomic absorption spectroscopy (AAS): principle and application. Principle and applications of NMR and ESR

### Unit V

Electrophoresis: principles, types and applications, Zonal electrophoresis: paper, PAGE, agarose gel electrophoresis, Radioactivity: principle of radioactive decay, half life, unit of measurement, Radioisotopes: applications in biological sciences, Scintillation counters: basic principle and types.



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## PRACTICAL EXERCISE\*

(\*Practicals are conducted as Biotechnology Lab with separate credits (02 credits))

1. To determine the isoelectric point of given sample
2. To separate the given amino acid mixture using TLC and identify the amino acids
3. To perform paper chromatography of amino acid mixture
4. To perform separation of sample by Radial Chromatography
5. To perform TLC by plant pigment sample
6. To identify the microorganisms in the given sample by light microscopy.
7. To perform paper chromatography of Plant pigment sample

## SUGGESTED READINGS

- Principles of Biochemistry by Nelson, Cox and Lehninger
- Biochemistry by G.Zubay
- Biochemistry by Stryer
- Biochemistry, DVoet and JG. Voet , J Wiley and Sons.



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Paper Code	Course Title	Credits
BSCBT-103	GENERAL MICROBIOLOGY	4(3-1-0)

## OBJECTIVE

Microbiology is the study of life forms too small to be seen with the naked eye, including Viruses, Bacteria, Archaea and Protists. The paper emphasizes on study of distribution, morphology, physiology and nutrition of microorganisms in addition to skills in aseptic procedures, isolation and identification and their classification.

## THEORY

### Unit I

History of Microbiology, Contributions of Antony Von Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister Alexander Fleming Role of microorganisms in fermentation, Germ theory of disease, Development of various microbiological techniques and golden era of microbiology.

### Unit II

Binomial Nomenclature, Whittaker's five kingdom and Carl Woese's threekingdom classification systems and their utilit. Difference between prokaryotic and eukaryotic microorganisms. General characteristics of different groups: Acellular microorganisms (Viruses, Viroids, Prions) and Cellular microorganisms (Bacteria, Algae, Fungi and Protozoa) with emphasis on distribution and occurrence, morphology, mode of reproduction and economic importance.

### Unit III

Pure culture isolation: Streaking, serial dilution and plating methods; cultivation, maintenance and preservation/stocking of pure cultures; cultivation of anaerobic bacteria, and accessing non-culturable bacteria. Enrichment culture technique, Detection of specific microorganisms - on XLD agar, Salmonella Shigella Agar, Manitol salt agar, EMB agar, McConkey Agar, Saboraud Agar. Microbial growth- mathematical expression of growth, growth curve, Factor affecting growth.

### Unit IV

Structure and diversity of Bacteria & Viruses. Microbes in Extreme Environments. Nutritional requirements of microbes. Bacteriology:- Morphology and ultra-structure of bacteriomorphological types, Archaeobacteria Structure Function of cell organelles.

### Unit V

Fundamentals of Microbial Control Principle and Types, Sterilization, Disinfectant, Antiseptic, Sanitizer, Germicidal and Bactericides. Characteristics Evaluation and Selection of Ideal antimicrobial agent. Physical Agents of Microbial Control:- High Temperature, Low temperature, Desiccation, Osmotic Pressure, Radiation, Ultraviolet lights, X- rays, Gamma rays, Cathode rays, surface tension and interfacial tension, filtration. Chemical Agents of





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Microbial Control:- Phenol and phenolic compound, Alcohol, Halogen, Heavy metals and their compounds, Dyes, Detergents, Quaternary ammonium compounds, Aldehydes, Gaseous sterilization. Biological Agents of Microbial Control :- (Antibiotics) Types, Mode of Action.

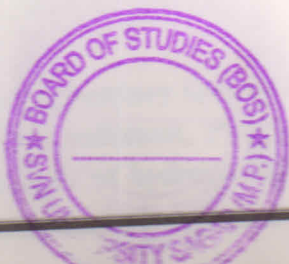
## PRACTICAL EXERCISE\*

(\*Practicals are conducted as Biotechnology Lab with separate credits (02 credits))

1. Preparation of broth and liquid culture media to grow the test bacterial culture.
2. Isolation of bacterial culture by serial dilution agar plate technique.
3. Perform the simple staining of the given test organisms to observe their shape.
4. Perform the negative staining of the given test organisms to observe their shape.
5. Perform the Gram's staining of the given test organism.
6. Perform the Endospore staining of the given test organisms.
7. Check the effect of UV radiation on the growth of microorganisms.
8. Demonstrate the acid and gas production by the organisms.
9. Perform catalase test by the given test organisms.

## SUGGESTED READINGS

- Microbiology, Pelczar, M.J., Chan, E.C.S. and Kreig, N.R., Tata McGraw Hill.
- Introduction to Microbiology, Harley and Prescott
- Microbial Genetics, Maloy, S.R., Cronan, J.E.Jr and Freifelder, D. Jones, Bartlett Publishers.
- Microbiology- a Laboratory Manual, Cappuccino, J.G. and Sherman, N. Addison Wesley.
- Introductory Mycology by C.J. Alexopoulos and Mims, Wiley publication New Delhi.
- General Microbiology, Vol. II by Powar and Dagainawala, Himalaya.



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Paper Code	Course Title	Credits
BSCBT-104	PHYSICAL CHEMISTRY	6(3-1-2)

## OBJECTIVE

The subject Physical Chemistry is designed for under graduate students of biotechnology for understanding of basic principle, techniques and applications of different instruments used in their laboratory.

## THEORY

### Unit I: liquid-liquid mixtures

Ideal liquid mixtures, Raoult's and Henry's law. Non-ideal system azeotropes : HCl-H<sub>2</sub>O and ethanol - water systems. Partially miscible liquids - Phenol-water, trimethylamine-water, nicotine-water systems. Lower and upper consolute temperature. Effect of impurity on consolute temperature. Immiscible liquids, steam distillation. Nernst distribution law - thermodynamic derivation, applications.

### Unit II: Electrochemistry -I

Electrical transport - Conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance, measurement of equivalent conductance, variation of equivalent and specific conductance with dilution. Migration of ions and Kohlrausch law. Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only). Transport number, definition and determination by Hittorf method and moving boundary method. Applications of conductivity measurements : determination of degree of dissociation, determination of  $K_a$  of acids, determination of solubility product of a sparingly soluble salt, conductometric titrations.

### Unit III: Electrochemistry -II

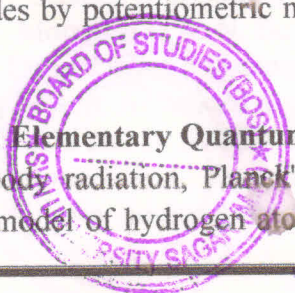
Types of reversible electrodes: gas metal ion, metal-metal ion, metal-insoluble salt-anion and redox electrodes. Electrode reactions. Nernst equation, derivation of cell E.M.F. and single electrode potential, standard hydrogen electrode-reference electrodes-standard electrode potential, sign conventions, electrochemical series and its significance. Electrolytic and Galvanic cells, reversible and irreversible cells, conventional representation of electrochemical cells

### Unit IV: Electrochemistry and Corrosion

Concentration cells with and without transport, liquid junction potential, application of conc cells, valency of ions, solubility product and activity coefficient, potentiometric titrations. Definition of pH and pK, determination of PH using hydrogen, quinhydrone and glass electrodes by potentiometric method, Corrosion: Types, theories and methods of combating it.

### Unit V: Elementary Quantum Mechanics

Black-body radiation, Planck's radiation law, photoelectric effects, heat capacity of solids, Bohr's model of hydrogen atom (no derivation and its defects. Compton effect. De Broglie



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hypothesis, Heisenberg's uncertainty principle. Sinusoidal wave equation. Hamiltonian operator. Schrodinger wave equation and its importance, physical interpretation of the wave function, postulates of quantum mechanics. Particle in a one dimensional box. .

## PRACTICAL

### Transition Temperature

1. Determination of the transition temperature of the given substance by thermometric method (e.g.  $\text{MnCl}_2 \cdot 4\text{H}_2\text{O} / \text{SrBr}_2 \cdot 2\text{H}_2\text{O}$ ).

### Phase Equilibrium

1. To study the effect of a solute (e.g. NaCl succinic acid) on the critical solution temperature of two partially miscible liquids (e.g. phenol- water system and to determine the concentration of that solute in the given phenol-water system.
2. To construct the phase diagram of two component (e.g. diphenylamine-benzophenone system by cooling curve method.)

### Thermochemistry

1. To determine the enthalpy of neutralization of a weak acid/ weak base versus base/ strong acid and determine the enthalpy of ionization of the weak acid base.

### Electrochemistry

1. To determine the strength of the given acid conductometrically using standard alkali solution.
2. To determine the solubility and solubility product of a sparingly soluble electrolyte conductometrically.
3. To study the saponification of ethyl acetate conductometrically.
4. To titrate potentiometrically the given ferrous ammonium sulphate solution using  $\text{KMnO}_4 / \text{K}_2\text{Cr}_2\text{O}_7$  as titrant and calculate the redox potential of  $\text{Fe}^{++} / \text{Fe}^{+++}$  system on the hydrogen scale.

### Refractometry / Polarimetry.

1. To verify law of refraction of mixture (e.g. of glycerol and water) using Abb's refractometer.
2. To determine the specific rotation of a given optically active compound. .

### Colorimetry

To verify Beer-Lambert law for  $\text{KMnO}_4 / \text{K}_2\text{Cr}_2\text{O}_7$  and determine the concentration of the given solution of the substance.

## SUGGESTED READINGS

- G. M. Barrow: Physical Chemistry Tata McGraw-Hill (2007).
- G. W. Castellan: Physical Chemistry 4th Ed. Narosa (2004).
- J. C. Kotz, P. M. Treichel, J. R. Townsend, General Chemistry, Cengage Learning India Pvt. Ltd.: New Delhi (2009).
- B. H. Mahan: University Chemistry, 3rd Edn. Narosa (1998).
- R. H. Petrucci, General Chemistry, 5th Edn., Macmillan Publishing Co.: New York (1985).
- T. W. Graham Solomon's: Organic Chemistry, John Wiley and Sons.
- R. T. Morrison & R. N. Boyd: Organic Chemistry, Prentice Hall.
- I. L. Finar: Organic Chemistry (Vol. I & II), E. L. B. S.
- Jerry March: Advanced organic Chemistry, John Wiley & Sons.
- Arun Bahl and B. S. Bahl: Advanced Organic Chemistry, S. Chand.
- F. G. Mann & B. C. Saunders: Practical Organic Chemistry, Orient Longman, 1960.
- B.D. Khosla: Senior Practical Physical Chemistry, R. Chand & Co.

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Paper Code	Course Title	Credits
BSCBT-105	ECOLOGY & ENVIRONMENTAL STUDIES	4(3-1-0)

## OBJECTIVE

The subject Ecology & Environment Studies is designed for under graduate students of biotechnology for understanding of basic concept related to ecology & environment.

## THEORY

### Unit I

Definition, scope and importance, need for public awareness. Natural resources and associated problems. Forest resources: Use and over-exploitation, deforestation, mining, dams and their effects on forest. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams benefits and problems. Land resources: Land as a resource, land degradation, soil erosion and desertification.

### Unit II

Food resources: World food problems, effects of modern agriculture, fertilizer-pesticide problems, Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

### Unit III

Concept of an ecosystem, Structure and function of an ecosystem. Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids. introduction, types, characteristic features, structure and function of the terrestrial ecosystem and Aquatic ecosystems. Diversity, Definition & types, Biogeographical classification of India, Value of biodiversity, Biodiversity at global, National and local levels. India as a mega-diversity nation, Hot-spots of biodiversity, Threats to biodiversity, Endangered and endemic species of India, Conservation of biodiversity.

### Unit IV

Definition: Cause, effects and control measures of :- Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards, Solid waste Management : Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies, Disaster management: floods, earthquake, cyclone and landslides.



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## Unit V

Sustainable development, urban problems related to energy Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people; its problems and concerns, Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Environmental legislation, Public awareness. Population growth, Population explosion - Family Welfare Programme. Environment and human health. HIV/AIDS. Role of Information Technology in Environment and human health.

## FIELD WORK

1. Visit to a local area to document environmental assets, river/ forest/grassland/hill/mountain
2. Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
3. Study of common plants, insects, birds.
4. Study of simple ecosystems-pond, river, hill slopes, etc

## SUGGESTED READINGS

- A text book of Environmental Studies, Erach Bharucha, UGC Publication Delhi
- A text book of Environmental science: Purohit Shami & Agrawal, Agrobios Student edition Jaipur
- A text book of Environmental Studies: Kaushi & Kaushik New age International Publication
- Paryavaran Addhyan : MP Hindi Granth Academy
- Paryavaran Addhyan : KL Tiwari and Jadhav
- Paryavaran Addhyan/Shiksha by: Dr Mahendra Kumar Tiwari University Publication Delhi
- A Text Book Of Environmental Science: P.C. Joshi & Namita Joshi, APH Publication Delhi
- Concept of Ecology: E.P.Odum
- A text book of Environmental science SC Santra, Kalyani Publication
- Ecology and Environment: PD Saharma, Rastogi publication Meerut UP



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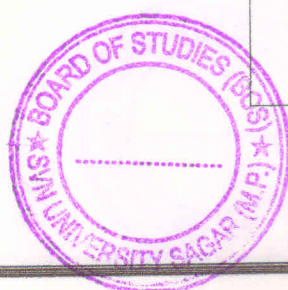


## Scheme- First Semester B.Sc. Biotechnology (Hons.) Course Code: BSCBT

### SUBJECT WISE DISTRIBUTION OF MARKS AND CORRESPONDING CREDITS

Paper Code	Paper Name	Period per week			Credit	Theory				Practical			Grand Total	Remarks	
		L	T	P		Final Semester	CCE	Total Marks		Total Marks					
								Max	Min	Max	Min				
BSCBT-101	Frontiers in Biotechnology	3	1	0	4(3-1-0)	80	20	100	40	-	-	100			
BSCBT-102	Bio-Instrumentation	3	1	0	4(3-1-0)	80	20	100	40	-	-	100			
BSCBT-103	General Microbiology	3	1	0	4(3-1-0)	80	20	100	40	-	-	100			
BSCBT-104	Physical Chemistry	3	1	2	6(3-1-2)	80	20	100	40	50	25	150			
BSCBT-105	Ecology & Environmental Studies	3	1	0	4(3-1-0)	80	20	100	40	-	-	100			
BSCBT-106	Agriculture Biotechnology	3	1	2	6(3-1-2)	80	20	100	40	50	25	150			
BSCBT-107	Functional English-I	3	1	0	4(3-1-0)	80	20	100	40	-	-	100			
BSCBT-108	Biotechnology Lab-I	0	0	2	2(0-0-2)	-	-	-	-	50	25	50			
Total Credits					34(21-7-6)	Total Marks								850	

Minimum Marks for passing in End Semester Theory- 40%  
Minimum Marks for passing in End Semester Practical - 50%



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Paper Code	Course Title	Credits
BSCBT-106	AGRICULTURE BIOTECHNOLOGY	6(3-1-2)

## OBJECTIVE

The subject Agriculture Biotechnology is designed for under graduate students of biotechnology for understanding the role of biotechnology in Agriculture.

