

**VIVEKANANDHA**  
**COLLEGE OF ARTS AND SCIENCES FOR WOMEN**  
**[AUTONOMOUS]**

An ISO 9001:2008 Certified Institution  
Affiliated to Periyar University  
(Approved by AICTE and Re-accredited with „A“ Grade by NAAC)  
Recognized Under 2(f) and 12 (b) of UGC Act, 1956.  
Elayampalayam, Tiruchengode-637 205, Namakkal Dt., Tamil Nadu, India

**DEPARTMENT OF BIOTECHNOLOGY**

**SYLLABUS**

*[For the Candidates admitted on 2016-2017 onwards under Autonomous, CBCS & OBE pattern]*  
(I to VI SEMESTERS)



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**ELAYAMPALAYAM – 637 205, TIRUCHENGODE Tk., Namakkal Dt., Tamil Nadu**  
**VEERACHIPALAYAM – 637 303, SANKARI Tk., Salem Dt., Tamil Nadu**

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**VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN  
ELAYAMPALAYAM, TIRUCHENGODE, NAMAKKAL**

**(Autonomous)**

**Affiliated to Periyar University – Salem 11**

**Accredited by NAAC – AUTONOMOUS**

**DEPARTMENT OF BIOTECHNOLOGY**

**B. Sc. (Biotechnology)**

**For candidates admitted from 2016-17 onwards under Autonomous CBCS  
pattern**

**I. SCOPE OF THE COURSE**

Projections for the next 20 years indicate that there will be thousands of unfulfilled science and engineering jobs. The demand for highly trained workers and scholars will be great. Scientists are rushing to use their new techniques to unravel the secrets of life, to tap that knowledge to create valuable products, and to develop a new generation of sophisticated techniques that will unlock new knowledge. Biotechnology is one of the most revolutionary and beneficial scientific advances of the last quarter century. It is an interdisciplinary science including not only biology but also subjects like mathematics, physics, chemistry and many more. It is also a conglomeration of various combined technologies applied to living cells for production of a particular product or enhancing its quality according to our preferences. Biotech is undoubtedly the future of Geneticengineering, Genomics and biotech industry.

**II. SALIENT FEATURES**

The course covers how life began on earth (Cosmogenesis & Evolution), what are the molecules of Life (Biochemistry, Molecular Biology), what is the structure of life (Cytology & Developmental Biology), how life continues (Principles of Genetics, Molecular Biology) how is it maintained (Comparative physiology, Biophysics), how does it respond to the environment (Ecology & Environmental Biotechnology), how organisms interact with each other (the offense & defence), how mathematics helps biology (elementary mathematics & Biostatistics), what aids we need to study organisms (Biophysics, Biotechniques), how life may be manipulated (Genetic Engineering), what organisms offer us and how they might be turned into factories (Microbial, Plant, Animal resources & technology, Fermentation Technology).

### **III. OBJECTIVES**

The program has been designed to bridge the gap between industry requirements and the growing demand for skilled manpower in life science sector. Hands on training in practical techniques, which are being, used commonly like culture methods, biochemical techniques etc. will be provided. Students will examine a range of practical applications. Projections for next 20 years indicate that there will be need for thousands of trained and skilled manpower in biotech industry. It is pertinent for students to gain sufficient knowledge and attain techno functional capabilities to meet the challenges in creating value added products and to develop a new generation of sophisticated techniques and technology that will unlock a whole new world.

It has been our constant endeavor to set ourselves high standards and achieve near perfection in imparting education to students in multitude of bio techniques, to get advised and guided to an ideal career in Biotech industry.

### **IV. ELIGIBILITY FOR ADMISSION**

- Candidates seeking admission to the first year Degree course shall be required to have passed PUC/12th Std. / 10+2/ its equivalent with at least Biology and Chemistry as two optional subjects.

### **V. DURATION OF THE COURSE**

The course shall extend over a period of three academic years consisting of six semesters. Each academic year will be divided into two semesters. The First semester will consist of the period from July to November and the Second semester from December to March.

The subjects of the study shall be in accordance with the syllabus prescribed from time to time by the Board of Studies of Vivekanandha College of Arts and Sciences for Women with the approval of Periyar University.

### **VI. ASSESSMENT**

Assessment of the students would be made through Continuous Internal Assessment (CIA) and External Assessment (EA) for passing each subject both theory and practical papers.

A candidate would be permitted to appear for the External Examination only on earning 75 % of attendance and only when his / her conduct has been satisfactory. It shall be open to grant exemption to a candidate for valid reasons subject to conditions prescribed.

### **CONTINUOUS INTERNAL ASSESSMENT (CIA)**

The performance of the students will be assessed continuously by the teacher concern and the Internal Assessment Marks will be as follows:

S. No.	Theory		Practical	
	Scheme	Marks	Scheme	Marks
1.	Average of two tests	15	Average of two tests	10
2	-	-	Observation note	10
3	Assignment	5	Practical performance	10
4	Attendance	5	Attendance	10
	Total	40	Total	40

Distribution of attendance mark

S. No.	Percentage	Marks	
		Theory	Practical
1	96-100	5	10
2	91-95	4	8
3	86-90	3	6
4	81-85	2	4
5	76-80	1	2

### **EXTERNAL ASSESSMENT (EA)**

The performance of the students would be assessed by examination at the end of each semester with a written test for theory for three hours and practical examination at the end of even semesters for six hours. Question papers would be set by the selected external examiners in the prescribed format and valued by the external examiners with the help of the teacher concern.

The pattern of assessment is as follows:

S. No	Theory		Practical	
	Scheme	Marks	Scheme	Marks
1	Section A – Answer all questions (10X2)	20	Major experiment	20
2	Section B-Internal choice (5X5)	25	Minor experiment	10
3	Section C-Any three out of five (3X10)	30	Spotters (5X4)	20
			Record & Viva	10
	<b>Total</b>	<b>75</b>	<b>Total</b>	<b>60</b>

## VII. PASSING MINIMUM

### INTERNAL

The passing minimum mark is 13 marks for CIA

### EXTERNAL

In the EA, the passing minimum shall be 30 % out of 75 Marks.

## VIII. CLASSIFICATION OF SUCCESSFUL CANDIDATES

Successful candidates passing the examination of Core Courses (main and allied subjects) and securing marks 75 % and above shall be declared to have passed the examination in first class with distinction, provided they pass all the examinations prescribed for the course at first appearance itself. 60% and above but below 75 % shall be declared, as first class without Distinction. 50% and above but below 60% shall be declared as second class. All the remaining successful candidates shall be declared as third class.

Candidates who pass all the examinations prescribed for the course at the first appearance itself and within a period of three consecutive academic years from the year of admission only will be eligible for University rank.

## IX. ELIGIBILITY FOR AWARD OF THE DEGREE

A candidate shall be eligible for the award of the degree only if she has undergone the above degree for a period of not less than three academic years comprising of six

semesters and passed the examinations prescribed and fulfilled such conditions has have been prescribed.

#### **X. PROCEDURE IN THE EVENT OF FAILURE**

Candidates fail in any subject would be permitted to appear for each failed subject or subjects in the subsequent EA. However, final year students failed in one or two subjects would be allowed to appear for a supplementary exam within a month of the final result.

#### **XI. COMMENCEMENT OF THESE REGULATIONS**

These regulations shall take effect from the academic year 2014-15 (i.e.,) for the students who are to be admitted to the first year of the course during the academic year 2014-15 and thereafter.

**XII. COURSE PATTERN**  
**VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN**  
**AFFILIATED TO PERIYAR UNIVERSITY, SALEM**  
**B.Sc., BIOTECHNOLOGY (CBCS SYLLABUS)**  
**(For candidates admitted from 2014-15 onwards)**

**FIRST YEAR**

Subject Code	Part	Course	Subject title	Hrs / week	Credit	Int. Mark	Ext. Mark	Mark
14U1LT01 14U1LM01 14U1LH01 14U1LF01	I	Language I	Tamil I Malayalam I Hindi I French I	6	3	25	75	100
14U1LE01	II	English I	Foundation English I	6	3	25	75	100
14U1BTC01	III	Core I	Cell Biology and Genetics	5	5	25	75	100
14U1BCA01	III	Allied I	Allied Biochemistry I	5	3	25	75	100
14U2BTCP01	III	Core I Practical	Lab in Cell biology, Genetics and Microbiology	3	-	-	-	-
14U2BCAP01	III	Allied I Practical	Biochemistry Practical I	3	-	-	-	-
14U1VE01	IV	Value Education	Yoga	2	2	25	75	100
<b>END OF FIRST SEMESTER</b>				<b>30</b>	<b>16</b>	<b>125</b>	<b>375</b>	<b>500</b>
14U2LT02 14U2LM02 14U2LH02 14U2LF02	I	Language II	Tamil II Malayalam II Hindi II French II	6	3	25	75	100
14U2LE02	II	English II	Foundation English II	6	3	25	75	100
14U2BTC02	III	Core II	Microbiology	5	5	25	75	100
14U2BCA02	III	Allied II	Allied Biochemistry II	5	3	25	75	100
14U2BTCP01	III	Core I Practical	Lab in Cell biology, Genetics and Microbiology	3	4	40	60	100
14U2BCAP01	III	Allied I Practical	Biochemistry Practical I	3	3	40	60	100
14U2ES01	IV	EVS	Environmental studies	2	2	25	75	100
<b>END OF SECOND SEMESTER</b>				<b>30</b>	<b>23</b>	<b>205</b>	<b>495</b>	<b>700</b>
<b>END OF FIRST YEAR</b>				<b>60</b>	<b>39</b>	<b>330</b>	<b>870</b>	<b>1200</b>

Subject Code	Part	Course	Subject title	Hrs / week	Credit	Int. Mark	Ext. Mark	Mark
14U3LT03 14U3LM03 14U3LH03 14U3LF03	I	Language III	Tamil III Malayalam III Hindi III French III	6	3	25	75	100
14U3LE03	II	English III	Foundation English -III	6	3	25	75	100
14U3BTC03	III	Core III	Molecular Biology	5	5	25	75	100
14U3CSA01	III	Allied III	Computer Application	4	4	25	75	100
14U4BTCP02	III	Core II Practical	Lab in Molecular, Plant and Animal Biotechnology	3	-	-	-	-
14U4CSAP01	III	Allied III Practical	Lab in Computer Application	2	-	-	-	-
14U3BTS01	IV	SBEC I	Genetic Engineering	2	3	25	75	100
14U3MBN01	IV	NMEC I	Concepts of Biotechnology	2	2	25	75	100
<b>END OF THIRD SEMESTER</b>				<b>30</b>	<b>20</b>	<b>150</b>	<b>450</b>	<b>600</b>
14U4LT04 14U4LM04 14U4LH04 14U4LF04	I	Language IV	Tamil IV Malayalam IV Hindi IV French IV	6	3	25	75	100
14U4LE04	II	English IV	Foundation English IV	6	3	25	75	100
14U4BTC04	III	Core IV	Plant and Animal Biotechnology	5	5	25	75	100
14U4BSA04	III	Allied IV	Biostatistics	4	4	25	75	100
14U4BTCP02	III	Core II Practical	Lab in Molecular Biology, Plant and Animal Biotechnology	3	3	40	60	100
14U4CSAP01	III	Allied II Practical	Lab in Computer Application	2	3	40	60	100
14U4BTS02	IV	SBEC II	Biodiversity and Environmental Biotechnology	2	3	25	75	100
14U4MBN02	IV	NMEC – II	Applied biotechnology	2	2	25	75	100
<b>END OF FOURTH SEMESTER</b>				<b>30</b>	<b>26</b>	<b>230</b>	<b>570</b>	<b>800</b>
<b>END OF SECOND YEAR</b>				<b>60</b>	<b>46</b>	<b>380</b>	<b>1020</b>	<b>1400</b>