## THEORY

### Unit I

Biotechnology in Agriculture, Growth and Historical perspective of Agricultural Bio-Technology. Agricultural Bio-Technology- Risk and challenges, Advantages and Applications.

### Unit II

Major crop plants and their improvement. Impact of fertilizers and possible alternatives. Losses due to biotic and abiotic stresses. Engineering for resistance against salinity, drought, herbicide, frost ant pest.

### Unit III

Transgenic plants, transfer of nif gene to transgenic plant. Production of therapeutic molecule in plants, edible vaccines, golden rice. Genetic basis of flowering, flower modification and colour. Delaying fruit ripening.

### Unit IV

Germplasm conservation, seed bank, cryopreservation. Importance of biofertilizers in agriculture (rhizobium, azatobactor, mycorrhiza). Vermicomposting, composting.

### Unit V

Role of microbes in agriculture. General symptoms of plant diseases, mode of infection , dispersal of plant pathogens and control of pathogens. Biopesticides- bacterial, fungal.



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## PRACTICALS

1. Preparation of broth and liquid culture media to grow the bacterial culture of Biofertilizers.
2. Isolation of bacterial bio-inoculants from soil by serial dilution agar plate technique.
3. Identification of bacterial biofertilizers using biochemical testing as well as molecular markers.
4. Identification of fungal biofertilizers using biochemical testing as well as molecular markers.
5. Biofertilizers in agriculture (rhizobium, azatobactor, mycorrhiza).
6. Vermicomposting.
7. Perform the simple staining of the given test organisms to observe their shape.
8. Perform the negative staining of the given test organisms to observe their shape.
9. Perform the Gram's staining of the given test organism.
10. Perform the Endospore staining of the given test organisms.
11. Transgenic plants for increased shelf life, molecular mapping of genes of agriculture importance chloroplast transformation.

## SUGGESTED READINGS

- Agriculture Biotechnology: B.D. Singh
- Biotechnology fundamental and application (4th edition) - S.S.Purohit.
- Plant Biotechnology – B.D.Singh
- Plants, Genes and agriculture by Maartein, J.Christpeels, David E.Sdava.
- Crop Biotechnology by P.R. Yadav, Rajiv Tyagi
- Plant Biotechnology by Chawla. Gendel,



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## PRACTICALS

1. Preparation of broth and liquid culture media to grow the bacterial culture of Biofertilizers.
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3. Identification of bacterial biofertilizers using biochemical testing as well as molecular markers.
4. Identification of fungal biofertilizers using biochemical testing as well as molecular markers.
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- Plant Biotechnology – B.D.Singh
- Plants, Genes and agriculture by Maartein, J.Christpeels, David E.Sdava.
- Crop Biotechnology by P.R. Yadav, Rajiv Tyagi
- Plant Biotechnology by Chawla. Gendel,



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Paper Code	Course Title	Credits
BSCBT-107	FUNCTIONAL ENGLISH-I	4(3-1-0)

**INTRODUCTION:** Grammar is vital for the efficient use of language in academic as well as social environment. You already know that our speech is made up of sentences. A sentence is the basic unit of the written and spoken language. In this unit we will learn about various structural and functional parts of the sentence, their types, subtypes and their usage.

## OBJECTIVES

- To enable the students to use verbs in appropriate contexts.
- To improve students' command of spoken English by practicing the functional language needed in different situations
- To familiarize the students with the concept of Functional English as a multi-focal discipline.
- To enable the students to use English correctly and confidently

## THEORY

### Unit I

- Articles: Definite, Indefinite and Zero, Noun: numbers (singular and plural) and Personal Pronouns.
- Introduction to verb: Ordinary and Auxiliary verbs, Regular and Irregular verbs
- The Present Tense: Present Continuous, Simple Present (Form and Use)

### Unit II

**The Past and Perfect Tenses:** Simple Past, The Past Continuous, The Present Perfect, The Present Perfect Continuous, The Past Perfect and The Past Perfect Continuous. (Form and Use)

### Unit III

**The Future Tense:** Future Simple, The future Continuous (Form and Use), Causative Verbs, The Sequence of Tenses.

### Unit IV

Introduction to Modal Auxiliaries (Form and Use)

May and can for Permission and Possibility.

Could for permission in the Past

May, Might for Possibility.

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Can and be able for Ability.

Ought, Should, Must, have to, had to, Need for Obligation.

## Unit V

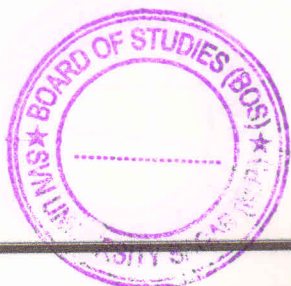
The Conditional Sentences, The Passive Voice; Active Tenses and their Passive Equivalents including Modals, Use of Passive Structure.

**NOTE:** Coverage of 1220 Regular (600) and Irregular Verbs (620) with their meaning and uses.

(Teachers are required to Introduce 25 verbs from the given verb list in every lecture)

Paper Code	Course Title	Credits
BSCBT-108	BIOTECHNOLOGY LAB-I	2(0-0-2)

(As per the guidelines of above mention subjects)



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# Swami Vivekanand University, Sagar (M.P.)



## Scheme- Second Semester B.Sc. Biotechnology (Hons.) Course Code: BSCBT

### SUBJECT WISE DISTRIBUTION OF MARKS AND CORRESPONDING CREDITS

Paper Code	Paper Name	Period per week			Credit	Theory				Practical		Grand Total	Remarks
		L	T	P		Final Semester	CCE	Total Marks		Total Marks	Total Marks		
								Max	Min	Max	Min		
BSCBT-201	Fundamentals of Biochemistry	3	1	0	4(3-1-0)	80	20	100	40	-	-	100	
BSCBT-202	Molecular Biology -I	3	1	0	4(3-1-0)	80	20	100	40	-	-	100	
BSCBT-203	Immunology	3	1	0	4(3-1-0)	80	20	100	40	-	-	100	
BSCBT-204	Inorganic Chemistry	3	1	2	6(3-1-2)	80	20	100	40	50	25	150	
BSCBT-205	Plant Tissue Culture	3	1	2	6(3-1-2)	80	20	100	40	50	25	150	
BSCBT-206	Bioinformatics	3	1	0	4(4-0-0)	80	20	100	40	-	-	100	
BSCBT-207	Hindi-I	3	1	0	4(3-1-0)	80	20	100	40	-	-	100	
BSCBT-208	Biotechnology Lab-II	0	0	2	2(0-0-2)	-	-	-	-	50	25	50	
Total Credits					34(22-6-6)	Total Marks						850	

Minimum Marks for passing in End Semester Theory- 40%  
Minimum Marks for passing in End Semester Practical - 50%



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# Swami Vivekanand University, Sagar (M.P.)

## B.Sc. Biotechnology (Hons.) Course Contents

### (SECOND SEMESTER)

Paper Code	Course Title	Credits
BSCBT-201	FUNDAMENTALS OF BIOCHEMISTRY	4(3-1-0)

### OBJECTIVES

The subject Fundamental Biochemistry is designed to under graduate students of biotechnology for understanding of basic concepts of biophysical chemistry, biomolecules and their types.

### THEORY

#### Unit I

Bonds in biological system. Principles of biophysical chemistry (pH, pKaHenderson Hasselbachquation)Buffers and its role in biological systems.Solution and its types.Osmosis, diffusion and its significance in biological syatems.

#### Unit II

Carbohydrates: Monosaccharide: Classification, Common Disaccharides, Structure and occurrence of storage and structural polysaccharides,

#### Unit III

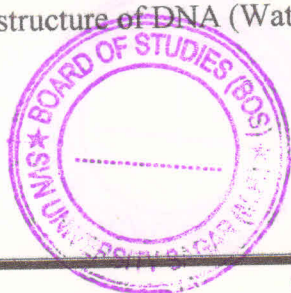
Lipids: Classification, structure-function, role in biological membrane. Lipoprotein, structure and functions. Prostaglandins and its role in biological systems.

#### Unit IV

Amino Acids: structure, nomenclature and general properties, Peptide bond, Classification of amino acids Proteins; Levels of organizationPrimary, Secondary structure, domains, motif and folds)., tertiary and quarternaryConformation of proteins (Ramachandran plot, Stability of proteins

#### Unit V

Composition, structure and function of nucleic acids.Conformation of nucleic acids (helix (A, B, Z), t-RNA, micro-RNA).Vitamins:Classification: source and biochemical function, RDA.Nucleic acids: DNA, RNA-basic structure (nucleosides and nucleotides): double helical structure of DNA (Watson - Crick Model), types of DNA, B-, A- and Z-DNA.



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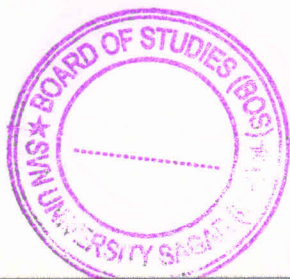
## PRACTICAL EXERCISE\*

(\*Practicals are conducted as Biotechnology Lab with separate credits (02 credits))

1. Qualitative analysis of sugars.by Molisch's Test.
2. Qualitative analysis of reducing sugars.by Fehling's Test.
3. Qualitative analysis of sugars.by Barfoed's Test.
4. Qualitative analysis of ketose sugars.by Seliwanoff Test.
5. Qualitative analysis of amino acids by ninhydrin Test.
6. Qualitative analysis of peptide bond by Biuret Test
7. Qualitative analysis of protein by Xanthoproteic Test.
8. Determination of acid value in given fat sample

## SUGGESTED READINGS

- Principles of Biochemistry by Nelson, Cox and Lehninger
- Biochemistry by G.Zubay
- Biochemistry by Stryer
- Biochemistry, DVoet and JG. Voet , J Wiley and Sons.
- Laboratory Techniques in Biochemistry and molecular Biology, Work and Work



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Paper Code	Course Title	Credits
BSCBT-202	MOLECULAR BIOLOGY –I	4(3-1-0)

## OBJECTIVES

The Objective of this subject is to provide fundamental Knowledge of molecular biology, various principles, applications and processes in a brief way.

## THEORY

### Unit I

Nature of gene concept, chemical nature of gene, genome, genome size, c- value paradox. Structure of DNA and their properties, A, B,C and Z type of DNA, Structure property and types of RNA, nucleic acid as a genetic information carriers: experimental evidence.

### Unit II

DNA replication in prokaryotes: Conservative and dispersive types, Experimental evidence for semi- conservative replication: DN A polymerase, other enzymes and protein factors involved in replication: Mechanism of replication: Inhibitors of DNA replication

### Unit III

Transcription in prokaryotes: RNA polymerase, promoters, initiation, elongation, rho dependent and rho in dependent termination of RNA synthesis, inhibitors of prokaryotic transcription: Reverse transcriptase, post transcriptional processing of RNA

### Unit IV

Genetic code: basic features of genetic code, biological significance of degeneracy, wobble hypothesis, gene within gene and overlapping genes. Mechanism of translation in prokaryotes. Regulation of gene expression in prokaryotes: operon concept, lac operon, Ara operon and Trp operon

### Unit V

Mutation: Molecular basis of Mutation, Physical and chemical mutagens types of mutation, e.g. transition, transversion, frame shift, insertion,deletion,suppressor sensitive, germinal and somatic, backward and forward mutations, spontaneous and induced mutations.DNA damage and repair: types of damage(deamination, oxidative damage, alkylation and pyrimidine dimers),repair mechanism



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## PRACTICAL EXERCISE\*

(\*Practicals are conducted as Biotechnology Lab with separate credits (02 credits))

1. Qualitative test of DNA in given sample
2. Qualitative test of RNA in given sample
3. Quantitative test of DNA in given sample
4. Quantitative test of RNA in given sample
5. Spectrophotometric analysis of DNA
6. Estimation of protein in given sample.

## SUGGESTED READINGS

- Microbial Genetics by David Freifelder.
- Molecular Biology by David Freifelder.
- Molecular Biology of Gene Watson, Baker et.al. 5th Edition
- Molecular Biology of the Cell by Alberts.
- Genes by Lewin and Benjamin.



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## Scheme- Second Semester B.Sc. Biotechnology (Hons.) Course Code: BSCBT



### SUBJECT WISE DISTRIBUTION OF MARKS AND CORRESPONDING CREDITS

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BSCBT-202	Molecular Biology –I	3	1	0	4(3-1-0)	80	20	100	40	-	-	100			
BSCBT-203	Immunology	3	1	0	4(3-1-0)	80	20	100	40	-	-	100			
BSCBT-204	Inorganic Chemistry	3	1	2	6(3-1-2)	80	20	100	40	50	25	150			
BSCBT-205	Plant Tissue Culture	3	1	2	6(3-1-2)	80	20	100	40	50	25	150			
BSCBT-206	Bioinformatics	3	1	0	4(4-0-0)	80	20	100	40	-	-	100			
BSCBT-207	Hindi-I	3	1	0	4(3-1-0)	80	20	100	40	-	-	100			
BSCBT-208	Biotechnology Lab-II	0	0	2	2(0-0-2)	-	-	-	-	50	25	50			
Total Credits					34(22-6-6)	Total Marks								850	

Minimum Marks for passing in End Semester Theory- 40%  
Minimum Marks for passing in End Semester Practical - 50%

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Paper Code	Course Title	Credits
BSCBT-203	IMMUNOLOGY	4(3-1-0)

## OBJECTIVES

The subject Immunology is designed for postgraduate students of biotechnology for making them understand basic and advanced concepts of Immunology and body's defense system.

## THEORY

### Unit I

Introduction to the immune system, Cells and organs of the immune system, Hematopoietic development and mediators of the process. Sign and symptoms and mechanism involved in inflammatory response.

### Unit II

Innate and Adaptive immune responses: Anatomical and Physiological barriers of the innate immunity. Receptors of Innate Immune system. Connection between innate and adaptive immune response and its mechanism. Antigens and its properties, Immunogens and its properties.

### Unit III

Structure, classification and functions of Antibody, Antigen-antibody reactions and applications, Organization and expression of Immunoglobulin genes and Class switching.

### Unit IV

Major histocompatibility complex (MHC), Types of MHC and Display of antigenic peptide, Role of MHC in antigen processing and presentation. Complement system: component, activation pathway, complement deficiency diseases.

### Unit V

Hypersensitivity: Allergens and its types, types of hypersensitivity and Their mechanism, Introduction to Autoimmune disorders (Central and peripheral Tolerance). Immunization: active and passive immunization, types of vaccines and their production strategy.