Subject Code	Part	Course	Subject title	Hrs. / week	Credit	Int. Mark	Ext. Mark	Mark
14U5BTC05	III	Core V	Enzymology and Enzyme technology	5	5	25	75	100
14U5BTC06	III	Core VI	Immunology	5	5	25	75	100
14U5BTC07	III	Core VII	Microbial Biotechnology	5	5	25	75	100
14U5BTE01	III	Elective -I	Medical and Pharmaceutical Biotechnology	5	5	25	75	100
14U5BTS03	IV	SBEC - III	Entrepreneurship in Biotechnology	4	2	25	75	100
14U6BTCP03	III	Core Pract.-III	Lab in Enzyme technology, Immunology and Microbial Biotechnology	6	-	-	-	-
14U6BTCP04	III	Core Pract.-IV	Lab in Nanobiotechnology, Bioprocess technology and Bioinformatics	6	-	-	-	-
<b>END OF FIFTH SEMESTER</b>				<b>30</b>	<b>22</b>	<b>125</b>	<b>375</b>	<b>500</b>
14U6BTC08	III	Core VIII	Nanobiotechnology	5	5	25	75	100
14U6BTC09	III	Core IX	Bioprocess Technology	5	5	25	75	100
14U6BTE02	III	Elective-II	Food Biotechnology	5	5	25	75	100
14U6BTE03	III	Elective- III	Bioinformatics, IPR and Bioethics	5	5	25	75	100
14U6BTS04	IV	SBEC-IV	Genomics	4	2	25	75	100
14U6BTCP03	III	Core Pract.-III	Lab in Enzyme technology, Immunology and Microbial Biotechnology	6	5	40	60	100
14U6BTCP04	III	Core Pract.-IV	Lab in Nanobiotechnology, Bioprocess technology and Bioinformatics	6	5	40	60	100
14U6EX01	IV	Extension activity	-	-	1	-	-	-
<b>END OF SIXTH SEMESTER</b>				<b>30</b>	<b>32</b>	<b>205</b>	<b>495</b>	<b>700</b>
<b>END OF THIRD YEAR</b>				<b>60</b>	<b>58</b>	<b>330</b>	<b>870</b>	<b>1200</b>
<b>END OF THREE YEARS</b>				<b>180</b>	<b>140</b>	<b>1040</b>	<b>2760</b>	<b>3800</b>



**SEMESTER-I**  
**CORE PAPER-I**  
**CELL BIOLOGY AND GENETICS**

**PAPER CODE: 14U1BTC01****Total Hours: 60****CREDIT: 5****Hrs/Week: 5 Hours****Subject Description**

This paper provides a thorough knowledge about structure and function of cells, cellular energy, function of genes, and mutations.

**Objectives**

Understanding the structural and functional aspects of the cell provides the student with a strong foundation in the molecular mechanisms and cellular functions.

**Goal**

Students after completion of this paper will be exceptionally well prepared to pursue careers in cellular and sub cellular biological research, biomedical research, or medicine or allied health fields.

UNIT	CONTENT	HOURS
I	Discovery of cell, The Cell theory. Ultrastructure of eukaryotic cell – (both plant and animal cell). Chromosomes: Discovery, morphology and structural Organization, Cell cycle, mitosis and meiosis.	12
II	Structure and functions of cell organelles – Endoplasmic reticulum, Golgi complex, Mitochondria, Chloroplast, Lysosomes, Peroxisomes, Nucleus Cytoskeletal structures (Microtubules, Microfilaments and Intermediate filaments).	12
III	Structure of DNA and RNA – a brief account. Mendelism: Mendel's work, laws of heredity, Test cross, Incomplete dominance and simple problems. Interaction of Genes: Supplementary factors; Complementary genes; Flower colour in sweet peas Multiple factors – Skin colour in human beings. Epistasis: Plumage colour in poultry. Comb pattern in fowls.	12
IV	Sex Determination in Plants and animals: Concepts of allosomes and autosomes, XX-XY, XX-XO, ZW-ZZ, ZO-ZZ types. Linkage and Crossing Over: Linkage in maize Mechanism of crossing over and its importance, Chromosome mapping – Linkage map in maize. Chromosomal Variations: A General account of structural and numerical aberrations.	12
V	Cytoplasmic Inheritance: Plastid inheritance in <i>Mirabilis Jalappa</i> , petite characters in yeast and kappa particles in paramecium. Mutations: Types: spontaneous and induced. Mutagens: Physical and chemical. Human Genetics: Karyotype in human. Inherited disorders - Allosomes (Klinefelter syndrome and Turner's syndrome), Autosomes (Down syndrome and Cri-Du-Chat syndrome). Plant and Animal Genetic models.	12

**References**

1. Ajay, P. (2007). Text Book of Cell and Molecular Biology. Books and Allied (P) Ltd, 2<sup>nd</sup> edition.
2. Alberts et al., (1994). Molecular Biology of cell – Bruce. Garland publications, NY.
3. Gardener, E.J. Simmons, M.J. and Snustad, D.P. (2006). Principles of Genetics. 8<sup>th</sup> edition, John Wiley & Sons Publications.
4. Jack, D. Bruke Cell Biology. The William Twilkins Company.
5. Karp, G. (2008). Cell and Molecular Biology. 5th edition, John Wiley and Sons Inc., Hardcover, ISBN: 978-0-470-04217-5.
6. Lodish, H. et al. (2008). *Molecular Cell Biology*, 6<sup>th</sup> edition.
7. Malacinski, G. M. (2003). Essentials of Molecular Biology. 4<sup>th</sup> edition. Jones and Bartlett.
8. Old, R.W. and Primrose, S.B. (1986). Principles of Gene manipulation- An introduction to genetic engineering, 3<sup>rd</sup> edition, Black well Scientific Publications.
9. Sharma, V. K. (1991). Techniques in Microscopy and Cell Biology. Tata-McGraw Hill.
10. Verma, P.S. and Agarwal, V.S. (1986). Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S. Chand and Company, New Delhi.
11. Watson, J. D. Baker, T. A. and Bell, S. P. (2007). Molecular Biology of the Gene. 6<sup>th</sup> edition, Benjamin Cummings.
12. Wilson, J. and Hunt, T. (2002). Molecular Biology of the Cell: A Problem Approach, 4<sup>th</sup> edition.

**SEMESTER-I****ALLIED PAPER-I-ALLIED BIOCHEMISTRY-I****PAPER CODE: 14U1BCA01****Total Hours: 60****CREDIT: 5****Hrs/Week: 5****Subject description**

This paper provides a thorough knowledge about Classification, structure and functions of protein, lipids, carbohydrates, vitamins and enzymes.

**Goal**

Students after completion of this paper will be exceptionally well prepared to pursue careers in biochemical research, biomedical research, or medicine or allied health fields.

**Objectives**

Understanding the structural and functional aspects protein, lipids, Carbohydrates, vitamins and enzymes provides the students to know about their role in our body and their need in day –today life

UNIT	CONTENT	HOURS
<b>I</b>	<b>Carbohydrates</b> –Carbohydrate – classification, monosaccharide's (glucose, fructose, galactose & xylose), disaccharides (sucrose, lactose), polysaccharides (glycogen, starch, pectin, keratin sulphate & chondroitin sulphate) – structure, chemical reactions and their importance.	<b>12</b>
<b>II</b>	<b>Amino acids:</b> Classification, Structure, Essential and Non-essential amino acids. <b>Proteins:</b> Definition, Classification based on structure and Functions, Properties. Structural organization of proteins (primary, secondary, tertiary and quaternary structures).	<b>12</b>
<b>III</b>	<b>Enzymes:</b> Definition, Enzyme units, classification, active site, lock and key model, induced fit hypothesis, enzyme kinetics (MM & LB plot), factors affecting enzyme activity.	<b>12</b>
<b>IV</b>	<b>Lipids:</b> Classification, structure, function and properties of simple, compound, Derived, essential fatty acids and cholesterol.	<b>12</b>
<b>V</b>	<b>Vitamins:</b> Classification, occurrence, deficiency symptoms and biochemical functions of vitamins (Fat soluble and water soluble vitamins).	<b>12</b>

**References**

1. Ambika Shanmugam. Textbook of Biochemistry.
2. Chatterjee, M.N. Textbook of Medical Biochemistry. 6<sup>th</sup> edition, Jaypee brothers medical publishers (P) Ltd.
3. Deb, A.C. Concepts of Biochemistry. Books and allied (P) Ltd.
4. Jain, J.L. Fundamentals of Biochemistry, 5<sup>th</sup> revised edition, S.Chand and Co Ltd
5. Nelson, D.L. and Cox, M. M. Lehninger's Principles of Biochemistry. Worth Publishers, 41 Madisons Avenue New York, USA, ISBN 0-333-94657-X.
6. Satyanarayana . U. Biochemistry. 2<sup>nd</sup> edition, Books and allied (P) Ltd.

**SEMESTER-II**  
**CORE PAPER-II-MICROBIOLOGY**

**PAPER CODE: 14U2BTCO2****Total Hours : 60****CREDIT: 5****Hrs/Week: 5 Hours****Subject Description**

This paper provides a thorough knowledge about role of microorganisms, sterilization process, staining techniques and use of microscopes.

**Objectives**

Understanding the structural and functional aspects microorganisms, sterilization process, staining techniques and use of microscopes, it provides the students to know about the role of microorganisms.

**Goal**

Students after completion of this paper will be exceptionally well prepared to pursue careers in microbiological research, biomedical research and microbiological laboratory.