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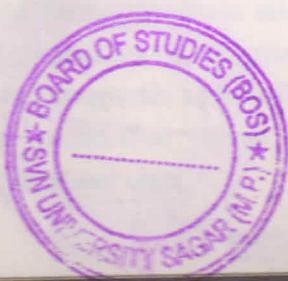
## PRACTICAL EXERCISE\*

(\*Practicals are conducted as Biotechnology Lab with separate credits (02 credits))

1. Anatomical view of mammalian thymus and various immune organs
2. Precipitation reaction.
3. Blood Group Detection by Agglutination Reaction
4. Radial immunodiffusion
5. Double immunodiffusion
6. Haemoglobin detection by given Blood Sample

## SUGGESTED READINGS

- Kuby Immunology by T. Kindst, R.A. Goldsby and B.A. Osborne
- Essential Immunology by Ivan Roitt
- Immunology understanding the immune system by Klaus D. Elgert
- Immunology by I. Roit J. Brostoff and D. Male



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Paper Code	Course Title	Credits
BSCBT-204	INORGANIC CHEMISTRY	6(3-1-2)

## OBJECTIVES

The subject Inorganic Chemistry is designed for under graduate students of biotechnology for understanding of basic principle, techniques and applications.

## THEORY

### Unit I Oxidation and Reduction

Use of redox potential data - analysis of redox cycle, redox stability in water - Frost, Latimer and Pourbaix diagrams principles involved in the extraction of the elements. Non-aqueous Solvents Physical properties of solvent, types of solvents and their general characteristics, reactions in non-aqueous solvents with reference to liquid  $\text{NH}_3$  and liquid  $\text{SO}_2$ .

### Unit II Chemistry of Lanthanids

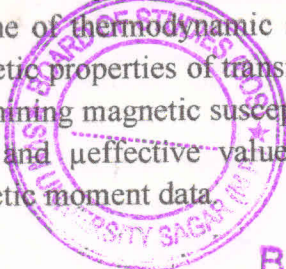
Electronic structure, oxidation states and ionic radii and lanthanide contraction, complex formation, occurrence and isolation of lanthanide compounds Chemistry of Actinides. General features and chemistry of actinides, chemistry of separation of Np, Pu, and Am from U, similarities between the later actinides and the later lanthanides.

### Unit III Molecular orbital theory

Molecular orbital theory., basic ideas - criteria for forming M.O. from A.O. construction of M.O.'s by LCAO- hydrogenion. calculation of energy levels from wave functions, physical picture of bonding and antibonding wave functions. Concept of  $\sigma$ ,  $\sigma^*$ ,  $\pi$ ,  $\pi^*$  orbitals and their characteristics. Hybrid orbitals -  $sp$ ,  $sp^2$ ,  $sp^3$ ; calculation of coefficients of A.O.'s used in these hybrid orbitals.

### Unit IV Metal ligand bonding in transition metal complexes

Limitations of valence bond theory, an elementary idea of crystal field theory, Crystal field splitting in octahedral, tetrahedral and square planar complexes, factors affecting the Crystal field parameters. Thermodynamics and kinetic aspects of metal complexes A brief out line of thermodynamic stability of metal complexes and factors affecting the stability. Magnetic properties of transition metal complexes Types of magnetic behaviour, Methods of determining magnetic susceptibility, spin (only formula) LS coupling, correlation of  $\mu_s$  (spin only) and  $\mu_{eff}$  values. Orbital contribution to magnetic moments, application of magnetic moment data.



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## Unit V Electronic Spectrum

Concept of potential energy curves for bonding and antibonding molecular orbitals. Qualitative description of selection rules and Frank-Condon principle. Electron spectra of transition metal complexes- Types of electronic transitions, selection rules for d-d transition, spectroscopic ground states, spectrochemical series Orgel energy level diagram for d1 –d9 states, discussion of the electronic spectrum of  $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ .

## PRACTICAL

### Inorganic Chemistry:

Quantitative Volumetric analysis –

1. Estimation of ferrous and ferric using dichromate.
2. Estimation of copper using thiosulphate .

### Solvent Extraction:

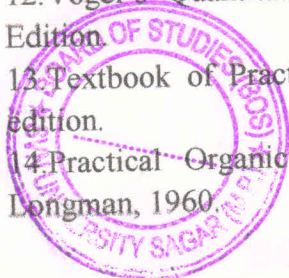
Separation and estimation of Mg (II) and Fe(II).

### Ion exchange method

Separation and estimation of Mg (II) and Zn (II).

## SUGGESTED READINGS

- J. D. Lee: A new Concise Inorganic Chemistry, E L. B. S.
- F. A. Cotton & G. Wilkinson: Basic Inorganic Chemistry, John Wiley.
- Douglas, McDaniel and Alexader: Concepts and Models in Inorganic Chemistry, John Wiley.
- James E. Huheey, Ellen Keiter and Richard Keiter: Inorganic Chemistry: Principles of Structure and Reactivity, Pearson Publication.
- T. W. Graham Solomon: Organic Chemistry, John Wiley and Sons.
- Peter Sykes: A Guide Book to Mechanism in Organic Chemistry, Orient Longman.
- E. L. Eliel: Stereochemistry of Carbon Compounds, Tata McGraw Hill.
- I. L. Finar: Organic Chemistry (Vol. I & II), E. L. B. S.
- R. T. Morrison & R. N. Boyd: Organic Chemistry, Prentice Hall.
- 10. Arun Bahl and B. S. Bahl: Advanced Organic Chemistry, S. Chand
- 11. Vogel's Qualitative Inorganic Analysis, A.I. Vogel, Prentice Hall, 7th Edition.
- 12. Vogel's Quantitative Chemical Analysis, A.I. Vogel, Prentice Hall, 6th Edition.
- 13. Textbook of Practical Organic Chemistry, A.I. Vogel, Prentice Hall, 5th edition.
- 14. Practical Organic Chemistry, F. G. Mann. & B. C. Saunders, Orient Longman, 1960.



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Paper Code	Course Title	Credits
BSCBT-205	PLANT TISSUE CULTURE	6(3-1-2)

## OBJECTIVES

To expose the students to the basic concepts and different techniques of plant tissue culture.

## THEORY

### Unit I

History: Important events in the history of plant tissue culture Laboratory requirements and general techniques Cellular Totipotency: Introduction, cytodifferentiation, organogenic differentiation, Somatic embryogenesis Micropropagation in plants.

### Unit II

Tissue Culture Media: Introduction, media constituents, media selection, media preparation and maintenance Plant growth regulators and elicitors.

### Unit III

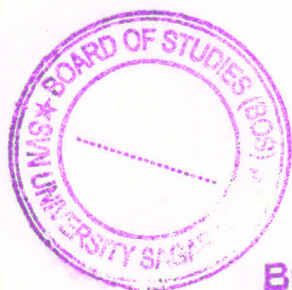
Anther Culture, haploid plant production and embryo culture: Introduction, techniques, culture requirements and applications. Protoplast Culture: Protoplast isolation, culture and regeneration. Somatic hybridization, somatic hybridization in improvement of crop plants.

### Unit IV

Cell and suspension cultures: Introduction, isolation, culture of single cells, applications of cell culture. Production of secondary metabolites by plant suspension cultures Plant products of industrial importance.

### Unit V

Plant cloning Vectors and their applications, *Agrobacterium* mediated transformation in plants, Transgenic in crop improvement. Concept of Intellectual property right (IPR) and protection (IPP), patenting of Biological material.



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## PRACTICAL

1. Laboratory design and setup of a plant tissue culture unit.
2. Preparation of culture media
3. Surface sterilization, sealing of culture, sources of contamination and their check measures.
4. Sterilization of media and apparatus.
5. Organ culture: seed culture, etc.
6. Callus induction
7. Regeneration of plants
8. Embryo culture
9. Protoplast isolation and culture.
10. Acclimatization of new plantlet.

## SUGGESTED READINGS

- Razdan, M. K. (1994). An Introduction to Plant Tissue Culture. Oxford and IBH Publishing Co., New Delhi
- Bhojwani, S.S. and Razdan, M.K. (1996). Plant Tissue Culture. Theory and Practice, Elsevier
- Plant Biotechnology: The genetic manipulation of plants. Adrian Slater, Nigel Scott and Mark Flower.
- An Introduction to Plant Biotechnology: H.S. Chawla (IBH-2002).
- Reinert, J., and Yeoman. 1988. Plant Cell and Tissue Culture - A Laboratory manual



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Paper Code	Course Title	Credits
BSCBT-206	BIOINFORMATICS	4(4-0-0)

### OBJECTIVES

The subject bioinformatics is designed to under graduate students of biotechnology for understanding of basic concepts of computational tools, their designing, applications, and their uses in industry and research.

### THEORY

#### Unit I

Introduction to bioinformatics, Divisions of bioinformatics, Scope, tasks, applications and future prospects of bioinformatics, Bioinformatics as multidisciplinary domain.

#### Unit II

Databases and search tools: Types of databases and their applications, National Centre for Biotechnology Information (NCBI), European Bioinformatics Institute (EBI), DNA Databank of Japan (DDBJ), PDB and SWISSPROT.

#### Unit III

Sequence alignment: Types of sequence alignment, Pairwise sequence alignment and its softwares, BLAST, Types and versions of BLAST, FASTA: Types and versions of FASTA.

#### Unit IV

Matrices and algorithms: Dot matrix, BLOSUM, PAM, BLAST algorithm Needleman Wunsch algorithm, Smith Waterman algorithm, Fitch Margoliash algorithm.

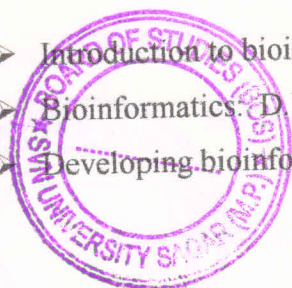
#### Unit V

Multiple sequence alignment methods and its softwares, Phylogenetic prediction, Maximum parsimony method, Distance method, Maximum likelihood method.

Non practical subject for B.Sc. students

### SUGGESTED READINGS

- Introduction to bioinformatics by Cynthia Gibas
- Bioinformatics: D.W. Mount, Cold Spring Harbour Laboratories Ltd.
- Developing bioinformatics Skills: Hoomann H Rashidi



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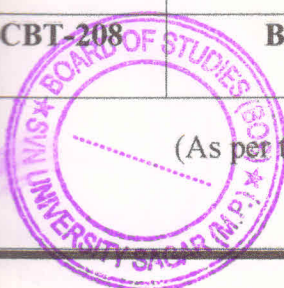


# Swami Vivekanand University, Sagar (M.P.)

Paper Code	Course Title	Credits
BSCBT-207	HINDI-I	4(3-1-0)

Unit	Topic to be Covered	Total Lec.
1.	भारत माता परशुराम की प्रतीक्षा, बहुत बड़ा सवाल, संस्कृति और राष्ट्रीय और राष्ट्रीय एकीकरण, कथन की शैलिया, विवरणात्मक, मूल्यांकन शैली व्याख्यानात्मक शैली, विवरणात्मक शैली	12
2.	विकास शील देशों की समस्या - मानव विकास प्रतिवेदन विकासात्मक पुनर्विचार - कल्याण के प्रश्न संरचना- विधि सूचक, विनम्रता सूचक, निषेध परक, काल बोधक, सीन बोधक, दिशा बोधक कारण कार्य, अनुक्रम संरचना	15
3.	प्रौद्योगिकी एवं नगरीकरण आधुनिक तकनीकी सभ्यता, पर्यावरण प्रदूषण तथा धारणीय विकास कार्यलयीन पत्र एवं आलेख- परिपत्र आदेश, अधिसूचना जापन, अनुस्मारक, पृष्ठांकन	15
4.	जनसंख्या एवं नगरीकरण गरीबी और बेरोजगारी अनुवाद छायांनुवाद, आशु अनुवाद, साक्षात्कार	15
5.	ऊर्जा शक्ति मानता अर्थशास्त्र घटनाओं का प्रतिवेदन (समारोह आदि) विभिन्न प्रकार के निमंत्रण पत्र	10
Total No. of Lecture		67

Paper Code	Course Title	Credits
BSCBT-208	BIOTECHNOLOGY LAB-II	2(0-0-2)



(As per the guidelines of above mention subjects)

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# Swami Vivekanand University, Sagar (M.P.)



## Scheme- Third Semester B.Sc. Biotechnology (Hons.) Course Code: BSCBT

### SUBJECT WISE DISTRIBUTION OF MARKS AND CORRESPONDING CREDITS

Paper Code	Paper Name	Period per week			Credit	Theory				Practical		Grand Total	Remarks
		L	T	P		Final Semester	CCE	Total Marks	Max	Min	Total Marks	Max	Min
BSCBT-301	Cell Structure & Dynamics	3	1	0	4(3-1-0)	80	20	100	40	-	-	100	
BSCBT-302	Molecular Biology -II	3	1	0	4(3-1-0)	80	20	100	40	-	-	100	
BSCBT-303	Pharmaceutical Biotechnology	3	1	0	4(3-1-0)	80	20	100	40	-	-	100	
BSCBT-304	Organic Chemistry	3	1	2	6(3-1-2)	80	20	100	40	50	25	150	
BSCBT-305	Food Microbiology	3	1	2	6(3-1-2)	80	20	100	40	50	25	150	
BSCBT-306	Fundamentals of Biostatistics and Computer Applications	3	1	0	4(3-1-0)	80	20	100	40	-	-	100	
BSCBT-307	Functional English-II	3	1	0	4(3-1-0)	80	20	100	40	-	-	100	
BSCBT-308	Biotechnology Lab-III	0	0	2	2(0-0-2)	-	-	-	-	50	25	50	
Total Credits						34(21-7-6)					Total Marks	850	

Minimum Marks for passing in End Semester Theory- 40%  
Minimum Marks for passing in End Semester Practical - 50%



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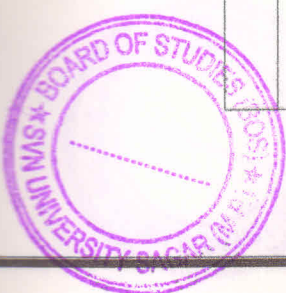


## Scheme- Third Semester B.Sc. Biotechnology (Hons.) Course Code: BSCBT

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BSCBT-302	Molecular Biology -II	3	1	0	4(3-1-0)	80	20	100	40	-	-	100	
BSCBT-303	Pharmaceutical Biotechnology	3	1	0	4(3-1-0)	80	20	100	40	-	-	100	
BSCBT-304	Organic Chemistry	3	1	2	6(3-1-2)	80	20	100	40	50	25	150	
BSCBT-305	Food Microbiology	3	1	2	6(3-1-2)	80	20	100	40	50	25	150	
BSCBT-306	Fundamentals of Biostatistics and Computer Applications	3	1	0	4(3-1-0)	80	20	100	40	-	-	100	
BSCBT-307	Functional English-II	3	1	0	4(3-1-0)	80	20	100	40	-	-	100	
BSCBT-308	Biotechnology Lab-III	0	0	2	2(0-0-2)	-	-	-	-	50	25	50	
Total Credits					34(21-7-6)	Total Marks						850	

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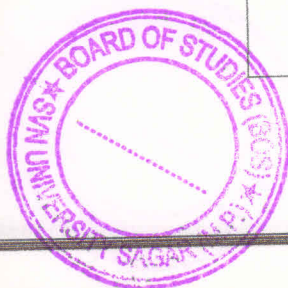


Scheme- Fourth Semester  
B.Sc. Biotechnology (Hons.) Course Code: BSCBT

SUBJECT WISE DISTRIBUTION OF MARKS AND CORRESPONDING CREDITS

Paper Code	Paper Name	Period per week			Credit	Theory				Practical			Grand Total	Remarks
		L	T	P		Final Semester	CCE	Total Marks		Total Marks	Total Marks			
								Max	Min		Max	Min		
BSCBT-401	Genetic Engineering-Tools and application	3	1	0	4(3-1-0)	80	20	100	40	-	-	100		
BSCBT-402	Bioprocess Engineering	3	1	0	4(3-1-0)	80	20	100	40	-	-	100		
BSCBT-403	Enzymology	3	1	0	4(3-1-0)	80	20	100	40	-	-	100		
BSCBT-404	Industrial Chemistry	3	1	2	6(3-1-2)	80	20	100	40	50	25	150		
BSCBT-405	Environmental Biotechnology	3	1	0	4(3-1-0)	80	20	100	40	-	-	100		
BSCBT-406	Applied Biology Sciences	3	1	2	6(3-1-2)	80	20	100	40	50	25	150		
BSCBT-407	Hindi-II	3	1	0	4(3-1-0)	80	20	100	40	-	-	100		
BSCBT-408	Biotechnology Lab-IV	0	0	2	2(0-0-2)	-	-	-	-	50	25	50		
Total Credits					34(21-7-6)					Total Marks			850	

Minimum Marks for passing in End Semester Theory- 40%  
Minimum Marks for passing in End Semester Practical - 50%



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# Swami Vivekanand University, Sagar (M.P.)

## B.Sc. Biotechnology (Hons.) Course Contents (THIRD SEMESTER)

Paper Code	Course Title	Credits
BSCBT-301	CELL STRUCTURE & DYNAMICS	4(3-1-0)

### OBJECTIVES

The student should have a basic understanding of cell organelles, Basic biochemistry and biology.

### THEORY

#### Unit I

Introduction of Cell Structure: Prokaryotic and Eukaryotic cell Bio membrane: Composition and Models, Diffusion potential and Nernst Equation Transport across cell membrane and Types and Function.

#### Unit II

Intracellular compartments and protein sorting, Compartmentalization Protein sorting and its types, Co-translational translocation of protein and its types, Protein sorting into Golgi body and Lysosomes, Protein sorting into nucleus and mitochondria.

#### Unit III

Cytoskeleton Structure: Types of Filament and its working mechanism, Microtubules, Intermediate filaments, Actin Filaments, Cell contraction and locomotion (Sliding Filament Theory).

#### Unit IV

Cell- Cell interaction: Extra cellular matrix: Composition and Function Cell- cell junction and types, Cell-ECM junction and types

#### Unit V

Cell- Cell communication and Physiological function of the cell Mechanism of cell signaling and its types, The cell division cycle Regulation, Comparison in Apoptosis and Necrosis with Examples.



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## PRACTICAL EXERCISE\*

(\*Practicals are conducted as Biotechnology Lab with separate credits (02 credits))

1. Introduction to chromosome preparation: Pre-treatment, Fixation, Staining, Squash and Semer preparation. Preparation of permanent slides.
2. Determination of mitotic index and frequency of different mitotic stages in pre-fixed root tips of *Allium cepa*.
3. Study of mitotic chromosome: Metaphase chromosome preparation, free hand drawing under high power objective.
4. The determine osmolarity in RBCs.
5. The fractionation of rat Liver
6. Estimation of chlorophyll content in spinach leaves.
7. Isolation of chlorophyll types by TLC.

## SUGGESTED READINGS

- Damell, J., Lodish, H., and Baltimore, D., 1990. Molecular and Cell Biology 2<sup>nd</sup> Edition, Scientific American Book, New York.
- Albert et al., Molecular Biology of the Cell.



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Paper Code	Course Title	Credits
BSCBT-302	MOLECULAR BIOLOGY –II	4(3-1-0)

## OBJECTIVES

The syllabus is designed to build theoretical and practical background of fundamental mechanisms of DNA replication mechanism, Basic concepts of flow of genetic information, transcription, translation, post transcriptional processing and regulation of gene expression in both prokaryotes and eukaryotes.

## THEORY

### Unit I

DNA Replication: General features of chromosomal replication: DNA Replication machinery in prokaryotes and its comparison with eukaryotes, prokaryotes, Enzymology of DNA replication, Regulation of DNA replication.

### Unit II

Transcription in eukaryotes and prokaryotes: Initiation, elongation and termination, Structure and function of eukaryotic/ prokaryotic promoters, RNA polymerases Types and properties of transcription factors, types and properties; Enhancers/silencers structure and transcriptional processing, Autocatalytic RNA.

### Unit III

Translation: Translation machinery of prokaryotes, Successive stages of protein synthesis in prokaryotes and its comparison with eukaryotes, Translational factors- Types and properties Post- translational Modification: Types and Significance.

### Unit IV

Regulation of Gene Expression in Eukaryotes: cis- acting DNA elements; Chromatin Organization and regulation of gene expression; regulation at the level of processing of transcripts. RNA editing; Gene Alteration; DNA methylation and gene regulation; Regulation of gene expression by hormones.

Unit V DNA libraries; Genomic and C-DNA Library, Transposable elements in prokaryotes and Eukaryotes: Types and Significance. Oncogenes and Tumor Suppressor Genes: Properties and Significance.



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## PRACTICAL EXERCISE\*

(\*Practicals are conducted as Biotechnology Lab with separate credits (02 credits))

1. Isolation of Genomic DNA and restriction Digestion
2. Size fractionation of restricted DNA fragments by Agarose Gel Electrophoresis.
3. Quantitation of DNA
4. Determination of max of purified DNA fragments
5. Determination of  $T_m$  of nucleic acid
6. Isolation of RNA
7. Protein Extraction

## SUGGESTED READINGS

- Benjamin Lewin. (2008) Genes IX, Jones and Bartelett Publishers Inc.
- Weaver R., (2007) Molecular Biology, 4th Edition, McGraw Hill Science.
- Molecular Biology: Strickburger.
- Principles of Genetics: Snustead and Simmons
- Molecular Biology of gene: Watson.



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Paper Code	Course Title	Credits
BSCBT-303	PHARMACEUTICAL BIOTECHNOLOGY	4(3-1-0)

## OBJECTIVES

The syllabus is designed to build theoretical and practical background of Pharmaceutical Biotechnology.

## THEORY

### Unit I Antibiotics and synthetic antimicrobial agents

Antibiotics and synthetic antimicrobial agents, (Aminoglycosides,  $\beta$ -lactams, tetracyclines, ansamycins, macrolid antibiotics), Antifungal antibiotics, antitumor substances, Peptide antibiotics, Chloramphenicol, Sulphonamides and Quinolone antimicrobial agents. Chemical disinfectants, antiseptics and preservatives.

### Unit II Mechanism of action of antibiotics

Mechanism of action of antibiotics (inhibitors of cell wall synthesis, nucleic acid and protein synthesis), Molecular principles of drug targeting. Drug delivery system in gene therapy, Bacterial resistance to antibiotics, Mode of action of bacterial killing by quinolones, Bacterial resistance to quinolones, Mode of action of nonantibiotic antimicrobial agents, Penetrating defences, How the antimicrobial agents reach the targets (cellular permeability barrier, cellular transport system and drug diffusion).

### Unit III Microbial production and Spoilage of pharmaceutical Products

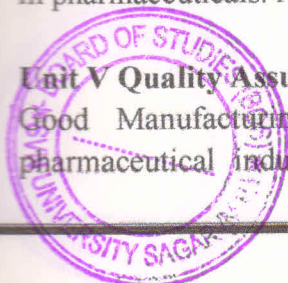
Microbial contamination and spoilage of pharmaceutical products (sterile injectibles, noninjectibles, ophthalmic preparations and implants) and their sterilization. Manufacturing procedures and in process control of pharmaceuticals. Other pharmaceuticals produced by microbial fermentations (streptokinase, streptodornase). New vaccine technology, DNA vaccines, synthetic peptide vaccines, multivalent subunit vaccines. Vaccine clinical trials.

### Unit IV Regulatory practices, biosensors and applications in Pharmaceuticals

Financing R&D capital and market outlook. IP, BP, USP. Government regulatory practices and policies, FDA perspective. Reimbursement of drugs and biologicals, legislative perspective. Rational drug design. Immobilization procedures for pharmaceutical applications (liposomes). Macromolecular, cellular and synthetic drug carriers. Biosensors in pharmaceuticals. Application of microbial enzymes in pharmaceuticals.

### Unit V Quality Assurance and Validation

Good Manufacturing Practices (GMP) and Good Laboratory Practices (GLP) in pharmaceutical industry. Regulatory aspects of quality control/Quality assurance and



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# Swami Vivekanand University, Sagar (M.P.)

quality management in pharmaceuticals ISO, WHO and US certification. Sterilization control and sterility testing (heat sterilization, D value, z value, survival curve, Radiation, gaseous and filter sterilization) Chemical and biological indicators. Design and layout of sterile product manufacturing unit. (Designing of Microbiology laboratory), Safety in microbiology laboratory.

## SUGGESTED READINGS

- Pharmaceutical Microbiology – Edt. By W.B.Hugo & A.D.Russell Sixth edition. Blackwell scientific Publications.
- Analytical Microbiology –Edt by Frederick Kavanagh Volume I & II. Academic Press New York.
- Quinolone antimicrobial agents – Edt. by David C. Hooper, John S.Wolfson .ASM Washington DC.
- Quality control in the Pharmaceutical Industry - Edt. by Murray S.Cooper Vol.2. Academic Press New York.
- Biotechnology – Edt. by H.J.Rehm & G.Reed, Vol 4. VCH Publications, Federal Republic of Germany.
- Pharmaceutical Biotechnology by S.P.Vyas & V.K.Dixit. CBS Publishers & Distributors, New Delhi.
- Good Manufacturing Practices for Pharmaceuticals Second Edition, by Sydney H.Willig, Murray.
- M.Tuckerman, William S.Hitchings IV. Mercel Dekker NC New York.
- Advances in Applied Biotechnology Series Vol 10, Biopharmaceuticals in transition. Industrial Biotechnology Association by Paine Webber. Gulf Publishing Company Houston.
- Drug Carriers in biology & Medicine Edt. by Gregory Gregoriadis. Academic Press New York.



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Paper Code	Course Title	Credits
BSCBT-304	ORGANIC CHEMISTRY	6(3-1-2)

## OBJECTIVES

The syllabus is designed to build theoretical and practical background of Organic chemistry.

## THEORY

### Unit I Phenols

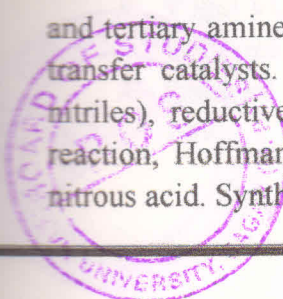
Nomenclature, structure and bonding, Preparation of phenols, physical properties and acidic character. Comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols - electrophilic aromatic substitution, acylation and carboxylation. Mechanisms of Fries rearrangement, Claisen rearrangement, Gatterman synthesis, Houben-Hoesch reaction. Lederer-Manasse reaction and Reimer-Tiemann reaction. Ethers and Epoxides : Nomenclature of ethers and methods of their formation, physical properties. Chemical reactions - cleavage and autoxidation, Ziesel's method. Synthesis of epoxides. Acid and base-catalyzed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and organolithium reagents with epoxides.

### Unit II Carboxylic Acids

Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Preparation of carboxylic acids. Reactions of carboxylic acids. Hell-Volhard-Zelinsky reaction. Synthesis of acid chlorides, esters and amides. Reduction of carboxylic acids. Mechanism of decarboxylation, methods of formation and chemical reactions of unsaturated monocarboxylic acids. Dicarboxylic acids; methods of formation and effect of heat and dehydrating agents, haloacids, hydroxy acids- Malic, tartaric & citric acid. Carboxylic Acid Derivatives Structure and nomenclature of acid chlorides, esters, amides (urea) and acid anhydrides. Relative stability of acyl derivatives. Physical properties, interconversion of acid derivatives by nucleophilic acyl substitution. Preparation of carboxylic acid derivatives, chemical reactions, Mechanisms of esterification and hydrolysis (acidic and basic).

### Unit III Organic Compounds of Nitrogen

Preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes and their reductions in acidic, neutral and alkaline media. Halonitroarenes: reactivity. Structure and nomenclature of amines, physical properties, separation of a mixture of primary, secondary and tertiary amines. Structural features effecting basicity of amines. Amine salts as phase-transfer catalysts. Preparation of alkyl and aryl amines (reduction of nitro compounds, nitriles), reductive amination of aldehydic and ketonic compounds. Gabriel-Phthalamide reaction, Hoffmann bromamide reaction. Reactions of amines, reactions of amines with nitrous acid. Synthetic transformation so farly ldiazonium salts, azo coupling.



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## Unit IV Heterocyclic Compounds

Introduction: Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reactions in pyridine derivatives. Comparison of basicity of pyridine, piperidine and pyrrole. Introduction to condensed five and sixmembered heterocycles. Preparation and reactions of Indole, quinoline and isoquinoline with special reference to Fischer indole synthesis, Skraup synthesis and Bischler-Napieralski synthesis. Mechanism of electrophilic substitution reactions of indole, quinoline and isoquinoline.

## Unit V Synthetic Polymers

Addition or chain-growth polymerization. Free radical vinyl polymerization, ionic vinyl polymerization, Ziegler-Natta polymerization and vinyl polymers. Condensation or step growth polymerization. Polyesters, polyamides, phenol formaldehyde resins, urea formaldehyde resins, epoxy resins and polyurethanes. Natural and synthetic rubbers.

## PRACTICAL

1. Identification of an organic compound systematically.
2. Qualitative analysis of organic mixture containing two solid component using water, NaOH, NaHCO<sub>3</sub> for separation, prepare suitable derivative
3. Identification of sugars and organic acids.
4. Test for proteins and aminoacids.
5. Test for fats, fatty acids, acids and saponification.
6. Identification of phenol, acids, carbonyl compounds, hydrocarbons.

## SUGGESTED READINGS

- J. D. Lee: A new Concise Inorganic Chemistry, E L. B. S.
- F. A. Cotton & G. Wilkinson: Basic Inorganic Chemistry, John Wiley.
- Douglas, McDaniel and Alexader: Concepts and Models in Inorganic Chemistry, John Wiley.
- James E. Huheey, Ellen Keiter and Richard Keiter: Inorganic Chemistry: Principles of Structure and Reactivity, Pearson Publication.
- T. W. Graham Solomon: Organic Chemistry, John Wiley and Sons.
- Peter Sykes: A Guide Book to Mechanism in Organic Chemistry, Orient Longman.
- E. L. Eliel: Stereochemistry of Carbon Compounds, Tata McGraw Hill.
- I. L. Finar: Organic Chemistry (Vol. I & II), E. L. B. S.
- R. T. Morrison & R. N. Boyd: Organic Chemistry, Prentice Hall.
- Arun Bahl and B. S. Bahl: Advanced Organic Chemistry, S. Chand
- Vogel's Qualitative Inorganic Analysis, A.I. Vogel, Prentice Hall, 7th Edition.
- Vogel's Quantitative Chemical Analysis, A.I. Vogel, Prentice Hall, 6th Edition.
- Textbook of Practical Organic Chemistry, A.I. Vogel, Prentice Hall, 5th edition.
- Practical Organic Chemistry, F. G. Mann. & B. C. Saunders, Orient Longman, 1960.