<b>UNIT</b>	<b>CONTENT</b>	<b>HOURS</b>
<b>I</b>	Introduction and Scope of Microbiology: Definition and history of Microbiology. Contributions of Antony van Leeuwenhoek, Louis Pasteur and Robert Koch.	<b>12</b>
<b>II</b>	Microscopy: Definition –Principle-Types of Microscopes – Dissection Microscope, Bright field, Dark field, Phase contrast, Fluorescence and Electron Microscope (SEM,TEM)	<b>12</b>
<b>III</b>	Microbial Techniques: Sterilization-Physical, Chemical Methods, Stains and staining Techniques- Simple, Differential (Gram's & Acidfast) and Special staining (Endospore Capsule, Flagella, Metachromatic granules)	<b>12</b>
<b>IV</b>	Bacterial Classification: ultrastructure of bacteria- Bacterial growth –Nutritional requirements, Factors influencing growth of bacteria, Growth curve. Culture media-Definition, types. Methods of isolation of pure cultures-Preservation and its types	<b>12</b>
<b>V</b>	Bacterial and Viral diseases of human: Tetanus, Tuberculosis and Cholera. and AIDS-HIV, Hepatitis and Polio virus, Herpes simplex virus(HSV & SAARS)	<b>12</b>

**References**

1. Ananthanarayan, R and Jayaram Paniker, C.K (2000). Text book of Microbiology. 6<sup>th</sup> edition, Orient Longman Limited, Chennai.
2. Atlas, R.M. (1997). Principles of Microbiology. Mc-Graw Hill.
3. Banerjee, A.K. and Banerjee, N. (2006). Fundamentals of Microbiology and Immunology. New Central Book Agency (P) Ltd. Kolkata.
4. Black, J. G. (2001). Microbiology: Principles and Explorations. 5<sup>th</sup> edition, John Wiley and Sons, New York.
5. Brock's Book of Microbiology.
6. Dubey, R. C and Maheswari. K. A text book of Microbiology. S. Chand Publications New Delhi
7. Pelczar, M. J., Reid, R. D. and Chan, E. C. (1993). Microbiology. 5<sup>th</sup> edition, Macmillan, London.
8. Powar, C. B. and Dagainawala, H. F. (2003). General Microbiology Vol. II. Himalayan Publishing House.
9. Prescott, L.M. Harley, J. P. and Klein, D. A. (1999). Microbiology, 4<sup>th</sup> edition. McGrawHill, New York. Microbiology – Pelczar, Chan, Krieg, Tata McGraw Hill Publications.
10. Purohit, S. S. (2002). Fundamentals and Application Agro-Bios. 6<sup>th</sup> revised edition.
11. Ronald, M. and Atlas. (1995). Microbiology. William C. Brown Publishers.
12. Talaro, K. and Talaro, A. (1999). Foundations in Microbiology. 3<sup>rd</sup> edition, Dubuque, McGraw Hill.
13. Tortora, G. J. Funke, B. R. and Case. C. L. (1999). Microbiology- An Introduction. 6<sup>th</sup> edition, Benjamin/Cummings Publishing, Menlo Park Calif.

**SEMESTER-II****ALLIED PAPER-II- ALLIED BIOCHEMISTRY-II****PAPER CODE: 14U2BCA02****Total Hours: 60****CREDIT: 5****Hrs/Week: 5****Subject description**

This paper provides a thorough knowledge about metabolism functions of protein, lipids, carbohydrates, vitamins and enzymes.

**Goal**

Students after completion of this paper will be exceptionally well prepared to pursue careers in biochemical research, biomedical research, or medicine or allied health fields.

**Objectives**

Understanding the structural and functional aspects protein, lipids, carbohydrates, and enzymes provides the students to know about their role in our body and their need in day –today life

UNIT	CONTENT	HOURS
<b>I</b>	<b>Bioenergetics</b> - Law of thermodynamics, Concepts of Free energy and Standard free energy, Exergonic and Entergonic reactions, Energy rich bonds – Electron transport chain , inhibitors, oxidative phosphorylation – theories of ATP formation	<b>12</b>
<b>II</b>	<b>Carbohydrate metabolism:</b> Glycolysis, Citric acid cycle with Energetics ,Glyoxylate cycle, glycogenesis,Glycogenolysis, and HMP shunt.	<b>12</b>
<b>III</b>	<b>Lipid and Protein metabolism:</b> -Transamination, oxidative and non-oxidative deamination, decarboxylation- urea cycle. Interrelationship of carbohydrates, proteins and fat metabolism. Lipid metabolism: $\beta$ & omega oxidation, Biosynthesis of saturated fatty acids.	<b>12</b>
<b>IV</b>	<b>Biophysics</b> – Concepts of Acids, Bases and Buffers (Biological important buffers). Principle and applications of chromatography (paper, thin layer & column), electrophoresis – Agarose, PAGE.	<b>12</b>
<b>V</b>	<b>Hormones</b> – Definition, Classification of Hormones, Biological function and disorders of Pancreatic Hormones (Insulin and Glucagon), Thyroid hormone (thyroxin).	<b>12</b>

**References**

1. Ambika Shanmugam. Textbook of Biochemistry.
2. Chatterjee, M.N. Textbook of Medical Biochemistry. 6<sup>th</sup> edition, Jaypee brothers medical publishers (P) Ltd.
3. Deb, A.C. Concepts of Biochemistry. Books and allied (P) Ltd.
4. Jain, J.L. Fundamentals of Biochemistry, 5<sup>th</sup> revised edition, S.Chand and Co Ltd
5. Murray, K., Daryl, K. Granner, Peter, A. Mayes, V. W. (1998). Rodwell Harper's Biochemistry Robert. 24<sup>th</sup> edition, Prentice Hall International Inc.
6. Nelson, D.L. and Cox, M. M. Lehninger's Principles of Biochemistry. Worth Publishers, 41 Madisons Avenue New York, USA, ISBN 0-333-94657-X.
7. Satyanarayana . U. Biochemistry. 2<sup>nd</sup> edition, Books and allied (P) Ltd.

**SEMESTER I & II****CORE PRACTICAL I****LAB IN CELL BIOLOGY, GENETICS AND MICROBIOLOGY****PAPER CODE: 14U2BTCPO1****Total Hours: 60****CREDIT: 4****Hrs/Week: 6****Subject Description**

This paper provides a thorough knowledge about the practical application of Cell biology, genetics and microbiology.

**Objectives**

Understanding the preparations of solution, calibrations, different stages of Mitosis and Meiosis. In microbiology the students can able to find the gram negative and gram positive bacteria, different types of staining and growth curve of bacteria.

**Goal**

Students after completion of this paper will be exceptionally well prepared to pursue careers in genetics, microbiological research, biomedical research.

**CELL BIOLOGY**

1. Preparation of stock and working solution: PPM solution, Percent solution, normal solution, molar solution, millimolar solution
2. Use of micrometer, pH meter/ conductivity meter, microscopy, spectrophotometer and calibration, measurement of onion epidermal cell.
3. Blood smear- differential staining.

**GENETICS**

1. Mitotic study using onion root tips
2. Meiotic study using flower buds
3. Isolation of Mutant by Gradient Plate Technique
4. Buccal smear test

**MICROBIOLOGY**

1. Techniques in Sterilization
2. Preparation of culture media, culturing techniques (pour plate, spread plate and streak plate methods).
3. Isolation and maintenance of pure cultures.(Slant, Agar deep)  
Preliminary test for the determination of Unknown Bacteria
4. Simple and Differential staining (Gram's Staining, spore staining, capsule staining)
5. Motility test (hanging drop method)
6. Oxidase tests
7. Catalase tests.
8. Biochemical Test -IMVIC Test
9. Screening and identification of fungi by LCB Mount
10. Morphology of Cyanobacteria and Algae
11. Antibiotic sensitivity test-Kirby Bauer Method, MIC-Minimal Inhibitory concentration zone test
12. Determination of bacterial growth curve based on absorbance by spectrophotometer

## References

1. Aneja, K.R. (2009). Microbiology: A laboratory Manual Experiments in Microbiology, Kannan, N. (2000). Microbiology manual, Palani Paramount Publ.
2. Dubey, R.C. and Maheswari, D.K. (2005). A Text book of Microbiology. S.Chand and Company Ltd., New Delhi.
3. James, G. Cappuccino and Natalie Sherman. (2004).
4. Pelczar Tr, M.J. Chan, E.C.S. and Kreig, N.R. (1993). Microbiology MC Graw-Hill Inc., New York.
5. Prescott, L.M. Harley, J.P. and Klein, D.A. (1993). Microbiology, 2<sup>nd</sup> Edition, WM, C Brown Publishers.



**I BSc MICROBIOLOGY/ BIOTECHNOLOGY  
ALLIED BIOCHEMISTRY PRACTICAL I**

**Paper code: 14U2BCAP01**

**I. PREPARATION OF SOLUTION**

1. Normal, Molar, Percentage solution and calculation

**II. QUALITATIVE ANALYSIS**

**1. Analysis of sugars**

- a) Monosaccharides-Glucose, Fructose, Galactose, Pentose.
- b) Disaccharides-Sucrose, Maltose and Lactose.
- c) Polysaccharides-Starch

**2. Analysis of amino acids**

- a) Histidine b) Tyrosine c) Tryptophan
- d) Methionine e) Cysteine f) Arginine

**III. Biochemical preparation**

- a. Starch from Potato
- b. Casein from milk
- c. Lecithin from egg yolk

**IV. QUANTITATIVE ANALYSIS**

- a) Estimation of Amino acid (Glycine) by Formal titration method.
- b) Estimation of Ascorbic acid by 2, 6 Di Chlorophenol Indophenol Dye method.

**V. TECHNIQUES**

- a. Separation of amino acid by paper chromatography
- b. Separation of lipid by thin layer chromatography

**References**

1. David, T. P. An introduction to practical bio-chemistry.
2. Pattabiraman. Laboratory manual in bio-chemistry.
3. Jayaraman, J. Practical bio-chemistry.

**SEMESTER-III****CORE PAPER-III-MOLECULAR BIOLOGY****PAPER CODE: 14U3BTC03****Total Hours: 60****CREDIT: 5****Hrs/Week: 5 Hours****Subject Description**

The paper provide basic insight into the structure and properties of nucleic acids, DNA replication, role of DNA and RNA in protein synthesis and gene expression and regulation

**Objectives**

To enable the understanding about basic concepts on genetic material and the molecular mechanism involved in replication and protein synthesis.

**Goal**

Students after completion of this paper will be proficient in fundamentals of molecular biological concepts like gene expression and gene regulation that may enable them to pursue career in molecular biology and genetic engineering research

UNIT	CONTENT	HOURS
I	<b>Genetic material:</b> Evidences showing DNA and RNA as genetic material; DNA- Chemical composition & molecular structure, Watson and Crick's model - its biological significance; Forms of DNA (A, B,C,D & Z).	10
II	<b>DNA replication:</b> Origin & Models of - Meselson and Stahl's experiment - types of replication - Mechanism of DNA replication in prokaryotes and eukaryotes - Enzymology of replication. DNA repair- causes of DNA damage & biochemical mechanism of DNA repair. Homologous recombination- Holliday model	15
III	<b>Transcription:</b> RNA types and functions; RNA polymerase; Transcription in prokaryotes and eukaryotes; Post transcriptional modification - Transcription and processing of RNA in prokaryotes; RNA editing	10
IV	<b>Translation &amp; Protein synthesis:</b> Central dogma of life - Genetic code: Properties of genetic code; codon- anticodon interaction- Wobble hypothesis and elucidation of genetic code; Translation in prokaryotes and eukaryotes; Post translational modification of proteins & molecular chaperonins .	15
V	<b>Regulation of gene expression:</b> Gene expression in transcriptional level (lac and trp operon); gene expression in bacteriophages. Transposons – types and mechanism of transposition. Oncogenes.	10