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## Unit IV Heterocyclic Compounds

Introduction: Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reactions in pyridine derivatives. Comparison of basicity of pyridine, piperidine and pyrrole. Introduction to condensed five and sixmembered heterocycles. Preparation and reactions of Indole, quinoline and isoquinoline with special reference to Fischer indole synthesis, Skraup synthesis and Bischler-Napieralski synthesis. Mechanism of electrophilic substitution reactions of indole, quinoline and isoquinoline.

## Unit V Synthetic Polymers

Addition or chain-growth polymerization. Free radical vinyl polymerization, ionic vinyl polymerization, Ziegler-Natta polymerization and vinyl polymers. Condensation or step growth polymerization. Polyesters, polyamides, phenol formaldehyde resins, urea formaldehyde resins, epoxy resins and polyurethanes. Natural and synthetic rubbers.

## PRACTICAL

1. Identification of an organic compound systematically.
2. Qualitative analysis of organic mixture containing two solid component using water, NaOH, NaHCO<sub>3</sub> for separation, prepare suitable derivative
3. Identification of sugars and organic acids.
4. Test for proteins and aminoacids.
5. Test for fats, fatty acids, acids and saponification.
6. Identification of phenol, acids, carbonyl compounds, hydrocarbons.

## SUGGESTED READINGS

- J. D. Lee: A new Concise Inorganic Chemistry, E L. B. S.
- F. A. Cotton & G. Wilkinson: Basic Inorganic Chemistry, John Wiley.
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- James E. Huheey, Ellen Keiter and Richard Keiter: Inorganic Chemistry: Principles of Structure and Reactivity, Pearson Publication.
- T. W. Graham Solomon: Organic Chemistry, John Wiley and Sons.
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- E. L. Eliel: Stereochemistry of Carbon Compounds, Tata McGraw Hill.
- I. L. Finar: Organic Chemistry (Vol. I & II), E. L. B. S.
- R. T. Morrison & R. N. Boyd: Organic Chemistry, Prentice Hall.
- Arun Bahl and B. S. Bahl: Advanced Organic Chemistry, S. Chand
- Vogel's Qualitative Inorganic Analysis, A.I. Vogel, Prentice Hall, 7th Edition.
- Vogel's Quantitative Chemical Analysis, A.I. Vogel, Prentice Hall, 6th Edition.
- Textbook of Practical Organic Chemistry, A.I. Vogel, Prentice Hall, 5th edition.
- Practical Organic Chemistry, F. G. Mann. & B. C. Saunders, Orient Longman, 1960



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# Swami Vivekanand University, Sagar (M.P.)

Paper Code	Course Title	Credits
BSCBT-305	FOOD MICROBIOLOGY	6(3-1-2)

## OBJECTIVES

To acquire an elementary knowledge about the aspects of interaction between micro organisms, food borne illness and food fermentation.

## THEORY

### Unit I

**Introduction to microbiology:** Microbiology in daily life, Characteristics and morphology of bacteria, fungi, virus, protozoa and algae. Control of micro-organisms- Growth curve; Influence of environmental factors on growth- PH, Water activity, O<sub>2</sub> availability, Temperature, Pressure and Radiation.

### Unit II

**Principles, physical methods of food preservation:** temperature (low, high, canning, drying), irradiation, hydrostatic pressure, high voltage pulse, microwave processing and aseptic packaging, chemical methods of food preservation: salt, sugar, organic acids, SO<sub>2</sub>, nitrite and nitrates, ethylene oxide, antibiotics and bacteriocins. HACCP.

### Unit III

**Contamination and spoilage of different foods:** Cereals, sugar and their products, Milk and milk products, Fruits and vegetables, canned foods, Meat, fish, egg and poultry.

### Unit IV

**Food borne illness:** Food intoxication- Staphylococcal intoxication, botulism Food infection- *Salmonellosis*, *Clostridium perfringens*, *Bacillus cereus gastroenteritis*, *E.coli* infection, *Yersinia enterocolitica*, *Listeria monocytogenes* and *Campylobacter jejuni* and others.

### Unit V

**SCP-** Microorganisms used, raw materials used as substrate, condition for growth and production, nutritive value and use of SCP; Fat from microorganisms- Microorganisms used raw materials, production of fat; Production of amino acids; Production of other substances added to foods. Production of enzymes- amylases, invertase, pectolytic enzymes, proteolytic enzymes, other enzymes.



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# Swami Vivekanand University, Sagar (M.P.)



Scheme- Fifth Semester

B.Sc. Biotechnology (Hons.) Course Code: BSCBT

## SUBJECT WISE DISTRIBUTION OF MARKS AND CORRESPONDING CREDITS

Paper Code	Paper Name	Period per week			Credit	Theory				Practical			Grand Total	Remarks
		L	T	P		Final Semester	CCE	Total Marks		Total Marks				
								Max	Min	Max	Min			
BSCBT-501	Cell Biology and Genetics	3	1	0	4(3-1-0)	80	20	100	40	-	-	100		
BSCBT-502	Introduction to Bio-nanotechnology	3	1	0	4(3-1-0)	80	20	100	40	-	-	100		
BSCBT-503	Genomics and Proteomics	3	1	0	4(3-1-0)	80	20	100	40	-	-	100		
BSCBT-504	Plant Diversity	3	1	2	6(3-1-2)	80	20	100	40	50	25	150		
BSCBT-505	Plant Physiology	3	1	2	6(3-1-2)	80	20	100	40	50	25	150		
BSCBT-506	Climate Change & Remedial Technologies	3	1	0	4(3-1-0)	80	20	100	40	-	-	100		
BSCBT-507	Waste Management	3	1	0	4(3-1-0)	80	20	100	40	-	-	100		
BSCBT-508	Biotechnology Lab-V	0	0	2	2(0-0-2)	-	-	-	-	50	25	50		
Total Credits					34(21-7-6)	Total Marks							850	

Minimum Marks for passing in End Semester Theory-- 40%

Minimum Marks for passing in End Semester Practical -- 50%



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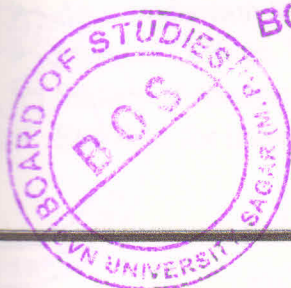


## PRACTICAL

1. Microbiology laboratory basic rules and requirements:
2. Laboratory rules- basic rules of a microbiology lab
3. Basic requirements of a microbiological lab- common glass ware; test tube, culture tube and screw capped tubes, Petri dish, pipette, Pasteur pipette, glass spreader, inoculation needle, busen burner, water bath, autoclave, laminar air flow, incubator, hot air oven, quebec colony counter, centrifuge, microscope.
4. Disposal of laboratory waste and culture.
5. Staining of microorganisms
6. Composition, preparation and sterilization of media:
7. Demonstration of techniques for pure culture of microorganisms:
8. Streak plate method
9. Pour plate method
10. Serial dilution agar plate method
11. Microbiology testing of milk

## SUGGESTED READINGS

- Frazier, W.C. Food Microbiology. 4th edition. McGraw Hill. New York,
- Khetarpaul, N. Food microbiology, Daya publishing house, New Delhi,
- Narayanan, L.M. and ManiL. Microbiology.Saras Publications, Nagercoil.
- Pelzar, H.J. and Rober, D. Microbiology 5th edition McGraw Hill. NewYork.
- Prescott, L.M., Harley, J.P. and Klein, D.A. Microbiology. 4th edition McGraw-Hill, NewYork.



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Paper Code	Course Title	Credits
BSCBT-306	FUNDAMENTALS OF BIostatISTICS AND COMPUTER APPLICATIONS	4(3-1-0)

## OBJECTIVES

To acquire an elementary knowledge about the aspects of biostatistics and computer application for undergraduate students of Biotechnology.

## THEORY

### Unit I

Introduction to biostatistics and its application, sampling: random and non random sampling, sampling errors and non sampling errors, frequency distribution, Definition and basic properties of probability and probability distribution- normal and binomial distribution.

### Unit II

Measures of central tendency: calculation of arithmetic mean, median and mode, merits and demerits of mean, median and mode, measures of dispersion: range, mean deviation and standard deviation. T-test for small sample, properties and its application, chi-square test.

### Unit III

Introduction to computer, block diagram of computer, input and output devices of computer, primary and secondary memory,

### Unit IV

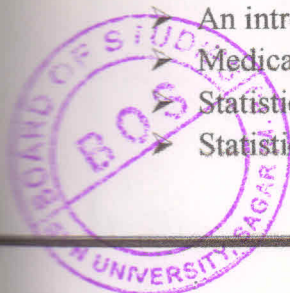
MS Office Packages: MS Word- general operation on file, formatting of document, mail merge, MS Excel- introduction to excel sheet, basic functions, charts, data filter and sorting.

### Unit V

MS Power Point- creating a slide and presentation, slide animation, custom animation, introduction to internet and intranet, E-mail services, WWW and web browsers, search engines.

## SUGGESTED READINGS

- Computer Science, J.G. Brookshear, Pearson, Addison Wesley
- Biostatistic, Dannel, W.W., 1987. New York, John Wiley Sons.
- An introduction to Biostatistics, 3rd edition, Sundarrao, P.S.S and Richards, J. Christian Medical College, Vellore
- Statistical Analysis of epidemiological data, Selvin, S., 1991. New York University Press.
- Statistics for Biology, Boston, Bishop, O.N. Houghton Mifflin.



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# Swami Vivekanand University, Sagar (M.P.)

Paper Code	Course Title	Credits
BSCBT-307	FUNCTIONAL ENGLISH-II	4(3-1-0)

## OBJECTIVES

Grammar is vital for the efficient use of language in academic as well as social environment. You already know that our speech is made up of sentences. A sentence is the basic unit of the written and spoken language. In this unit we will learn about various structural and functional parts of the sentence, their types, subtypes and their usage.

## THEORY

### Unit I

Subject verb Agreement, Adjectives and Comparison of Adjectives, Determiner.

### Unit II

Introduction to Prepositions (Use and omission), Preposition of travel and movement, Preposition of Date and Time, Relations expressed by Preposition, Words followed by preposition, Finite and Non Finite Clauses & Uses of Let.

### Unit III

Conjunction: Co-ordinating and Subordinating, Sentences: Simple, Compound and Complex.

### Unit IV

Statement: Direct & Indirect, Phrasal Verb, Antonyms, Synonyms, Letter Writing: Formal (Parts & Layout).

### Unit V

**Communication:** Definition & Meaning of Communication, Importance & Process, Types: Verbal & Non-Verbal, Barriers, and how to overcome these barriers.

## SUGGESTED READINGS

- Thomson, A.J and A.V. Martinet. *A Practical English Grammar*. Oxford University Press: New York.
- Wren and Martin. *High School English Grammar and Composition*. S.Chand & Company Pvt. Ltd. : New Delhi
- Greenbaum, Sidney. *Oxford English Grammar*. Oxford University Press: New York.
- Rudzka-Ostyn, Brygida. (2003) *Word Power: Phrasal Verbs and Compounds*. Mouton de Gruyter, Berlin: New York
- Chambers Dictionary of Antonyms & Synonyms
- Hudson, Richard. *English Grammar*. Routledge: New York.
- Rodrigues, M.V. *Effective Business Communication*. Concept Publishing Company: New Delhi.
- Raman, Meenakshi & Sangeeta Sharma. *Communication Skills*. Oxford University Press



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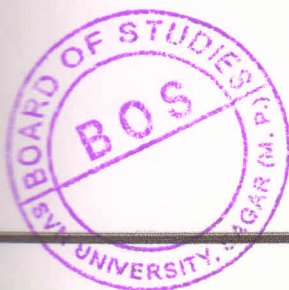
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# Swami Vivekanand University, Sagar (M.P.)

Paper Code	Course Title	Credits
BSCBT-308	BIOTECHNOLOGY LAB-III	2(0-0-2)

(As per the guidelines of above mention subjects)



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# Swami Vivekanand University, Sagar (M.P.)



## Scheme- Fourth Semester B.Sc. Biotechnology (Hons.) Course Code: BSCBT

### SUBJECT WISE DISTRIBUTION OF MARKS AND CORRESPONDING CREDITS

Paper Code	Paper Name	Period per week			Credit	Theory				Practical		Grand Total	Remarks
		L	T	P		Final Semester	CCE	Total Marks	Max	Min	Total Marks	Max	Min
BSCBT-401	Genetic Engineering-Tools and application	3	1	0	4(3-1-0)	80	20	100	40	-	-	100	
BSCBT-402	Bioprocess Engineering	3	1	0	4(3-1-0)	80	20	100	40	-	-	100	
BSCBT-403	Enzymology	3	1	0	4(3-1-0)	80	20	100	40	-	-	100	
BSCBT-404	Industrial Chemistry	3	1	2	6(3-1-2)	80	20	100	40	50	25	150	
BSCBT-405	Environmental Biotechnology	3	1	0	4(3-1-0)	80	20	100	40	-	-	100	
BSCBT-406	Applied Biology Sciences	3	1	2	6(3-1-2)	80	20	100	40	50	25	150	
BSCBT-407	Hindi-II	3	1	0	4(3-1-0)	80	20	100	40	-	-	100	
BSCBT-408	Biotechnology Lab-IV	0	0	2	2(0-0-2)	-	-	-	-	50	25	50	
Total Credits					34(21-7-6)	Total Marks					850		

Minimum Marks for passing in End Semester Theory- 40%  
Minimum Marks for passing in End Semester Practical - 50%



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Paper Code	Course Title	Credits
BSCBT-401	GENETIC ENGINEERING- TOOLS AND APPLICATION	4(3-1-0)

## OBJECTIVES

The subject Recombinant DNA Technology is designed for under graduate students of biotechnology for understanding of basic concepts of gene cloning and various tools used in Recombinant DNA Technology or genetic engineering.

## THEORY

### Unit I

Applications of RDT, Production of recombinant protein (Insulin, Growth hormone), production of Recombinant vaccine. Golden rice, Artificial seed production, biofertilizers and biopesticide production, GM crops and GM food etc

### Unit II

Introduction to gene cloning and its necessity: DNA modifying enzymes: Restriction enzymes (RE)- structure function and types, polymerase, kinases, ligase, alkaline phosphatase, exonuclease etc.. Cloning methods. linkers and adaptors.

### Unit III

Isolation and purification of genomic DNA from bacterial, plant and animal cells Isolation and purification of plasmid DNA from bacterial cells, methods of introduction of DNA into living cells, *E.coli*, plant and animal cells.

### Unit IV

Cloning vectors: Plasmids and Bacteriophages, Phagemids, Cosmids, Artificial chromosomes (BAC and YAC) for *E.coli*, yeast. Strategies for identification of recombinant clones containing cloned genes: Nucleic acid hybridization, immune screening etc. Expression vectors for *E.coli* and Yeast.

### Unit V

DNA sequencing techniques- Maxam-Gilbert's method, Sanger's Dideoxy method, Tools for RDT: Restriction mapping, Southern and northern blotting, Forensic application of biotechnology: DNA fingerprinting and its applications, forensic medicine



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## PRACTICAL EXERCISE\*

(\*Practicals are conducted as Biotechnology Lab with separate credits (02 credits))

1. Preparation of stock and buffer solutions for DNA isolation
2. Isolation of DNA from yeast cells.
3. Isolation of DNA from plant tissue
4. Isolation of plasmid DNA
5. Agarose gel electrophoresis of Genomic DNA
6. Quantification of DNA by spectrophotometer (260/280nm)
7. Isolation of RNA
8. Estimation of Chlorophyll content from leaves through spectrophotometer.

## SUGGESTED READINGS

- Gene cloning – by T.A. Brown
- Molecular Biology of the Gene: Waston J. D.
- Molecular Biotechnology: Glick
- DNA Cloning – A Practical approach: D. M. Glover and B. D. ames
- Principles of Gene Manipulation and Genomics – Primrose and Twyman



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Paper Code	Course Title	Credits
BSCBT-402	BIOPROCESS ENGINEERING	4(3-1-0)

## OBJECTIVES

The subject bioprocess engineering is designed for understanding of basic concepts of different techniques used for the production of microbial products in industries as well as extraction, purification and transport of different metabolites from one place to another.

## THEORY

### Unit I

Units and dimensions, types of variables and their applications, stoichiometric and composition relationship, Newton's law of viscosity and its measurement. Introduction to bioprocess technology.

### Unit II

Kinetics of microbial growth, death and product synthesis, Air and media sterilization, types of bioreactor, Kinetics of batch and continuous reactor. Transport phenomenon: Mass transfer, heat transfer and rheology. Techniques: centrifugation, chromatography, extraction crystallization, drying.

### Unit III

Microbial production of Antibiotics: Penicillin and Enzymes: Amylase with applications. Microbial Production of Vitamin B12, amino acids (Glutamic acid), Organic acids (Citric acid) and solvents (Ethanol).

### Unit IV

Aeration and agitation, Immobilization techniques and their applications, Microbial production of food-SCP, Product recovery processes.



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## PRACTICAL EXERCISE\*

(\*Practicals are conducted as Biotechnology Lab with separate credits (02 credits))

1. Production of alcohol using different substrates and its downstream process.
2. Isolation of industrially important microbes from the environment.
3. Media balancing experiments.
4. Isolation of Industrially important microorganisms for microbial processes.
5. Microbial production of citric acid using *Aspergillus niger*.
6. Microbial production of acetic acid.
7. Organic Solvent production.
8. Use of alginate for cell immobilization.

## SUGGESTED READINGS

- Bioprocess Engg. Principles, P.M. Doran, Elsevier.
- Principles of Fermentation Technology, Peter F. Stanbury, Allan
- Whitaker, Stephen Hall, Pergamon.
- Bioprocess Engg., Schuler, Kargi
- Biochemical Engineering, Aiba S., Humphrey AE, Millis NF. Univ. Tokyo Press, Tokyo
- Biochemical Reactors, Atkinson B., Pion Ltd London.
- Biochemical Engineering Fundamentals, Baily JE and Ollis DF. McGraw Hill Book Cooperation, New York.



  
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Paper Code	Course Title	Credits
BSCBT-403	ENZYMOLGY	4(3-1-0)

## OBJECTIVES

The subject Enzyme Technology is a specialized paper designed for undergraduate students of B.Sc. Biotechnology to expose them to the concepts of enzyme kinetics, purification and significance enzymes in physiology, biochemistry, molecular biology, genetic engineering as well as industrial applications.

## THEORY

### Unit I

Introduction to enzymes. Historical aspect of enzymes. Chemical nature and properties of enzymes. Classification and nomenclature of enzymes. Enzyme Commission Number. Enzyme Models: Fischer's Lock and key and Koshland's Induced fit hypothesis. Factors affecting enzyme activity.

### Unit II

Mechanism of enzyme action (active site, chemical modification) and regulation (Zymogens, Isozymes). Enzyme specificity, Coenzymes and Cofactors Allosterism: Allosteric regulation of enzymes, Covalently Modulated Regulatory Enzymes.

### Unit III

Enzyme Catalysis and types. Free energy of activation and effect of catalyst. Enzyme kinetics: Kinetics of enzyme catalysed Reactions: The MichaelisMenten Equation. Line Weaver Burk Plot. Significance of  $K_m$  and  $V_{max}$ .

### Unit IV

Enzyme purification, Isolation of enzymes, Homogenization techniques. Purification and large-scale production of enzymes, Stable storage of enzymes,

### Unit V

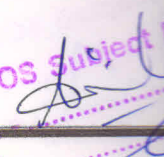
Immobilization of enzymes, Methods, Advantages and disadvantages. Applications of enzymes in food and beverage industries, leather industries, textile industries. Diagnostic enzymology,



  
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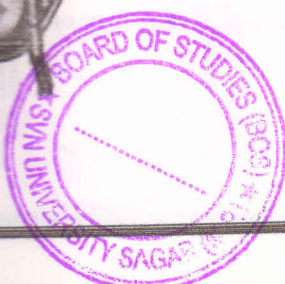


## Scheme- Sixth Semester B.Sc. Biotechnology (Hons.) Course Code: BSCBT

### SUBJECT WISE DISTRIBUTION OF MARKS AND CORRESPONDING CREDITS

Paper Code	Paper Name	Period per week			Credit	Theory				Practical			Grand Total	Remarks
		L	T	P		Final Semester	CCE	Total Marks		Total Marks	Total Marks			
								Max	Min		Max	Min		
BSCBT-601	Bioethics; IPR; Scientific Writing & Bio-entrepreneurship	3	1	0	4(3-1-0)	80	20	100	40	-	-	-	100	
BSCBT-602	Field work, Study Tour/Industrial Visit	0	0	2	2(0-0-2)	-	-	-	-	50	25	-	50	
BSCBT-603	Disaster Management	3	1	0	4(3-1-0)	80	20	100	40	-	-	-	100	
BSCBT-604	Seminar	0	0	4	4(0-0-4)	-	-	-	-	100	60	-	100	
BSCBT-605	Major Project	0	0	6	6(0-0-6)	-	-	-	-	150	90	-	150	
Total Credits					20(6-2-12)					Total Marks			500	

Minimum Marks for passing in End Semester Theory- 40%  
Minimum Marks for passing in End Semester Practical ~ 50%



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## PRACTICAL EXERCISE\*

(\*Practicals are conducted as Biotechnology Lab with separate credits (02 credits))

- BSCBT-4
1. To assay total protein by Folin Lowry Method
  2. To assay transaminases in the given sample.
  3. To assay the activity of Urease enzyme in the legumes.
  4. To assay inorganic phosphatase by Fiske and Subbarow method.
  5. Estimation of bilirubin (Total, Direct and Indirect)

## SUGGESTED READINGS

- Lehninger, A.L. Biochemistry Kalyani Publishers.
- Enzymes by Trevor Palmer.
- Satyanarayana U, Chakrapani U Biochemistry IV Edition.
- An introduction to Practical Biochemistry David T. Plummer
- Laboratory manual in Biochemistry EA Stroev, VG Makarova





  
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Paper Code	Course Title	Credits
BSCBT-404	INDUSTRIAL CHEMISTRY	6(3-1-2)

## OBJECTIVES

The subject Industrial Chemistry is a specialized paper designed for undergraduate students of B.Sc. Biotechnology to expose them to the concepts of chemistry involve in Industry and its application.

## THEORY

### Unit I

Chemical Technology Basic principles of distillation, solvent extraction, solid-liquid leaching and liquidliquid extraction, separation by absorption and adsorption. An introduction into the scope of different types of equipment needed in chemical technology, including reactors, distillation columns, extruders, pumps, mills, emulgators. Scaling up operations in chemical industry. Introduction to clean technology.

### Unit II

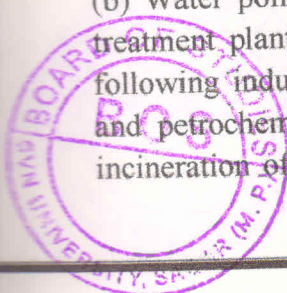
Industrial Gases and Inorganic Chemicals (a) Industrial Gases: Large scale production, uses, storage and hazards in handling of the following gases: oxygen, nitrogen, argon, neon, helium, hydrogen, acetylene, carbon monoxide, chlorine, fluorine, sulphur dioxide and phosgene. (b) Inorganic Chemicals: Manufacture, application, analysis and hazards in handling the following chemicals: hydrochloric acid, nitric acid, sulphuric acid, caustic soda, common salt, borax, bleaching powder, sodium thiosulphate, hydrogen peroxide, potash alum, chrome alum, potassium dichromate and potassium permanganate.

### Unit III

Industrial Metallurgy Preparation of metals (ferrous and nonferrous) and ultra pure metals for semiconductor technology. 3. Environment (a) Air Pollution: Pollutants and their sources, pollution by SO<sub>2</sub>, CO<sub>2</sub>, CO, NO<sub>x</sub>, H<sub>2</sub>S and other foul smelling gases. Methods of estimation of CO, NO<sub>x</sub>, SO<sub>x</sub> and control procedures. Green House effect and Global warming, Ozone depletion by oxides of nitrogen, chlorofluorocarbons and Halogens, removal of sulphur from coal. Control of particulates.

### Unit IV

(b) Water pollution and Water Quality Standards: Pollutants and their sources, Effluent treatment plants (primary, secondary and tertiary treatment). Industrial effluent from the following industries and their treatment: electroplating, textile, tannery, dairy, petroleum and petrochemicals, agro, fertilizer, etc. Sludge disposal. Industrial waste management, incineration of waste. Water treatment and purification (reverse osmosis, electro dialysis,



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ion exchange). Water quality parameters for waste water, industrial water and domestic water.

## PRACTICAL

1. Determination of dissolved oxygen in water.
2. Determination of Chemical Oxygen Demand (COD)
3. Determination of Biological Oxygen Demand (BOD)
4. Percentage of available chlorine in bleaching powder.
5. Measurement of chloride, sulphate and salinity of water samples by simple titration method. ( $\text{AgNO}_3$  and potassium chromate)
6. Estimation of total alkalinity of water samples ( $\text{CO}_3$ ,  $\text{HCO}_3$ ) using double titration method.
7. Measurement of dissolved  $\text{CO}_2$ .
8. Study of some of the common bio-indicators of pollution.
9. Estimation of SPM in air samples. 10. Preparation of borax/ boric acid.

## SUGGESTED READINGS

- E. Stocchi: Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK.
- R.M. Felder, R.W. Rousseau: Elementary Principles of Chemical Processes, Wiley Publishers, New Delhi.
- J. A. Kent: Riegel's Handbook of Industrial Chemistry, CBS Publishers, New Delhi.
- S. S. Dara: A Textbook of Engineering Chemistry, S. Chand & Company Ltd. New Delhi.
- A. K. De, Environmental Chemistry: New Age International Pvt, Ltd, New Delhi.
- S. M. Khopkar, Environmental Pollution Analysis: Wiley Eastern Ltd, New Delhi



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Paper Code	Course Title	Credits
BSCBT-404	IENVIRONMENTAL BIOTECHNOLOGY	4(3-1-0)

## OBJECTIVES

The objective of this subject is to provide knowledge of microorganisms and their role in Environment and ecosystem.

## THEORY

### Unit I

Biochemistry: Introduction, Lipids, sugars, polysaccharides, nucleotides, RNA, DNA, amino acids, proteins, hybrid biochemicals, hierarchy of cellular organisms.

### Unit II

Multiple interacting microbial populations: Neutralism, mutualism, commensualism and amensalism. Classification of interaction between two species. Bioconcentration, bio/geomagnification.

### Unit III

Biotechnology: Introduction to microbial biotechnology, uses of enzymes and biomass production, isolation and purification of enzyme engineering, Sewage treatment using microbial systems, nitrogen fixing and pollutant degrading genes, bio-control agents.

### Unit 4

Uses of microbes: Isolating and culturing of microorganisms, production of organic compounds like, ethanol and acetone by microbial fermentation, production of enzymes by microorganism.

### Unit 5

Specific biotechnological applications to: Pollution control, restoration of degraded lands, freecells and immobilized cell technology for wastewater treatment aerobic and anaerobic digestion, biogas from wastes. biotechniques for air pollution abatement and odour control.

## SUGGESTED READINGS

- Environmental Microbiology, W.D. Grant & P.E. Long, Blakie, Glassgow and London.
- Environmental Biotechnology by Bruce Rittmann and Perry McCarty
- Environmental biotechnology, 1995 S.N.Jogdand. Himalaya Publishing House, Bombay, Delhi, Nagpur.
- Bioremediation 1994 Baker, K.H.and Herson, D.S. McGraw Hill, Inc.New York.



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Paper Code	Course Title	Credits
BSCBT-406	APPLIED BIOLOGY SCIENCES	6(3-1-2)

## OBJECTIVES

The objective of this paper is to introduce students to applied aspects of biological sciences such as aquaculture and agriculture- basic principles and practices.

## THEORY

### Unit I

Aim, scope and prospects of Aquaculture. Frog Culture, Prawn culture, Pearl culture and Poly culture.

### Unit II

Aim, scope and prospects of Pisces culture, Edible pearl oyster, Edible fishes, Carp culture, and Economic importance of fishes

### Unit III

Apiculture and Lac culture

### Unit IV

Bioindicators, Allergy and allergens, Allelopathy and Organic Farming

### Unit V

Breeding for disease resistance, crop improvement and crop evolution. Deforestation and its effect on environment, impact of climatic change. Applications of plant growth regulators in agriculture, brassinosteroids. Methods of plant propagation, Synthetic seeds and their economic and commercial aspects.

## PRACTICAL

1. Isolation of Rizobium from root nodule
2. Organic Farming
3. Edible pearl oyster, Edible fishes, Carp culture
4. Aquarium maintenance
5. Frog Culture, Prawn culture, Pearl culture
6. Identification of fishes and planktons.

## SUGGESTED READINGS

- Joshi, M. 2012 Organic farming
- Kochar. 2009 Economic botany in the tropics. Macmillan publishing.
- Nickell, L.G. 1983 Plant growth regulating chemicals volume 1 CRC press
- Stickney, R.R. 2005 Aquaculture: An introductory text CABI press.
- Vedanthan, P.K., Nelson, H.S., Agash, S.N., Mahesh, P.A. and Katial R. 2014 Allergy for the clinician. CRC Press



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Paper Code	Course Title	Credits
BSCBT-407	HINDI-II	4(3-1-0)

Unit-I	हिन्दी भाषा
	1. वह तोड़ती पत्थर (कविता) - सूर्यकांत त्रिपाठी निराला
	2. दिमागी गुलामी (निबंध) - राहुल सांकृत्यायन
	3. वर्ण - विचार (स्वर - व्यंजन, वर्गीकरण, उच्चारण स्थान)
Unit-II	हिन्दी भाषा
	1. नारीत्व का अभिशाप (निबंध)
	2. चीफ की दावत (कहानी)
	3. विराम चिन्ह
Unit-III	हिन्दी भाषा
	1. चली फगुनाहट बौर आम (ललित निबंध) विवेकी राय
	2. इंद्रधनुष का रहस्य (वैज्ञानिक लेख) - डॉ कपूर मल जैन
	3. संधि (संकलित)
Unit-IV	हिन्दी भाषा
	1. सपनों की उड़ान (प्रेरक निबंध) - ए. पी. जे. अब्दुल कलाम
	2. हमारा सौर मण्डल (संकलित)
	3. प्रमुख वैज्ञानिक आविष्कार (संकलित)
	4. समास (संकलित)
Unit-V	नैतिक मूल्य
	1. शिकागो व्याख्यान (व्याख्यान) - स्वामी विवेकानंद
	2. धर्म और राष्ट्रवाद - (लेख) महर्षि अरविन्द
	3. सादगी (आत्मकथा) - महात्मा गाँधी
	4. वित्त जहाँ भव शून्य (कविता) रवीन्द्रनाथ टैगोर



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# Swami Vivekanand University, Sagar (M.P.)