**Reference**

13. Alexander, M, L. Andy, B. Puil, T. and Mike, W. (2015). Molecular Biology. 4<sup>th</sup> edition, GS Garlan Sciences, Taylor and Francis Group.
14. Bhamrah, H.S. and Kavita, J. (2002). Molecular Cell Biology. Anmol Publications.
15. David, F. (1990). Molecular Biology. 2<sup>nd</sup> edition, Narosa Publishing house.
16. De Robertis, E. D. P. and De Robertis, E. M. F. (2001). Cell and Molecular Biology, 8<sup>th</sup> edition, Lipin cott William and Wilkins.
17. George, M. M. (2008). Essentials of Molecular Biology. 4<sup>th</sup> Edition, Narosa Publishing house.
18. George, M. M. and David F. (1998). Essentials of Molecular Biology, 3<sup>rd</sup> edition, Jones and Bartcett Publishers.
19. James, D. Watson, T. A. Baker, S. P. Bell, A. G. Michael, L. and Richard L. (2008). Molecular Biology of the gene. 5<sup>th</sup> edition, Pearson Education.
20. Jeyanthi, G. P. (2009). Molecular Biology. MJP Publishers.
21. Kumar, H. D. (2000). Molecular Biology. 2<sup>nd</sup> edition, Vikas Publishing House.
22. Lehninger. (2005). Principles of Biochemistry. Nelson Cox, CBS Publishers.
23. Lodhish, B. Matsun, D. Kaiser, K. Scott, Z. and Darnell. (2004). Molecular Cell Biology. 5<sup>th</sup> edition, W. H. Freeman and Company.
24. Phil, T, Alexander, Mc. L. Andy, B. and Mike, W. (2001). Molecular Biology. 3<sup>rd</sup> edition, Bios Instant Notes.
25. Pragya, K. (2008). Cell and Molecular Biology. IK International Publishing House.
26. Rastogi, R.C. (2010). Cell and Molecular Biology. New Age International Publishers.
27. Richard, R. S. (1994). DNA Structure and function. Academic press.
28. Robert, F. W. (1999). Molecular Biology. WCB Mc Graw Hill.
29. Sambamurthy, A.V.S.S. (2008). Molecular Biology. Narosa Publishing House.
30. Veer, B. R. 2010. Fundamentals of Molecular Biology. Ane Books, India.
31. Verma, P.S. and Agarwal, V. K. (1998). Concepts of Molecular Biology. S. Chand and Company Ltd.
32. Vidhyarasthi, N. and Chelan, D. M. (2007). Molecular Biology. IK International Publishing House.
33. William, D. Stanfield, J. S. Colome and Raul, J. C. (2008). Shaum"s Outline- Molecular Cell Biology. Tata Mc Graw Hill.

**SEMESTER-III****ALLIED PAPER-I- COMPUTER APPLICATIONS****PAPER CODE: 11U3CSA01****Total Hours: 52****CREDIT: 4****Hrs/Week: 4****Subject Description**

The present paper designed with the intension to skill with the computer application

**Objectives**

To educate students towards descriptive skill towards use of computer for data processing and statistical application.

**Goal**

Enhance student's statistical skill and use of computer.

UNIT	CONTENT	HOURS
<b>I</b>	<b>Introduction:</b> Introduction to Computer-History of computers-Basic anatomy of computers. Ms-Office - MS-WORD: Introduction to Word Basics –Menus, Commands, Toolbars - Formatting Text - Mail Merge –Macros - Table.	<b>4</b>
<b>II</b>	<b>MS-EXCEL:</b> Introduction – Menus – Toolbars -Icons – Opening Excel – Cells – Entering and Editing Data – Creation of Chart- Naming Formulas – Functions.	<b>5</b>
<b>III</b>	<b>MS-POWER POINT:</b> Introduction – Menus – Toolbars – Navigating in PowerPoint – Working with PowerPoint	<b>4</b>
<b>IV</b>	<b>MS-ACCESS:</b> Introduction – Starting Microsoft Access – Creating and Saving the New Database – Opening Existing Database – Creating Reports	<b>4</b>
<b>V</b>	<b>MS-FRONT PAGE:</b> Introduction – Menus – Toolbars – Creating Webpage- With Wizard - Hyperlinks.	<b>3</b>

**TEXT BOOKS:**

1. Saxena, S. "MS-OFFICE 2000 for Everyone". Vikas Pub. House, NewDelhi (Part: I, II, III, IV, V, VI & IX).

**SEMESTER-III****SKILL BASED ELECTIVE-I-GENETIC ENGINEERING****PAPER CODE: 14U3BTS01****Total Hours: 32****CREDIT: 2****Hrs/Week: 2****Subject Description**

This paper provides a thorough knowledge about application of biotechnology in different fields in biotechnology.

**Objectives**

Enhance students' skill towards use of biotechnology and its application in microbiology.

**Goal**

After completion of this paper will be exceptionally well prepared to pursue careers in various field of biotechnological research works.

UNIT	CONTENT	HOURS
I	<b>Basics of recombinant DNA:</b> genetic code and control of gene expression using lac and trp operon. Strategies of gene cloning.	5
II	<b>Enzymes in genetic engineering:</b> Restriction endonucleases, Polymerase, DNA Ligase, Alkaline phosphatase, Polynucleotide kinase, Terminal Transferase, RNases, S1 Nucleases.	7
III	<b>Hybridisation Techniques:</b> Blotting Techniques (Southern, Northern and Western Blotting). Construction of cDNA library, Construction of Genomic library, Polymerase chain reaction (PCR) and its applications.	8
IV	<b>Vectors:</b> Types, biology and salient features of vectors: Plasmids – Ti plasmid, pBR322, pUC. Cosmids, Phagemid and YAC's.	7
V	<b>Gene transfer techniques:</b> Biological methods (Transformation and Transduction), chemical methods and physical or mechanical methods.	5

**Reference**

1. Benjamin, L. (2008). Genes VIII - Oxford University & Cell Press.
2. Dubey, R. C. A Textbook of Biotechnology. S. Chand and company Ltd.
3. Preethi, J. Genetic Engineering and its Applications. Agrobios.
4. Primrose S.B. and Twyman R.M. (2008). Principles of gene manipulation and Genomics. Blackwell Scientific Publications.
5. Rastogi, S. and Pathak, N. Genetic Engineering, 6<sup>th</sup> edition, Oxford University Press.

**SEMESTER-III****NON- MAJOR ELECTIVE –I-CONCEPTS OF BIOTECHNOLOGY****PAPER CODE: 14U3BTN01****TOTAL HOURS: 32****CREDIT: 2****Hrs/Week: 2****Subject Description**

This paper provides a thorough knowledge about application of biotechnology in different fields in biotechnology.

**Objectives**

Enhance students' skill towards use of biotechnology and its application in microbiology.

**Goal**

After completion of this paper will be exceptionally well prepared to pursue careers in various field of biotechnological research works.

UNIT	CONTENT	HOURS
I	<b>Introduction:</b> Old vs New Biotechnology, Scope and importance of Biotechnology, Biotechnology in India, Strategies of gene cloning.	5
II	<b>Enzymes used in genetic engineering</b> - Restriction Endonucleases - Types & features, Ligases, Linkers, adaptors and homopolymer tailing, Modifying enzymes - Nucleotidyl kinase, Alkaline phosphatase, Taq polymerase, Terminal nucleotidyl transferase, Methyl transferase.	8
III	<b>Vectors</b> – Properties of a good vector, Shuttle vectors: PBR322, YAC, pUC. Specialised vectors: Cosmids, Phagemids. Expression Vectors: Plant viral vectors – CaMV plasmid, Animal viral vectors – SV40.	7
IV	<b>Gene transfer techniques:</b> Biological methods (Transformation and transfection), chemical methods (Calcium phosphate coprecipitate and Lipofection) and physical or mechanical methods (Biolistic and electroporation).	7
V	<b>Selection of Recombinants:</b> Insertional inactivation of antibiotic resistance gene and lac Z gene, nutritional complementation, radio immuno assay, colony hybridization, Benton and Davis plaque lift method.	5

**Reference**

1. Brown, T.A. (1996). Gene cloning and DNA Analysis. Blackwell science, osney mead, Oxford.
2. Dubey, R.C. (2001). A Textbook of Biotechnology. Rajendra printer, New Delhi.
3. Gupta, P. K. (2000). Elements of Biotechnology. 1<sup>st</sup> edition, Rastogi Publications.
4. Old and Primrose. (1989). Principles of gene manipulation, 3<sup>rd</sup> edition.
5. Satyanarayana, U. (2008). Biotechnology. Books and Allied (p) Ltd.
6. Singh, B.D. (2004). Biotechnology. Kalyani publishers, New Delhi.

## SEMESTER – IV

## CORE PAPER –IV-PLANT AND ANIMAL BIOTECHNOLOGY

PAPER CODE: 11U4BTC04

Total Hours: 60

CREDIT : 5

Hrs/ Week : 5

**Subject description**

The chapters in the paper provides a basic and advanced knowledge on plant and animal cell cultures and the application of molecular biology and recombinant DNA technology in plant and animals.

**Objectives**

To enable the students to understand the fundamental concepts in plant and animal cell culture techniques and the application of molecular biological methods for the development of genetically engineered plants and animals.

**Goal**

The thorough understanding of this paper enables the students to confidently pursue their career in the field of Plant Tissue culture and animal cell culture laboratories, Clinical research, Biomedical and Genetic engineering research and Allied health fields.

UNIT	CONTENT	HOURS
I	<b>Plant tissue culture:</b> Cellular totipotency- PTC laboratory organization- General methodology for media preparation- Plant growth regulators – Sterilization techniques. Types of culture. Protoplast fusion. Micropropagation Artificial seeds - Germplasm and cryopreservation	12
II	<b>Gene transfer in plants:</b> <i>Agrobacterium</i> mediated transformation- Direct DNA transfer. Selectable marker, promoters and reporter genes used in plant transgenics. Resistance to insects (Bt cotton and Brinjal) - delayed ripening ( <i>Flavr Savr</i> tomato) - Improving vitamin (Golden rice). production of edible vaccines and plantibodies- biodegradable plastic. Transgenic plants to male sterility and terminator seed technology.	12
III	<b>Animal cell culture:</b> ATC Laboratory design- Equipments - Medium, nutrients and biochemical ingredients- pH, Oxygen- Serum free media. Disaggregation of tissues-primary culture and establishment of cell lines- Growth Kinetics and senescence of cell line, cytotoxicity and viability assays.	12
IV	<b>Gene transfer in animals:</b> Animal viral vectors: SV40, Epstein-Barr virus, Baculovirus and Vaccinia virus vectors. Microinjection, Calcium phosphate coprecipitation, Transfection & Lipofection. Selectable markers, promoters and reporter genes in animal transgenics. Genetic engineering in mammals (transgenic mice & goat)	12
V	<b>Application of animal biotechnology &amp; advanced transgenic technology:</b> Embryonic Stem cell culture, maintainance and applications. Basic concepts and application of tissue engineering. Intracytoplasmic sperm injection (ICSI), <i>In vitro</i> fertilization (IVF), Embryo transfer and test tube babies - Gene silencing strategies and gene inhibition at protein level.	12

### Reference

1. Chawla, H. S. (2004). Introduction to Plant Biotechnology.
2. James, D.W. Michael, G. Jan, W. and Mark, Z. (1992). Recombinant DNA technology. W. H. Freeman and Company.
3. John, R. W. and Masters. (2000). Animal cell culture. 3<sup>rd</sup> edition, Oxford University Press.
4. Nirmala, C.B. Rajalakshmi, G. and Chandra, K. (2009). Plant Biotechnology. MJP Publishers.
5. Primrose, S.B and Twyman, R.M. (2006). Principles of Gene manipulation and Genomics. 7<sup>th</sup> edition, Blackwell Publishing.
6. Ranga, M. M. (2006). Animal Biotechnology.
7. Sandy, P. Richard, T. and Old, B. (2001). Principles of Gene Manipulation. 6<sup>th</sup> edition. Blackwell Science Ltd.
8. Satyanarayana, U. (2005). Biotechnology. Books and allied (P) Ltd.



**SEMESTER-IV****SBEC-II- BIODIVERSITY AND ENVIRONMENTAL BIOTECHNOLOGY****PAPER CODE: 14U4BTS02****Total Hours: 32****CREDIT: 3****Hrs/Week: 2****Subject Description**

This paper provides a thorough knowledge about biodiversity, preservation of endangered species and bioremediation methods

**Objectives**

Understanding the importance of the living species in the world and protect them from the destroying from the environment and protect the environment from pollution.

**Goal**

Students after completion of this paper will be able to know the endangered species and how to protect them. Different conservation methods are known. Biodegradation methods will be cleared in detail.

<b>UNIT</b>	<b>CONTENT</b>	<b>HOURS</b>
<b>I</b>	<b>Biodiversity:</b> Introduction to Biodiversity - definition, hot spots of Biodiversity, strategies for Biodiversity Conservation, National Parks, Sanctuaries and Biosphere reserves, gene pool. Aquatic common flora and fauna in India - phytoplankton, zooplankton and macrophytes, terrestrial common flora and fauna in India - forests, endangered and threatened species.	<b>5</b>
<b>II</b>	<b>Conservation of biodiversity:</b> Strategies for Biodiversity Conservation, cryopreservation, gene banks, tissue culture and artificial seed technology, new seed development policy 1988, conservation of medicinal plants. International conventions, treaties and protocols for Biodiversity Conservation, Biodiversity in the welfare of mankind, Species concept, Biological nomenclature theories of biological classification.	<b>8</b>
<b>III</b>	<b>Bioremediation &amp; Phytoremediation:</b> Applications of bioremediation, phytoremediation, Bioreduction, Bioabsorption and Bioleaching of heavy metals: Cadmium, Lead, Mercury, Metal binding targets and organisms, Bioabsorption, Metal microbial interaction, Biomethylation of elements (Methylation of mercury and arsenic), Commercial biosorbants, bioleaching, metal precipitation, advantages and disadvantages of bioleaching.	<b>7</b>
<b>IV</b>	<b>Waste water Treatment:</b> Biological treatment system (Oxidative ponds, aerobic and anaerobic ponds, facultative ponds, aerated ponds), Biological waste treatment, activated sludge treatment, microbial pollution in activated sludge, percolating filters, waste water treatment by biofilms. Treatment scheme of Dairy, Distillery, Tannery, Sugar, Fertilizers, Refinery and Chemical waste.	<b>7</b>
<b>V</b>	<b>Pollution management:</b> Solid waste and pollution management: Composting systems, vermicomposting, sewage treatment. Pollution control techniques in water air and land.	<b>5</b>

**Reference**

1. Alan, S. (1999). Environmental Biotechnology. Pearson Education Limited, England.
2. Allsopp, D. and Seal, K.J . (1986). Introduction to Biodeterioration. ELBS/Edward Arnold, London.
3. Athie, D. and Ceri, C. C. (1990). The use of Macrophytes in Water Pollution Control. Pergamon Press, Oxford.
4. Biswas, S. (2007). Biodiversity conservation: A Genetic Approach. Oxford Book Company.
5. Chin, K. K. and Kumarasivam, K. (1986). Industrial Water Technology Treatment, Reuse and Recycling. Pergamon Press, Oxford.
6. De, A. k. (2004). Environmental Chemistry . Wiley Eastern Ltd., New Delhi.
7. Jogdand, S. N. (1995). Environmental Biotechnology. Himalaya Publishing House, Bombay.
8. Krishnamurthy, K. V. An advanced text book of biodiversity- Principles and practice. Oxford and IBH company Pvt Ltd.
9. Pushpangadan, P. Ravi, K. and Santhosh, V. (1997). Conservation and Economic evaluation of Biodiversity Vol.I & II, Wealth of India CSIR, New Delhi.
10. Samit, R. and Arun, K. R. (2007). Biodiversity and Biotechnology. New Central Book Agency (P) Ltd.
11. Technoglous, G. Burton, F.L. and Stensel, H.D. (2004). Wastewater Engineering-Treatment, Disposal and reuse. Metcalf and Eddy, Inc., Tata McGraw Hill, New Delhi.

**SEMESTER- IV****NON- MAJOR ELECTIVE – II-APPLIED BIOTECHNOLOGY****PAPER CODE: 14U4BTNO2****Total Hours : 32****CREDIT:2****Hrs/Week : 2****Subject Description**

This paper provides a thorough knowledge about application of biotechnology in different fields in biotechnology.

**Objectives**

Enhance students' skill towards use of biotechnology and its application in microbiology.

**Goal**

After completion of this paper will be exceptionally well prepared to pursue careers in various field of biotechnological research works.

<b>UNIT</b>	<b>CONTENT</b>	<b>HOURS</b>
<b>I</b>	<b>Plant biotechnology</b> – Media preparations, Plant growth hormones, secondary metabolites, synthetic seed, micropropagation, protoplast isolation & fusion.	<b>7</b>
<b>II</b>	<b>Animal biotechnology</b> - Media preparation for animal tissue culture, Animal as a bioreactor, Transgenic animals –Applications of transgenic sheep. In vitro fertilization and embryo transfer, Stem cells, Cryopreservation.	<b>7</b>
<b>III</b>	<b>Medical biotechnology</b> – Cytokines, Biochip, Biosensor, DNA Vaccine, Somatotropin, Interferon.	<b>6</b>
<b>IV</b>	<b>Industrial biotechnology</b> - Production of microbial products, Antibiotics- penicillin, tetracycline, Citric acid, vinegar. Applications of enzymes. Dairy production and Single Cell Protein.	<b>6</b>
<b>V</b>	<b>Environmental biotechnology</b> - Microbial degradation of xenobiotics, Biogas production, Biowar, cleaning technology in vitro and in vivo.	<b>6</b>

**Reference**

1. Brown, T.A. (1996). Gene cloning and DNA Analysis. Blackwell science, Osney mead, Oxford.
2. Chawla. (2003). Introduction to plant biotechnology. 2<sup>nd</sup> edition, Oxford and IBH Publisher.
3. Dubey, R.C. (2001). A Textbook of Biotechnology. Rajendra printer, New Delhi.
4. Gupta, P.K. (2004). Biotechnology and Genomics. Rastogi Publication.
5. Ian Freshney, R. (2000). Culture of Animal cells., 4<sup>th</sup> edition. Wiley-liss.
6. Old and Primrose. (1989). Principles of gene manipulation. 3<sup>rd</sup> Edition
7. Patel, A.H. (2005). Industrial biotechnology. Macmillan Publisher.
8. Ranga, M.M. (2000). Animal biotechnology. Agro bios, India.
9. Satyanarayana, U. (2008). Biotechnology. Books and allied (P) Ltd.

**SEMESTER- IV**  
**ALLIED PAPER-IV-BIOSTATISTICS**

**PAPER CODE: 14U4BSA04**

**Total Hours :**

**CREDIT:4**

**Hrs/Week : 4**

**Objectives:**

Enhance students' skill towards use of and its application of biostatistics in biotechnological research.

UNIT	CONTENT	HOURS
<b>I</b>	<b>Statistics</b> – Definitions – Limitation and uses of Statistics – Sources of data in Life Sciences – Collection data – Primary and Secondary data – Methods of collection of data – Classification, Tabulation and assentation.	
<b>II</b>	<b>Measures of Central tendency</b> – Mean, Median, Mode – Merits and Demerits.	
<b>III</b>	Measures of dispersion – Range, Quartile Deviation, Mean Deviation and Standard Deviation – Merits and Demerits – Coefficient of Variation.	
<b>IV</b>	<b>Correlation</b> – Types of Correlation, Rank Correlation, Regression equations – Fitting and redictions (Simple problems)	
<b>V</b>	<b>Test of significance</b> – Null and Alternative hypothesis – Large sample tests based on mean, difference of means, small sample test – student t-test, chi-square test.	

**Reference**

1. Gupta, S.P. (2011). Statistical Methods. 41<sup>th</sup> edition, Sultan Chand & sons, New Delhi.
2. Mahajan, B.K. (1997). Methods in Biostatistics. 6<sup>th</sup> edition, Jaypee Brothers Medical Publishers (P) Ltd.

**SEMESTER III & IV**

**LAB IN MOLECULAR BIOLOGY, PLANT AND ANIMAL  
BIOTECHNOLOGY**

**PAPER CODE: 14U4BTCP02**

**TOTAL HOURS : 60**

**CREDIT : 3**

**Hrs/ Week : 3**

1. Isolation of genomic DNA from bacterial cells
2. Plasmid DNA isolation from *E. coli* by alkaline lysis method
3. Isolation of genomic DNA from animal tissue
4. Isolation of genomic DNA from plant tissue
5. Determination of nucleic acid concentration and analysis of purity of DNA and T<sub>m</sub> value
6. Determination of molecular weight of the isolated DNA
7. Preparation of M.S media
8. Callus induction
9. Micro propagation of plant tissue
10. Protoplast isolation
11. Preparation of chicken embryo fibroblast culture (monolayer)
12. Routes of egg inoculation

**REFERENCE**

1. Chellam, R. Experimental protocols in Basic Molecular Biology. Osho Scientific Publications.
2. Gakhar, S. K. Monika, M. Ashwani, K. (2013). Molecular Biology- A laboratory Manual. IK International Publishing House.

**SEMESTER-III & IV**

**ALLIED PRACTICAL I - LAB IN COMPUTER APPLICATIONS**

**PAPER CODE: 11U4CSAP01**

**Total Hours:52**

**CREDIT: 3**

**Hrs/Week: 4**

1. Prepare Student Bio data using MS Word.
2. Create letters using Mail merge in MS Word.
3. Create Word Document to implement Table and Sort the data.
4. Create Excel document to sort the data.
5. Create Excel document and implement various charts.
6. Create Excel document and implement various types of functions.
7. Create Slide Show for a seminar in Power point.
8. Create Slide Show form an Advertisement in PowerPoint.
9. Create table and perform various operations in MS Access.
10. Create Student Mark List using MS Access.
11. Create Employee Personal Informations using MS Access.

**SEMESTER-V****COREPAPER-V****ENZYMOLGY AND ENZYME TECHNOLOGY**

<b>PAPER CODE:</b>	<b>14U5BTC05</b>	<b>TOTAL HOURS:</b>	<b>75</b>
<b>CREDIT:</b>	<b>5 (Five)</b>	<b>Hrs./Week:</b>	<b>5 Hours</b>

**Subject description:**

Enzymes are known to catalyze more than 5,000 biochemical reaction types and increase the rate of reaction. An enzyme's activity decreases markedly outside its optimal temperature and pH. Most enzymes are proteins, although a few are catalytic RNA molecules. Some enzymes are used commercially, for example, in the synthesis of antibiotics. Some household products use enzymes to speed up chemical reactions like in washing powders which break down protein, starch and fat stains on clothes, in meat breaks down proteins into smaller molecules, making the meat tender and easier to chew. Enzyme technology is one of the important corner stones of Industrial Biotechnology. The syllabus in this subject involves both fundamental and applied enzymology, biocatalysis, molecular modelling, structural biology and diagnostics. The generic subject of Enzymes and Enzyme Technology provide the student a broad knowledge on the enzymes and its general characteristics with special emphasis on study of active center and the mechanisms responsible for the action enzyme, study of the mechanisms and kinetic diagnosis of the same.