Paper Code	Course Title	Credits
BSCBT-408	BIOTECHNOLOGY LAB-IV	2(0-0-2)

(As per the guidelines of above mention subjects)



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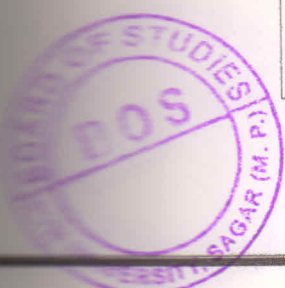


## Scheme- Fifth Semester B.Sc. Biotechnology (Hons.) Course Code: BSCBT

### SUBJECT WISE DISTRIBUTION OF MARKS AND CORRESPONDING CREDITS

Paper Code	Paper Name	Period per week			Credit	Theory					Practical		Grand Total	Remarks
		L	T	P		Final Semester	CCE	Total Marks		Total Marks				
BSCBT-501	Cell Biology and Genetics	3	1	0	4(3-1-0)	80	20	100	40	-	-	100		
BSCBT-502	Introduction to Bio-nanotechnology	3	1	0	4(3-1-0)	80	20	100	40	-	-	100		
BSCBT-503	Genomics and Proteomics	3	1	0	4(3-1-0)	80	20	100	40	-	-	100		
BSCBT-504	Plant Diversity	3	1	2	6(3-1-2)	80	20	100	40	50	25	150		
BSCBT-505	Plant Physiology	3	1	2	6(3-1-2)	80	20	100	40	50	25	150		
BSCBT-506	Climate Change & Remedial Technologies	3	1	0	4(3-1-0)	80	20	100	40	-	-	100		
BSCBT-507	Waste Management	3	1	0	4(3-1-0)	80	20	100	40	-	-	100		
BSCBT-508	Biotechnology Lab-V	0	0	2	2(0-0-2)	-	-	-	-	50	25	50		
Total Credits					34(21-7-6)	Total Marks						850		

Minimum Marks for passing in End Semester Theory- 40%  
Minimum Marks for passing in End Semester Practical - 50%



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Paper Code	Course Title	Credits
BSCBT-501	CELL BIOLOGY AND GENETICS	4(3-1-0)

## OBJECTIVES

The objective of this paper is to introduce role of Cell biology and Genetics in modern science for B.Sc. Biotechnology students.

## THEORY

### Unit I

Cell as basic unit of living System: Pre-cellular evolution, cell theory, ultra structure of cell types (P.F.L.O.s, bacteria, plant and animals cell), tools and techniques of cell biology.

### Unit II

Ultrastructure of cell membrane, structure and function of cell organelles, golgibodies, cytosol, endoplasmic reticulum, ribosome, mitochondria, peroxisomes, nucleus, cytoskeleton structure intermediate filament, microtubules, actin filament, cilia and centrioles.

### Unit III

Cell division and cycle: Mitosis, meiosis, cell cycle regulation, cell junctions, cell adhesion and extracellular matrix, programmed cell death, cell signaling, signaling molecules and their receptor. Intracellular signal transduction pathway, signaling network.

### Unit IV

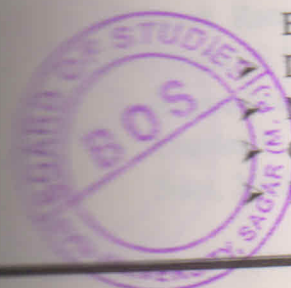
Mendelian Genetics: Mendal and his experiment, Multiple alleles, Chromosomal theory of inheritance, Interaction of genes- Intragenic and Intergenic Interaction, Incomplete dominance lethal genes, Complementary genes, Supplementary genes, inhibitory genes, duplicate genes, epistatic genes and population genetics.

### Unit V

Molecular organization of chromosome: Chromosome structure and organization in prokaryotes and eukaryotes, extranuclear genome, abnormal chromosome, chromosomal mutation, deletion duplication, Inversion, translocation, aneuploidy and polyploidy, linkage chromosome mapping. Crossing over, sex determination: chromosomal mechanism, environmental factors determining sex determination, Barr bodies and dosage compensation.

## SUGGESTED READINGS

- Cell & molecular biology- De Robertis B.J. publications Pvt.Ltd.
- Cell & molecular biology - Gerald karp john wills & essential cell biology Balberts D. Bray
- Developmental biology- SF Gilbert senior associates.
- Molecular Biology of Cell- Alberts, B *et al.*
- Genetics- Strickberger, 2 nd.
- Microbial Genetics – D. Frifielder.



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Paper Code	Course Title	Credits
BSCBT-502	INTRODUCTION TO BIO-NANOTECHNOLOGY	4(3-1-0)

## OBJECTIVES

The objective of this subject is to provide knowledge of modern techniques such as Nanotechnology and their role in biology.

## THEORY

### Unit I

#### Fundamental Concepts

Nanotechnology: Basic concepts and introduction; Nanomechanics- Nanotribology; Scanning probe microscopy; nanomaterials and its handling; nanobots and nanofuture, nanoflying Electronics, nanofibres, nanopore and nanotubes.

### Unit II

#### Production and characterization of nanoparticles

Introduction to Nanoscience Techniques used in Nanobiotechnology: Optical Microscopy, Atomic Force, Microscopy, SEM; Production of nanoparticles: Collision / Coalescence mechanism of primary particle formation, nanoparticles agglomerates & aerogels.

### Unit III Nanoparticles for Cancer Drug Delivery

Cancer and current approach to its cure through nanoparticles, characteristics of tumor tissues, drug delivery to tumors, physio-chemical properties of nanoparticles in cancer therapy, site specific delivery of chemotherapeutic agents using nanoparticles.

### Unit IV Non-viral Gene Therapy with nanoparticles

Introduction, Hyperthermia, controlled delivery of chemotherapeutic drugs, nanoparticles to circumvent MDR, potential problems using nanoparticles. Application of Nanotechnology in Agriculture, Medicine, Communication technology, Biotechnology and Bioinformatics.

### Unit V

Channel Gating Biomimetic Membranes for Biosensor Applications, Membrane Biosensors Based on Ion Channel Gating, Nanofabrication, medicine-Potential Biomedical Applications of Polymer Nanostructures.

## SUGGESTED READINGS

- Bharat Bhushan., Nanotribology and Nanomechanics - An introduction, Springer.
- Mark, Ratner Daniel Ratner, Nanobiotechnology- next big idea.
- Challa S.S.R.Kumar, Joseph Hornes, Carola Leuschner, Nanofabrication towards Biomedical applications.
- Charles P. Poole, Jr., Frank J. Owens; "Introduction to Nanotechnology", John Wiley & Sons, 2003,

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# SYLLABUS

**Bachelor of Science in Biotechnology (Hons.)**

**Faculty of Sciences**

**Department of Biotechnology**



**Study and Evaluation Scheme  
of**


**B.Sc. (Hons.) Biotechnology**

(Applicable w.e.f. Academic Session 2018 to till revised)

**Duration of Course: 03 year  
Mode of Examination: Semester**

**SWAMI VIVEKANAND  
UNIVERSITY, SIRONJA, SAGAR,  
(M.P.)**



  
**BOS Chairman**





Paper Code	Course Title	Credits
BSCBT-503	GENOMICS AND PROTEOMICS	4(3-1-0)

## OBJECTIVES

The objective of this subject is to provide fundamental knowledge of gene expression and gene therapy by covering topics such as genome mapping, proteomic techniques and new targets for drug discovery.

## THEORY

### Unit I

Genome evolution and structure: Forward genetics and Reverse genetics. Genomics history, Types of genome. Chromosome structure and organization of genome. Genome sequencing methods, Tools of genomics.

### Unit II

Comparative Genomics: Phylogenetics, Orthologous and Paralogous genes, genomic and cDNA libraries, selection and screening of library. Functional Genomics: ESTs, Microarrays tools and analysis, Application of Microarrays, PCR, Real Time PCR, Genome annotation

### Unit III

Genomics techniques and applications: Genetic and physical mapping: Introduction to molecular markers- Single nucleotide polymorphisms, RFLP, RAPD, AFLP, FISH for genome analysis, Human Genome Project, Pharmacogenomics: An introduction.

### Unit IV

Fundamentals of Proteomics: Proteomics Basics and 2D Gel Electrophoresis, Protein Identification and Analysis: Protein preparation and Separation, HRT, HART.

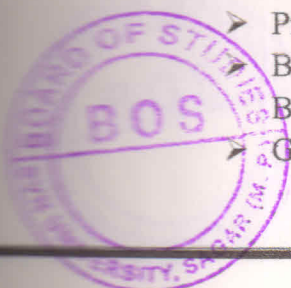
## PRACTICAL EXERCISE\*

(\*Practicals are conducted as Biotechnology Lab with separate credits (02 credits))

1. To isolate DNA from plant leaves
2. To visualize the isolated DNA using agarose gel electrophoresis
3. To isolate plasmid DNA using alkaline lysis method and Quick method and its visualization by agarose gel electrophoresis
4. To perform restriction digestion using kit and its visualization using agarose gel electrophoresis.

## SUGGESTED READINGS

- Biotechnology and Genomics by P.K.Gupta
- Biotechnology: Expanding Horizons by B.D. Singh
- Principles of Proteomics. R.M Twyman (2004). (BIOS Scientific publishers).
- Bioinformatics: A practical guide to the analysis of genes and proteins, A.D. Baxevanis and B.F.F. Ouellette, John Wiley and Sons Inc.
- Genomes II, T.A. Brown



BOS Chairman

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Paper Code	Course Title	Credits
BSCBT-504	PLANT DIVERSITY	6(3-1-2)

## OBJECTIVES

The paper is designed for understanding the basic concepts of plant diversity and evolution of plants.

## THEORY

### Unit I

Discovery, physicochemical and biological characteristics; classification, replication: Symptoms, transmission and management of viral diseases in plants. Bacteria: - General characteristics, Cell structure, nutrition, reproduction and economic importance of bacteria.

### Unit II

Algae: General Characteristics, classification and economic Importance. Thallus structure, reproduction and life cycles. Fungi: General characteristics, classification and economic importance. Thallus structure, reproduction and life cycle. General Account of Lichen.

### Unit III

Bryophyta: General characteristics; and classification. Pteridophyta: Characteristic features, classification. Stellar organization, Evolution of seed habit.

### Unit IV

Gymnosperms: Characteristic features and classification Evolution of gymnosperms. Geological time scale and origin of gymnosperms.

### Unit V

Angiosperms: Origin and evolution, Taxonomy & classifications (Bentham and Hooker, Engler and Prantl and Hutchinson classification). Phylogeny of angiosperms. Vascular organization of dicots and monocots, secondary growth, growth rings, sap wood and heart wood, cork. Structure of a typical flower, pollination, double fertilization, fruit and seed formation.



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### PRACTICAL

1. Study of the vegetative and reproductive structures in *Volvox*, *Oedogonium*, *Vaucheria*, *Ectocarpus*, *Polysiphonia*, *Nostoc* through, EM, temporary preparations and permanent slides
2. Study of thallus and reproductive structures in *Phytophthora*, *Mucor*, *Aspergillus*, *Puccinia*, *Alternaria*
3. Study of bacterial infected plants and root nodules
4. Study of habit, vegetative organization, anatomy, reproductive structure of *Riccia*/*Marchantia*/*Anthoceros* and *Polytrichum* through temporary preparations and permanent slide
5. Anatomy of dicot root, stem, leaf
6. Anatomy of monocot stem, root & leaf
7. Secondary growth of stem of *Bignonia*
8. Morphology, anatomy and reproductive structures of *Riccia*, *Marchantia*, *Anthoceros* and *Polytrichum* through temporary preparations and permanent slide

### SUGGESTED READINGS

- Alexopoulos, C. J. and C. W. Mims: Introduction to Mycology. Wiley Eastern Ltd, New Delhi
- Mehrotra, R. S. and K. R. Aneja: An introduction to Mycology. New Age International publishers
- Bold, H.C. and Wayne, M.J. 1996 (2<sup>nd</sup> Ed.) Introduction to Algae
- Cronquist, A. (1981). An Integrated System of Classification of Flowering Plants. Columbia University Press, New York.
- Esau, K. 1977 Anatomy of Seed Plants. Wiley Publishers
- Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F. and Donoghue, M.J. (2008). Plant Systematics- A Phylogenetic Approach. Sinauer Associates Inc, Massachusetts, USA.



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Paper Code	Course Title	Credits
BSCBT-505	PLANT PHYSIOLOGY	6(3-1-2)

## OBJECTIVES

The paper is designed for understanding basic concepts about physiological process occurring in plants, their mechanisms and practical applications.

## THEORY

### Unit I

Water Relations: Importance of water to plants, Permeability – related theories, diffusion, osmosis, imbibition, plasmolysis, mechanism of absorption – (active and passive). Ascent of sap. Transpiration, kinds of transpiration, mechanisms of transpiration. Mechanisms of Stomatal movement, plant antitranspirants, guttation.

Unit II Photosynthesis: Photosynthetic pigments, mechanisms of photosynthesis, photophosphorylation, Light and dark reactions, C<sub>3</sub> (Calvin cycle), C<sub>4</sub> (Hatch and Slack cycle), Factors affecting the rate of photosynthesis.

### Unit III

Respiration: Significance of respiration, types of respiration, respiration quotient, Aerobic and Anaerobic respiration, Glycolysis, Krebs's cycle, Electron transport system. Oxidative phosphorylation, pentose phosphate pathway. Factors affecting the rate of respiration.

Unit IV Mineral nutrition- Essential micro and macro nutrients, role of essential elements, their deficiency and toxicity symptoms. Assimilation of mineral nutrients. Organic Translocation: phloem sap, P-protein, phloem loading and unloading, mass flow (pressure flow) hypothesis and its critical evaluation. Stress physiology: Plant responses to water stress, temperature stress, salt stress.

Unit V Plant growth hormones – Auxins, Gibberellins, Cytokinin, Abscissic acid Brassinosteroids and Ethylene. Plant movement. Photoperiodism. Senescence, vernalisation. Seed dormancy, phytochrome and plant development.