**Goal:**

This paper provides students with basic knowledge in concepts of enzymes, enzyme kinetics, enzyme inhibition and clinical and industrial application of enzymes.

**Objectives:**

1. Introduce the subject enzymes and enzyme technology to the students on their definitions classification and nomenclature.
2. To understand their functional attributes
3. Enhance knowledge on industrial application of enzymes
4. Enhance bioinformatics application in enzyme technology
5. To know about Legal issues related to enzyme based industries

UNIT	CONTENTS	HOURS
I	Introduction to Enzymes, enzyme nomenclature, enzyme commission numbers, and classification of enzymes. Isolation and purification of enzymes, preparation of purification chart, Enzyme activity, Specific activity and turn over number, Marker enzymes.	14
II	Enzyme Kinetics: Steady state, pre-steady state, equilibrium kinetics, Michaelis and Menten Equation and its derivation, Different methods to calculate the Km and Vmax and their significance. Factor affecting enzyme activity and catalysis: pH, substrate and enzyme concentration, temperature, coenzyme and cofactors, Mechanism of action of enzymes involving two/more substrates. Role of metal ions in enzyme catalysis. Enzyme inhibition, different types of inhibitors and activators.	18
III	Structure and function of enzymes: Lysozyme, chymotrypsin, DNA polymerase, RNase, proteases. Enzyme regulation and control of their activity. Introduction to allosteric enzymes and isozymes. Bioinformatics analysis of structural and functional properties of enzymes	15
IV	Enzyme Technology: Immobilization of enzymes, whole cell immobilization and their application, commercial production of enzymes, RNA-catalysis, Catalytic antibodies -abzymes, Protein and Enzyme engineering: Design and construction of novel enzymes using Insilco methods.	15
V	Paper making, Meat processing, Bread making, Detergent preparation, Enactments, regulations and guidelines in Enzyme industries, IPR in enzyme technology (Stone wash, Bioplastics, corn to plastic)	13

**TEXT BOOKS**

Trevor, P. 2004. Enzymes: Biochemistry, Biotechnology, Clinical chemistry - East West Press Edition, New Delhi.

1. Satyanarayana, U. and Chakrapani, U. 2008. Biochemistry, Books and Allied (P) Ltd, Kolkata.

**REFERENCE**

1. Nicholas, C. and Price Lewis Stevens, 1998. Fundamentals of Enzymology, 2<sup>nd</sup> edition, Oxford University Press, Newyork.
2. David L. Nelson and Michael M. Cox, 2007. Lehninger Principles of Biochemistry, W.H Freeman and Company, New York.
3. Lubert, S. Jeremy M. Berg and John L. Tymoczko, 2001. Biochemistry, V edition, W.H.Freeman & Company, Newyork.
4. Ashok Pandey, Colin Webb, Calos Ricardo Soccl and Christian Larroche, 2005. Enzyme Technology, Asiatech publishers Inc, New Delhi.



PAPER CODE: 14U5BTC05

VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN  
(AUTONOMOUS)

B.Sc., DEGREE BIOTECHNOLOGY

Sixth Semester

ENZYMOLGY AND ENZYME TECHNOLOGY

Time: 3hrs

Max.Marks:75

Section-A (10 x 2 = 20)

Answer all the questions.

1. Define enzymes,
2. Define enzyme units.
3. Define active site.
4. Define abzymes.
5. Define lipoic acid
6. Draw the structure of TPP.
7. Define Inhibitors.
8. Define allosteric enzymes.
9. Define immobilization.
10. Write any two industrial applications of protease and lipase.

Section-B (5X5=25)

Answer All the Questions

- 1.a) Write a short note on specificity of an enzyme towards substrate (or)  
b) Define the following: Holoenzyme, apoenzyme, coenzyme and cofactor.
- 2.a) Give an account on induced fit theory (or)  
b) Describe the characteristics feature of active site.
- 3.a) Write a short note on nicotinamide coenzymes. (or)  
b) Discuss about covalent catalysis.
- 4.a) Give an account on non competitive and un competitive inhibition(or)  
b) Discuss about aspartate transcarbamoylase.
- 5.a) Give a detailed note on enzyme immobilization. (or)  
b) Write short note on enzyme engineering.

Section-C (3X10=30)

Answer Any Three Questions

1. Write the classification of enzymes.
2. Derive Micaelis Menten equation.
3. Explain in detail about mechanism of action of chymotrypsin.
4. Write in detail about enzyme inhibition.
5. Write a note on industrial and clinical application of enzymes.

## SEMESTER-V

### CORE-VI : IMMUNOLOGY

**PAPER CODE:** 14U5BTC06  
**CREDIT:** 5 (Five)

**TOTAL HOURS:** 75  
**Hrs./Week:** 5 Hours

#### **Subject description:**

The introductory Unit I include history of immunology and focuses on facets of immunity and the biomedical applications of immunology. The basic description of the cells, organs and tissues of the immune system, key aspects of cellular origins has also been addressed. The understanding of nature of antigens; the structure and functional properties of immunoglobulin has been taken into a deep insight in Unit II. The nature and practical applications of antigen-antibody interaction and medically relevant applications of immunoassay and topics consistent with modern immunological practice; the plethora of cytokines and their complex network of interconnected functions, widening application and clinical focus of cytokines; critical role of complement system in clearing our immune complexes through different pathways has been describe in Unit III. A comprehensive overview of hypersensitive reactions; the description of specific organ transplantations and the disease conditions for which they offer a viable treatment has been described in Unit IV. The factors that contribute to autoimmunity and advances in the treatment of autoimmunity; the various types of primary immunodeficiency's and their relationship to components of immune system; the practical aspects of vaccine development and recent strategies in vaccines have been illustrated in Unit V.

#### **Goal:**

The thorough understanding of this paper enables the students to confidently pursue their career in the field of Immunological research, diagnostics, Healthcare, Pharmaceuticals, Vaccine production, Clinical research, Biomedical and Genetic engineering research and Allied health fields.

#### **Objectives:**

1. To learn about early discoveries on immunology; role of Innate and acquired immunity; B-cell and T-cells; Hematopoiesis & Programmed cell death; Immune cells; Thymus (primary lymphoid organ) and Bone marrow (secondary lymphoid organ)
2. To understand basic concepts of Antigen, Immunogens, Haptens, Adjuvants, epitopes; Immunoglobulin structure and functions; immune response- Humoral and Cell mediated; Major histocompatibility & its role in antigen processing and presentations
3. To yield a precise knowledge on the principle and applications of antigen-antibody interaction and production of monoclonal antibody; Cytokine properties, types and functions; Complement pathways and its significance
4. To illustrate the immunological basis of hypersensitivity and allergic reactions; fundamentals of transplantation immunology and HLA typing for organ transplantation; the role of immunosuppressive drugs
5. To elaborate the immunological reason behind autoimmune disorder; immunodeficiency disease; immunization strategies and learn about different types of vaccination.

UNIT	CONTENT	HOURS
I	History and scope of immunology; Infection & Immunity – types and mechanisms; Hematopoiesis and cells of immune system. Organs of immune system – Primary and secondary lymphoid organs – structure and functions	15
II	Antigen & Immunogens – Properties; Haptens, Mitogens, adjuvants, epitopes. Immunoglobulin – Basic structure, classes, function, molecular diversity of immunoglobulins. Immune responses – Humoral & Cell mediated immune responses & antigen recognition. Generation of lymphocyte specificity and clonal selection of lymphocytes. MHC – General organization and its role in antigen processing and presentation	15
III	Antigen-antibody interactions – Principle and applications of Precipitation & Agglutination reactions; FACs; Hybridoma technology and monoclonal antibody production. Complement components: Properties and Activation of pathways; Cytokines- properties, structure and function. Detection of immune complex in tissues	15
IV	Hypersensitivity reactions – Types and mechanisms; Transplantation immunology and HLA typing; Immunosuppressive therapy and Immunological tolerance; Autoimmune diseases; Immunodeficiency diseases	15
V	Ethics in immunological research & WHO guidelines. Immunization schedule and recent strategies in vaccine production. Role of stem cells in immunology. Animal models; Immunization of animals and production of antibodies.	15

#### REFERENCES

1. Goldsby, R. A., Kindt, T. J., Osborne, B. A. and Kuby, J. 2003. Immunology 6<sup>th</sup> Edition. WH Freeman & Co. New York.
2. Kuby, J. 2000. Immunology 4<sup>th</sup> Edition, WH Freeman & Co, New York.
3. Benjamini, E. Coico, R. and Sunshine, G. 2000. Immunology 4<sup>th</sup> Edition, A John Wiley & Sons, Inc. Publications.
4. Roitt, I., Brostoff, J. and Male, D. 1993. Immunology 3<sup>rd</sup> Edition, Mosby.
5. Tizard, I. R. 1995. Immunology 4<sup>th</sup> Edition. Saunders College Publishing Harcourt, Brace College Publishers.
6. Darnell, H. Lodish and Baltimore, D., 1994. Molecular Biology 2<sup>nd</sup> Edition. Scientific American Book, USA
7. WHO guidelines on Animal research.

**Paper code: 14U5BTCO6**  
**VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR**  
**WOMEN**

**(AUTONOMOUS)**  
**MODEL QUESTION PAPER – April, 2013**

**B.Sc Biotechnology**  
**SEMESTER – V**  
**IMMUNOLOGY**

**Time: Three Hours**

**Maximum marks: 75**

**Section – A (10x2=20 marks)**

**Answer all the questions**

1. Define prophylaxis
2. Define hematopoiesis
3. What are haptens? Give examples
4. Define opsonization
5. What is an agglutinin?
6. Define Membrane Attack Complex (MAC)
7. What are allergens?
8. What is graft rejection?
9. What is AIDS?
10. Define toxoid vaccine

**Section – B (5x5=25)**

**Answer all the questions choosing either (a) or (b)**

11. (a) Describe the process of phagocytosis (or)  
(b) Explain the process of hematopoiesis
12. (a) Describe the basic structure of Immunoglobulin (or)  
(b) Write short notes on humoral immunity
13. (a) Write short notes on different types of agglutination reaction (or)  
(b) Explain the properties of cytokines
14. (a) Explain delayed type hypersensitivity (or)  
(b) Describe the principle and applications of HLA typing
15. (a) Write short notes on Rheumatoid arthritis (or)  
(b) Write short notes on DNA vaccines

**Section – C (3x10=30)**

**Answer any three of the following questions**

16. Describe the structure and functions of secondary lymphoid organs
17. Explain the general organization and the role of MHC in antigen processing and presentation
18. Enumerate the different types of complement activation pathways
19. Give a detailed account on Hypersensitivity reactions
20. Describe in detail on recent strategies in vaccine development

**CORE PAPER-VII**  
**MICROBIAL BIOTECHNOLOGY**

<b>PAPER CODE:</b>	<b>14U5BTC07</b>	<b>TOTAL HOURS:</b>	<b>75</b>
<b>CREDIT:</b>	<b>5 (Five)</b>	<b>Hrs./Week:</b>	<b>5 Hours</b>

**Subject description:**

Microorganism plays important role in the field of biotechnology which helps in production many industrial products. It helps in breakdown of complex organic compounds helps in industrial production of organic acids, ethanol, alcoholic beverages, antibiotics, vinegar, fermented foods etc. It also used is agriculture biotechnology for production of single cell protein, production biofertilizers and bioinsectides as these are safe to our environment. It also helps in production vaccine and insulin in medical field. Microbes are also used in the treating water mineral and oil recovery and helps in the breakdown of xenobiotics in the environment

**Goal:**

This paper enables the student to understood the applications of Microbes and confidently pursue their career in the field of Industrial, Agricultural, Medical and Environmental Biotechnology

**Objectives:**

1. Impart scope of microbial biotechnology
2. To impart knowledge on different types of industrial products produced using microbes
3. To impart importance of microbes involved environment safety
4. To create awareness on microbes role in agricultural biotechnology
5. To create awareness on microbes role in medical biotechnology.

UNIT	CONTENT	HOURS
I	<b>Microbial Biotechnology:</b> Scope and applications. Isolation of Industrial microorganisms, Production of Proteins in bacteria and yeast.	15
II	<b>Environmental Biotechnology:</b> Microbes in waste water treatment, microbial leaching and mineral recovery, oil recovery, degradation of Xenobiotics.	15
III	<b>Industrial Biotechnology:</b> Microbial synthesis and applications – organic acids(Citric acid), alcohol(ethanol), alcoholic beverages(wine), enzyme(amylase),antibiotics(penicillin),polysaccharide(xanthan), amino acid(glutamic acid).	15
IV	<b>Agricultural Biotechnology:</b> Micro-algal cultivation for human welfare (Spirullina, Chlorella, Haemotococcus, etc.), production, Mushroom cultivation, Biofertilizers (Rhizobium,), Bioinsecticides ( <i>Bacillus thuringiensis</i> ,).	18
V	<b>Medical Biotechnology:</b> RNA vaccine, DNA Vaccine, Insulin production.	12

#### TEXT BOOKS

1. Atlas, M. R. and Bartha, R. 2005, Microbial Ecology: Fundamentals and Applications, 4<sup>th</sup> Edition, Pearson Education.
2. Patel, A.H. 1997. Industrial Microbiology, Macmillan India Limited.

#### REFERENCES

1. Glazer, A. N. and Nikaido, H. 2007. Microbial Biotechnology: Fundamentals of Applied Microbiology, 2<sup>nd</sup> Edition, Cambridge University Press.
2. Prescott, C. and Dunn, G. 2006. Industrial Microbiology, Agrobios(India).
3. Pepler, H. J. and Perlman, D. 2006. Microbial Technology: Microbial processes, 2<sup>nd</sup> Edition, Vol. I, Academic Press.
4. Stanbury, F., Whittaker, A. and Hall, J. S. 1997. Principles of Fermentation Technology, Aditya books, New Delhi.
5. Jogdand, S. N. 2000. Medical Biotechnology, Himalayan Publishing House.

PAPER CODE : 14U5BTC07

VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES  
FOR WOMEN(AUTONOMOUS), ELAYAMPALAYAM.

Fifth Semester

MICROBIAL BIOTECHNOLOGY

Time: Three Hours

Maximum marks: 75

**SECTION A (10 X 2 = 20 Marks)**

**Answer ALL Questions.**

1. Define Fermentation.
2. What is recombinant DNA?
3. Write any two applications of citric acid.
4. Write about Xanthan.
5. Give two examples for free living and symbiotic nitrogen fixing bacteria.
6. What is carrier.
7. What is Gene therapy.
8. Write briefly about insulin.
9. Define BOD.
10. Define Xenobiotics.

**SECTION B (5 X 5 = 25 Marks)**

**Answer ALL Questions.**

11. (a) Discuss the scope of microbial biotechnology. (OR)  
(b) Explain the methods of preservation of microorganisms.
12. (a) Write a note on microbial production of xanthan. (OR)  
(b) Explain the production of wine.
13. (a) Enumerate the applications of Biofertilizers. (OR)  
(b) Write briefly about Bacillus thuringiensis.
14. (a) Illustrate the protocol for production of Insulin by using bacteria. (OR)  
(b) Compare conventional techniques with molecular techniques of disease.
15. (a) How microbes used for enhanced oil recovery. (OR)  
(b) Explain the process of microbial leaching of gold.

**SECTION C (3 X 10 = 30 Marks)**

**Answer Any THREE Questions.**

16. Describe the production of proteins in bacteria.
17. Elaborate the procedure for microbial production of penicillin.
18. Write an essay on mushroom cultivation.
19. How ELISA technique is used to detect infection? Explain.
20. What is xenobiotics? How it is degraded by microorganisms? Explain.

**SEMESTER – V****Elective - I****MEDICAL AND PHARMACEUTICAL BIOTECHNOLOGY**

<b>PAPER CODE:</b>	<b>14U5BTE01</b>	<b>TOTAL HOURS:</b>	<b>75</b>
<b>CREDIT:</b>	<b>5 (Five)</b>	<b>Hrs./Week:</b>	<b>5 Hours</b>

**Subject description:**

The fundamental aspects of pharmacology are introduced in the first unit with elaboration about the historical prospective; principle of pharmacology; the drugs, its usage and mechanism of action. The methods involved in drug discovery and drug designing and the different phases of clinical trials for development of new drugs; various assay methods in evaluation of drugs; the role of recombinant DNA technology and transgenic in development of pharmaceutical products has been discussed in the second topic. The recent strategies in vaccine production and the role of enzymes, hormones and antisense technology in therapeutics are discussed in the third unit. The development of different methods of diagnostics using enzymes, nucleic acids, monoclonal antibodies and the role of biosensors in diagnostics has been discussed in fourth unit. The role of biotechnology in the health care industries, the global market potential and the ethical problems associated with the medical and Pharmaceutical Biotechnology was discussed in the fifth unit

**Goal:**

This paper is focused to create a precise understanding for the students on basic concepts and advanced applications in pharmaceutical and medical biotechnology that may enables the students to confidently pursue their career in the field of Healthcare, Clinical research, Biomedical and Genetic engineering research and Allied health fields.

**Objectives:**

1. To introduce the fundamental concepts of pharmacology and mechanism of drug action
2. To provide a in-depth knowledge on drug discovery, drug design and clinical evaluation of drugs and to make them understand the role of rDNA technology in production of biopharmaceuticals
3. To illustrate the novel methods in vaccine design and delivery system and elucidate novel approaches in therapies using enzymes, hormone and antisense technology
4. To expose about the novel methods in diagnosis using enzymes, nucleic acids and monoclonal antibodies and development of different applications like strip test, biosensors and radio imaging techniques
5. To create an awareness on the role of biotechnology in healthcare, its future prospective; market potential around the world; ethical and legal issues



concerned with medical and pharmaceutical Biotechnology

UNIT	CONTENTS	HOURS
I	Introduction to pharmacology- History & Principles of pharmacology, Drugs- sources, dosage forms and routes of administration; Pharmacokinetics, Pharmacodynamics, measurement of drug action.	15
II	Drug discovery & Drug designing; Drug development - Preclinical & Clinical evaluation- Phases in Clinical trials; Bioassay of drugs. Recombinant DNA in production of therapeutic drugs; Biopharmaceuticals using transgenic animals.	15
III	Vaccines & Therapy: New generation vaccines & novel vaccine design and delivery system; DNA vaccine and Edible vaccine. Enzymes in therapy and therapeutic proteins, hormone therapy, human gene therapy, Antisense technology, Immunotherapy and immunomodulation as therapy	15
IV	Diagnosis: Enzymes in diagnosis, nucleic acid analysis, Monoclonal antibodies as tool for diagnosis, Immunodiagnosics and immunological strip test, biosensors in clinical diagnosis, radionuclide imaging	15
V	Role of Biotechnology in health care; worldwide market and opportunities in medical Biotechnology. Legal, socio economic and ethical issues associated with medical Biotechnology.	15

#### TEXT BOOKS

1. Ramadas, P. 2008. Animal Biotechnology, Recent concepts & developments.

#### REFERENCES

1. Vyas, S. P. and Dixit, V. K. 2005. Pharmaceutical Biotechnology, CBS Publishers & Distributors.
2. Jogdand, S. N. 2000. Medical Biotechnology, Himalaya Publishing House.
3. Barar, F. S. K. 2007. Essentials of Pharmacotherapeutics, S. Chand & Company Ltd.
4. Thomas, G.M. and Schalkhammer. 2004. Analytical Biotechnology, Springer International Edition.
5. Satoskar, R.S., Bhandarkar, S. D. and Ainapure, S.S. 2003. Pharmacology & Pharmacotherapeutics, Popular Prakasham, Mumbai.
6. Goldsby, R.A., Kindt, T.J., Osborne, B.A. and Kuby, J. 2003. Immunology 6<sup>th</sup> Edition, WH Freeman & Co, New York.

Paper code: 14U5BTE01

**VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR  
WOMEN (AUTONOMOUS)**

**MODEL QUESTION PAPER – April, 2013**

**B.Sc Biotechnology**

**SEMESTER – V**

**MEDICAL & PHARMACEUTICAL BIOTECHNOLOGY**

**Time: Three Hours**

**Maximum marks:**

**75**

**Section – A (10x2=20 marks)**

**Answer all the questions**

1. Mention some application of Biotechnology in health care industries
2. List out few companies dealing with medical biotechnology products
3. Give the application of immunological strip.
4. Define Biosensors
5. What is a recombinant vector vaccine?
6. What is radionuclide imaging?
7. Mention some routes of drug administration.
8. What is drug metabolism?
9. What is therapeutic index?
10. Define probit transformation.

**Section – B (5x5=25)**

**Answer all the questions choosing either (a) or (b)**

11. (a) Explain the role of Biotechnology in health care (or)  
  
(b) Discuss the world wide market and opportunities in medical biotechnology
12. (a) Explain the role of Biosensors in clinical diagnosis (or)  
  
(b) Discuss the principle and production of immunological strip test kit
13. (a) Enumerate with a schematic sketch on novel vaccine design (or)  
(b) Write short notes on Human gene therapy
14. (a) Write short notes on source and dosage of drugs(or)  
(b) Explain the measurement of drug action
15. (a) Write short notes on phases in clinical trials (or)  
(b) Explain the methods in bioassay

**Section – C (3x10=30)**

**Answer any three of the following questions**

16. Discuss the legal and ethical issues in Medical Biotechnology
17. Explain the role of Enzyme in diagnosis
18. Give an account on hormone therapy
19. Explain in detail on pharmacokinetics and pharmacodynamics
20. Describe in detail on preclinical and clinical evaluation involved in drug development

**SEMESTER-V**  
**SBEC-III**  
**ENTREPREUNERSHIP IN BIOTECHNOLOGY**

<b>PAPER CODE:</b>	<b>14U5BTS03</b>	<b>TOTAL HOURS:</b>	<b>60</b>
<b>CREDIT:</b>	<b>2 (Five)</b>	<b>Hrs./Week:</b>	<b>4 Hours</b>

**Subject Description:**

The subject enhances the business avenues and administration relevant to biotechnology products. Unit I helps to know how to develop the creativity and entrepreneurial personality and entrepreneurship in biotechnology. Unit II helps to develop knowledge about government regulations in biotech products. Unit III helps to develop production management in biotechnology. Unit IV helps to know about marketing strategies in marketing biotechnology products and unit V helps to know about the genetic engineering products.