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## PRACTICAL

1. To demonstrate the process of osmosis (Potato and Egg. Membrane)
2. To demonstrate the process of Plasmolysis.
3. To prove that chlorophyll, light and CO<sub>2</sub> are necessary for photosynthesis..
4. Experiment to show anaerobic respiration.
5. To determine the value of R. Q.
6. To demonstrate the process of transpiration among green plants.
7. Enzymes specificity: effect of temperature, heavy metals.

## SUGGESTED READINGS

- Hopkins, W.G. and Huner, P.A. 2008 Introduction to Plant Physiology. John Wiley and Sons.
- Nelson, D.L., Cox, M.M. 2004 Lehniger Principles of Biochemistry, 4<sup>th</sup> edition, W.H. Freeman and Company, New York, USA.
- Salisbury, F.B. and Ross, C.W. 1991 Plant Physiology, Wadsworth, Publishing Co. Ltd.
- Taiz, L. and Zeiger, E. 2010 Plant Physiology, 5<sup>th</sup> edition, Sinauer, Associates Inc. MA, USA.



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Paper Code	Course Title	Credits
BSCBT-506	CLIMATE CHANGE & REMEDIAL TECHNOLOGIES	4(3-1-0)

## OBJECTIVES

To acquaint the students about the impact of climate change, environmental degradation & the strategies for mitigation, development of clean technologies, laws & legislation for environmental protection.

## THEORY

### Unit I

Concept and definition: climate and climate change, component of climate system, greenhouse gases and their effects, Genesis of Climate change. Natural climate changes: Records of climate change (glacial cycles, ocean sediments, corals, tree rings etc). Global Energy balance. Human Impacts on climate.

### Unit II

Planning and Mitigation: Control mechanism, afforestation, energy conservation, health and hygiene, use of new renewable sources. Policies and regulation. Global Environmental Concerns. Ozone Layer Depletion, Acid Rain, Inversion, El Niño, La Niño, Flood and Drought. World Water, Food, Population distribution and imbalances.

### Unit III

Climate change and Agriculture, Mechanism of Climatic impacts on crops. Mechanism of  $C_3$  And  $C_4$  plants and the  $CO_2$  fixation. Impact of climate change on natural resources, adaptation & mitigation.

### Unit IV

The concept of green management; evolution; nature, scope, importance and types; developing a theory; green management in India, Indian corporate structure and environment; green energy management; green product management, carbon emissions & sequestration.

### Unit V

The United Nations Framework Convention on Climate Change (UNFCCC). The Intergovernmental Panel on climate change (IPCC), the Kyoto Protocol, UNEP, UNDP & the Clean Development Mechanism (CDM). Afforestation and Reforestation projects, Reduced Emissions from Deforestation and Degradation (REDD).



BOS Chairman

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## SUGGESTED READINGS

- Cartimes J. Jepma and Mohan Munasinghe, 1998, Climate change Policy, Cambridge University Press.
- Ehrlich, Paul et al: Long Term Biological consequences of Nuclear War, 1983 (Stanford University).
- Howes, R.; Skea, J. and Whelan, B., 1997, Clean & Competitive? Motivating Environmental Performance in Industry
- Toman (Michael) (Ed.), 2002, Climate Change, Economics and Policy, Cambridge University Press.
- Olguin, E., Sanchez, G. and Hernandez, E., 1999, Environmental biotechnology and cleaner bioprocesses, Taylor & Francis, London.
- IPCC Reports [www.ipcc.ch](http://www.ipcc.ch)



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# Swami Vivekanand University, Sagar (M.P.)

Paper Code	Course Title	Credits
BSCBT-507	WASTE MANAGEMENT	4(3-1-0)

## OBJECTIVES

The proposed course is designed to teach students the scientific and engineering principles of waste management technologies to waste reduction, recycling and reuse and recovery and create public awareness on the waste management and recycling industry as well as environmental and industry concerns.

## THEORY

### Unit I

Introduction to Waste, Definitions, sources, types and composition of various types of wastes. Characterisation of Municipal Solid Waste (MSW), Industrial waste, Biomedical Waste (BMW) and Chemical waste. Classification and Quantification of waste. Waste generation rates. Impact of waste on environmental health.

### Unit II

Municipal Solid Waste Disposal Methods— composting, incineration, pyrolysis, medical waste disposal strategies. Disposal in landfills: site selection and operation of sanitary landfills; leachate and landfill gas management.

### Unit III

Hazardous wastes Disposal Method and treatment technologies. Hazardous waste landfills: site selection, design and operation. Different type of incineration; land fill classification, types, methods and siting consideration.

Unit IV Handling and segregation of wastes at source. Collection, transportation and storage of municipal solid wastes; labeling and handling of hazardous wastes. Public participation and the role of NGOs. Concepts of waste reduction, recycling and reuse. Concepts of waste reduction, recycling and reuse.

### Unit V

Sources of energy generation, incineration, pyrolysis, gasification of waste using gasifiers, direct combustion of MSW- production, land fill gas generation and utilization, present status of technologies for conversion of waste into energy. Environmental and health impacts of waste to energy conversion. Rules related to the handling, treatment and disposal of MSW, BMW and Hazardous waste in India.



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## PRACTICAL EXERCISE\*

Practicals are conducted as Biotechnology Lab with separate credits (02 credits))

1. To determine the alkalinity of given soil sample, collected from deferent areas of Gwalior.
2. To estimate Dissolved Oxygen in a given water sample.
3. To determine Biochemical Oxygen Demand in a given water sample.
4. To determine the Chloride content in a given water sample.

## SUGGESTED READINGS

- Dhamija, U., (2009). Sustainable solid waste management: issues, policies, and structures. Academic Foundation, New Delhi.
- Kreith F, Tchobanoglous G (2002), Handbook of solid waste management 2nd edition, McGraw-Hill Publication, USA.
- Tchobanoglous, G., Theisen, H and Vigil, S., "Integrated Solid Waste Management", McGraw-Hill, New York, 1993.

Paper Code	Course Title	Credits
BSCBT-508	BIOTECHNOLOGY LAB-V	2(0-0-2)

(As per the guidelines of above mention subjects)



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# Swami Vivekanand University, Sagar (M.P.)



## Scheme- Sixth Semester

## B.Sc. Biotechnology (Hons.) Course Code: BSCBT

### SUBJECT WISE DISTRIBUTION OF MARKS AND CORRESPONDING CREDITS

Paper Code	Paper Name	Period per week			Credit	Theory				Practical		Grand Total	Remarks
		L	T	P		Final Semester	CCE	Total Marks		Total Marks			
								Max	Min	Max	Min		
BSCBT-601	Bioethics; IPR; Scientific Writing & Bio-entrepreneurship	3	1	0	4(3-1-0)	80	20	100	40	-	-	100	
BSCBT-602	Field work, Study Tour/Industrial Visit	0	0	2	2(0-0-2)	-	-	-	-	50	25	50	
BSCBT-603	Disaster Management	3	1	0	4(3-1-0)	80	20	100	40	-	-	100	
BSCBT-604	Seminar	0	0	4	4(0-0-4)	-	-	-	-	100	60	100	
BSCBT-605	Major Project	0	0	6	6(0-0-6)	-	-	-	-	150	90	150	
Total Credits					20(6-2-12)						Total Marks	500	

Minimum Marks for passing in End Semester Theory- 40%  
Minimum Marks for passing in End Semester Practical - 50%



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# B.Sc. Biotechnology (Honors)

## (Three Years Bachelor Degree Programme)

### REQUIREMENT OF CREDIT HOURS FOR AWARD OF THE DEGREE

S. No.	Nature of Courses	Credit
1	First Semester	34
2	Second Semester	34
3	Third Semester	34
4	Fourth Semester	34
5	Fifth Semester	34
6	Sixth Semester	34
7	Seventh Semester	34
8	Eighth Semester	20
<b>Total Credits</b>		<b>258</b>

<b>Resources:</b>	LCD, Black Board, Laboratory
<b>Assignment/Tutorial:</b>	Students are required to submit one assignment and deliver one power point presentation as a part of their continuous evaluation system.



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# Swami Vivekanand University, Sagar (M.P.)

Paper Code	Course Title	Credits
BSCBT-601	<b>BIOSAFETY; BIOETHICS; IPR; SCIENTIFIC WRITING &amp; BIO-ENTREPRENEURSHIP</b>	4(3-1-0)

## OBJECTIVES

The proposed course is designed to teach students for important scientific aspects such as **BIOSAFETY; BIOETHICS; IPR; SCIENTIFIC WRITING & BIO-ENTREPRENEURSHIP**.

## THEORY

### Unit I

**Biosafety:** Introduction, Historical prospective, objectives, risk assessment in biotechnological research and their regulation, physical and biological contaminants, field trial and planned introduction of GMOs, Biosafety guidelines in India, Biosafety levels for plant, animal and microbial researches.

### Unit II

**Bioethics:** Introduction, Ethical issues related to biotechnology, legal and socioeconomic impacts of biotechnology, health and safety issues, possible benefits of successful cloning, Ethical concerns of gene cloning, hazards of environmental engineering, Ethical issues in Human Cloning and stem cell research.

### Unit III

**Intellectual Property Right (IPR):** Introduction, intellectual property: trade secret, patent, copyright, plant variety protection, WIPO, GATT, TRIPs, plant breeder's rights, protection of plant varieties and former's right act (2001), Choice and management of IPRs, advantage and limitations of IPRs. **Patents and patent processing:** Introduction, Essential requirements, International scenario of patents, patenting of biological materials, significance of patents in India, Patent application, Procedures and granting, protection of biotechnological inventions, Patent Act (1970), Patent (Amendments) Act (2002). **Regulatory framework in Biotechnology:** Regulation of RDT research, Regulation of food and food ingredients, Regulatory framework in India governing GMOs, Recombinant DNA Guidelines (1990), Revised Guidelines for Research in Transgenic Plants (1998), Prevention Food Adulteration Act (1955), Food Safety and Standards Bill (2005),

### Unit IV

**Scientific Writing & Research-** meaning, types, objectives, and approaches: Literature collection. Different sources, Biological online databases, Determining sample design, collecting data, analysis and hypothesis testing, generalization and interpretation. Writing reviews and journal articles, books, and monographs-bibliography, Structure of thesis; Manuscript and proof correction, Research Process: selection of problems stages in the

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# Swami Vivekanand University, Sagar (M.P.)

execution of research; Research Designs. Journals: standard of research journals - impact factor - citation index.

## Unit IV

**Entrepreneurial motivation:** the social and economic importance of commercialising science and technology; the innovative aspects of it; education & training, role models, examples and discussions. 2. Opportunity recognition: this is a very important aspect of entrepreneurship, one needs to "identify" an opportunity that motivates them to pursue it. Opportunities at research and commercial levels. 3. Commercialisation: through a variety of methods of technology transfer to different levels of product development. Lectures from practitioners; business plan competitions; short pieces of course work; small group supervisions etc.

## SUGGESTED READINGS

- Writing the doctoral dissertation. Barrons Educational series, 2nd edition, Davis, G.B. and C.A. Parker, 1997. pp 160.
- Authoring a PhD, thesis: how to plan, draft, write and finish a doctoral dissertation, Duncary, P. 2003.
- The law and strategy of Biotechnological patents by Sibley. Butterworth publications. Intellectual property rights – Ganguli – Tat McGraw-Hill
- Biotechnology-B. D. Singh- Kalyani Publications



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# Swami Vivekanand University, Sagar (M.P.)

Paper Code	Course Title	Credits
BSCBT-602	FIELD WORK, STUDY TOUR/INDUSTRIAL VISIT	2(0-0-2)

## OBJECTIVES

The purpose of this Field work enables students and researchers to examine the way scientific theories interact with real life

## THEORY

### Unit I

Field work enables students and researchers to examine the way scientific theories interact with real life. Field work enables students and researchers to examine the way scientific theories interact with real life. Field work is important in both the social and natural sciences. Social sciences, such as economics or history, focus on people, culture, and society.

### Unit II

**Study Tour/Industrial Visit:** As a part of B.Sc. Biotechnology (Hons.), Swami Vivekanand University: An exposure towards the industry and corporate section. SVNU is known for its practical approach towards the learning and development of students. Industrial Visit focuses on preparing the students to learn about the day-to-day workings of a particular industry and understand its operational issues. The visit also helps the students to keep update regarding the current management practices followed by the organizations and acquire traits that the industry demands from them.



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Paper Code	Course Title	Credits
BSCBT-603	DISASTER MANAGEMENT	4(3-1-0)

## OBJECTIVES

To introduce learners to the key concepts and practices of natural disaster management; to equip them to conduct thorough assessment of hazards, and risks vulnerability; and capacity building.

## THEORY

The course provide students an exposure to different types of disasters, their significance and types. The contents of syllabus are also designed to inculcate deep understanding of the relationship between vulnerability, disasters, disaster prevention and risk reduction. Further it also allow students to gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR) and awareness of institutional processes in the country and abroad.

### Unit I

Natural Disasters- Meaning and nature of natural disasters, their types and effects. Floods, Drought, Cyclone, Earthquakes, Landslides, Avalanches, Volcanic eruptions, Heat and cold Waves, Climatic Change: Global warming, Sea Level rise, Ozone Depletion

### Unit II

Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire. Oil fire, air pollution, water pollution, deforestation, Industrial wastewater pollution, road accidents, rail accidents, air accidents, sea accidents.

### Unit III

Disaster Management- Efforts to mitigate natural disasters at national and global levels. International Strategy for Disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, Community-based organizations, and media. Central, State, District and local Administration; Armed forces in Disaster response; Disaster response: Police and other organizations.

## SUGGESTED READINGS

- > Gupta H. K. 2003. *Disaster Management*. Indian National Science Academy. Orient Blackswan.
- > Hodgkinson P. E. & Stewart M. 1991. *Coping with Catastrophe: A Handbook of Disaster Management*. Routledge.
- > Sharma V. K. 2001. *Disaster Management*. National Centre for Disaster Management, India. Alexander David, Introduction in „Confronting Catastrophe“, Oxford University Press, 2000.
- > Ancharia J. Vulnerability in Disaster Discourse, JTCDM, Tata Institute of Social Sciences Working Paper no 8, 2008.

BOS Members  
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# Swami Vivekanand University, Sagar (M.P.)

- Blaikie, P, Cannon T, Davis I, Wisner B 1997. At Risk Natural Hazards, Peoples Vulnerability and Disasters, Routledge.
- Coppola P Damon, 2007. Introduction to International Disaster Management.
- Carter, Nick 1991. Disaster Management: A Disaster Manager's Handbook. Asian Development Bank, Manila Philippines.
- Govt. of India: Disaster Management Act. 2005, Government of India, New Delhi.
- Government of India, 2009. National Disaster Management Policy.
- Gupta Anil K, Sreeja S. Nair. 2011 Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi

| Paper Code | Course Title | Credits  |
|------------|--------------|----------|
| BSCBT-604  | SEMINAR      | 4(0-0-4) |

(On the basis of above mentioned subjects)

| Paper Code | Course Title  | Credits  |
|------------|---------------|----------|
| BSCBT-605  | MAJOR PROJECT | 6(0-0-6) |

Note: To complete master project from the same campus as well from any ICAR, CSIR laboratory/ institute to fulfillment of his/her B.Sc. Biotechnology (Hons.).



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