**Goal:**

Improve entrepreneurship skills in biotechnology

**Objectives:**

1. To introduce prospects of entrepreneurships in biotechnology based industry
2. To enhance knowledge on policies and challenges in government regulation of biotech products
3. To create awareness on production management in biotechnology
4. To develop knowledge on marketing skill in introduction of biotechnology products
5. To create awareness on global status of genetic engineering in biotechnology products

UNIT	CONTENTS	HOURS
I	Biotechnological application in industry uses yeasts, bacteria and enzymes as „cell factories“ to generate sustainable energy, or create detergents, vitamins, chemicals, paper and a host of other everyday items. <b>Creativity and Entrepreneurial personality and Entrepreneurship in Biotechnology:</b> Organizational Structure and management. Capital management, Product innovation and management, Government schemes for commercialization of technology (Eg. Biotech Consortium).	12
II	<b>Government regulations for Biotech products:</b> Public policy, regulatory and ethical challenges facing the biotechnology entrepreneurship, Business development for medical products, Business development for consumable products.	10
III	<b>Basics of production management:</b> Methods of manufacturing-Project/jobbing, Batch production, process production-Characteristics of each method. Plant location-Importance-Factors affecting location-Factory building-Plant layout- Installation of facilities, Operational research: Linear programming, PERT and CPM; Production planning and Control-Scheduling-Gantt Charts-Documentation-Production-Work Order. Basics of material management.	15
IV	<b>Marketing:</b> Introduction to Marketing, Marketing Process, Marketing Environment, Segmentation, Targeting, Positioning, Consumer Behaviour, Marketing Research, Demand Forecasting, Competition, Marketing Strategy, Customer Satisfaction, Labeling, logo development, trade mark registration, and value added marketing strategy, organic certification and marketing.	13
V	<b>Business in Genetic engineering:</b> Evolution of business in genetically engineered organisms and products, Global status, Companies based on Genetically engineered products, Monsanto experience.	10

## REFERENCES

1. Dale, H. Besterfiled. 1999. Total Quality Management, Pearson Education Asia, (Indian reprint 2002).
2. Wankat, P.C. 1990. Rate Controlled Separations, Elsevier.
3. Belter, P.A. and Cussler, E. 1985. Bioseparations , Wiley.
4. Product Recovery in Bioprocess Technology, BIOTOL Series, VCH, 1990.
5. Asenjo, J.M. 1993. Separation processes in Biotechnology, Marcel Dekker Inc.
6. Innovation and Entrepreneurship in Biotechnology: Concept, Theories and Cases by Hyne & Others.
7. The business of Biotechnology: From the bench to the Street: by Richard Dano Ono, published by Butterworth-Heinemann, 1991.
8. Entrepreneurship in Biotechnology: Managing For Growth from start-up: By Martin Gross Mann, 2003.
9. Best Practices in Biotechnology Education: By Yali Friedman, published by Logos Press, 2008.

PAPER CODE: 14U5BTS03

VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN  
(AUTONOMOUS)

B.Sc., DEGREE BIOTECHNOLOGY

Fifth Semester

SBEC III-ENTREPREUNERSHIP IN BIOTECHNOLOGY

Time: 3hrs

Max.Marks:75

Section-A (2 x 10 = 20)

Answer All The Questions

1. Define Organization structure
2. Define Capital management
3. What are methods of manufacturing
4. Explain batch production
5. Define entrepreneurship
6. Explain business development.
7. Write about Marketing
8. Explain Organic certification
9. Define genetic engineering
10. Write the names of genetic engineering products

Section-B (5 X5 = 25)

Answer All The Questions

- 11.a). Explain Entrepreneurship in Biotechnology. (or)  
b) With about Product innovation and management.
- 12.a) Explain public policy in biotech products (or)  
b) Explain about business development for consumable products.
- 13.a). Explain basics of material management. (or)  
b) Write short notes on Production planning.
- 14.a). Describe about Demand Forecasting, Competition (or)  
b) Explain trade mark registration, and value added marketing strategy
- 15.a). Explain about Global status on Genetically engineered product (or)  
b). Explain Companies based on Genetically engineered product

Section-C (3X10=30)

Answer Any Three Questions

1. Explain the Government schemes for commercialization of technology (Eg. Biotech Consortium)..
2. Explain about regulatory and ethical challenges facing the biotechnology entrepreneurship.
3. Discuss Methods of manufacturing-Project/ jobbing and batch production.
4. Explain about organic certification and marketing.
5. Write about Evolution of business in genetically engineered organisms and products

**SEMESTER-VI  
CORE PRACTICAL-III**

**LAB IN ENZYME TECHNOLOGY, IMMUNOLOGY AND MICROBIAL  
TECHNOLOGY**

**PAPER CODE: 14U6BTCP03**

**CREDITS: 5**

**Hrs/Week: 6 Hours**

**Total hours:90**

**A. ENZYMETECHNOLOGY**

1. Isolation and screening of industrially important enzymes (amylase) from microbe
2. Enzyme production and assay (amylase)
3. Optimization of pH and temperature for enzyme production (amylase)
4. Immobilization of enzymes

**B.IMMUNOLOGY**

1. Study on Blood cells
  - a. Identification of blood cells
  - b. Total counting of blood cells – RBC & WBC
2. Preparation of specimen for immunology
  - a. Separation of serum and plasma
3. Agglutination test
  - a. ABO blood grouping
  - b. Widal test for typhoid fever (qualitative and quantitative test)
4. Passive agglutination test
  - a. Anti- streptolysin (ASO) test
5. Agglutination inhibition test
  - a. Pregnancy test
6. Flocculation test
  - a. Rapid Plasma regains test (RPR)
7. Precipitation test
  - a. Radial Immunodiffusion test (RID)
  - b. Ouchterlony Double Immunodiffusion test (ODD)
  - c. Immunoelectrophoresis
8. ELISA

**C.MICROBIAL BIOTECHNOLOGY**

1. Isolation and screening of antibiotic producers from soil
2. UV mutagenesis and isolation of antibiotic resistant mutants of its activity

**SEMESTER-VI**

**CORE PRACTICAL-IV**

**LAB IN NANOBIO TECHNOLOGY, BIOPROCESS TECHNOLOGY AND  
BIOINFORMATICS**

**PAPER CODE: 14U6BTC04**

**Total hours:90**

**CREDITS: 5**

**Hrs/Week: 6 Hours**

**NANOBIO TECHNOLOGY**

1. Synthesis of silver nanoparticles by chemical method and biological method
2. Antimicrobial activity of nanoparticles.
3. Antioxidant properties of nanoparticles

**BIOPROCES TECHNOLOGY**

1. Basic preservation methods of industrially important microorganisms – subculture method, mineral oil overlay method, freezing, preservation by soil
2. Design of basic fermentor
3. Production of citric acid from *Aspergillus niger* by submerged fermentation
4. Wine production
5. Estimation of alcohol by chromic acid method
6. Estimation of total and volatile acidity in alcoholic beverages
7. Production and estimation of SCP from *Spirulina* and *Azolla*

**BIONFORMATICS**

1. Sequence retrieval from NCBI and Uniprot
2. Similarity search by BLAST N & BLAST P
3. Protein structure file retrieval from PDB and visualization by Rasmol
4. Phylogenetic analysis



**SEMESTER – VI**

**CORE PAPER – VIII- NANOBIO TECHNOLOGY**

**PAPER CODE: 14U6BTC08**

**TOTAL HOURS: 75**

**Credit: 5**

**Hrs/Week: 5 Hours**

**Subject description**

Nanobiotechnology is an emerging frontier in nanotechnology. It integrates materials science, chemical engineering, physics and life science toward the biological and biochemical applications. The first unit introduces the history, definition, concepts and types of nanomaterials. The second unit deals with the properties and characterization of nanomaterials. Fabrication of nanomaterials constitutes the third unit. The fourth unit covers the applications of Nanobiotechnology. Prospects and Impact of Nanobiotechnology is covered in fifth unit.

**Objectives**

To learn the principles governing the effect of size on material properties at the nanoscale. To acquire working knowledge in nanotechnology techniques (synthesis, fabrication and characterization). To learn the wide range of applications of nanotechnology and its interdisciplinary aspect. To correlate the impact of nanotechnology and nanoscience in a global, economic, environmental and societal context.

**Goal**

The goal of the course is to provide basic knowledge in the interface between chemistry, physics and biology on the nanostructured level with a focus on biotechnological usage.

UNIT	CONTENT	HOURS
<b>I</b>	<b>Nanobiotechnology and Nanomaterials</b> – Definition, History, Concepts, significance and prospects, Types of nanomaterials - Natural and Engineered nanomaterials, Carbon nanomaterials, Metal and metal oxide nanoparticles, Quantum Dots, Nanorods, Nanocomposites, Lipid and Polymer based nanoparticles.	<b>15</b>
<b>II</b>	<b>Properties and Characterization of Nanomaterials</b> Unique properties of nanomaterials - optical, magnetic and biological, Characterization-UV Visible spectroscopy, Surface Plasmon Resonance (SPR), X-Ray diffraction technique, Dynamic light scattering, Zeta potential, Fourier Transform Infrared spectroscopy, Electron microscopy (SEM and TEM) and Scanning probe microscopy (AFM and STM).	<b>15</b>
<b>III</b>	<b>Fabrication of Nanomaterials</b> - Top Down and Bottom up approaches, Top Down- Physical and Chemical vapor deposition techniques, Lithography and its types of Lithography, Bottom up - Chemical Synthesis, Reduction processes, Co-precipitation and Biological methods, Self-assembly.	<b>15</b>
<b>IV</b>	<b>Applications of Nanobiotechnology</b> – Agriculture and Food Industry, Environmental, Nanomedicine, Nanobiosensors, Imaging techniques, Biochips, Nanopharmaceuticals - Drug delivery systems, Cancer treatment and Tissue engineering.	<b>15</b>
<b>V</b>	<b>Prospects and Impact of Nanobiotechnology</b> – Prospects and Challenges of Nanobiotechnology, Safety and ethical issues related to the usage of nanomaterials, Regulations in Nanobiotechnology, Medical, social, economic and environmental impact of Nanobiotechnology.	<b>15</b>

#### TEXT BOOKS

1. Parthasarathy, B. K. 2007. Nanotechnology in Life Science, Isha Books.
2. Balaji, S. 2010. Nanobiotechnology, MJP Publishers.

#### REFERENCES

1. Niemayer, M., Mirkin, C. A. 2004. Nanobiotechnology: Concepts, applications and perspectives, Wiley VCH publishers.
2. Chattopadhyay, K. K. and Banerjee, A. N. 2009. Introduction to Nanosciences and Nanotechnology, PHI Learning Private Limited, New Delhi.
3. Fulekar, M. H. 2011. Nanotechnology Importance and Applications, I. K. International Publishing House Private Limited.
4. Pradeep, T. 2010. Nano: The Essentials Understanding Nanoscience and Nanotechnology, Tata McGraw Hill Education Private Limited.

PAPER CODE: 14U6BTCO8

VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN  
(AUTONOMOUS)

B.Sc., DEGREE BIOTECHNOLOGY

Sixth Semester

NANOBIOTECHNOLOGY

Time: 3hrs

Max.Marks:75

**Section-A (5x5=25)**

**Answer All The Questions:**

1. Define nanobiotechnology.
2. What is Nano Phase Carbon material?
3. Write a short note on AFM.
4. Define lithography.
5. What is biochip?
6. Explain biosensors.
7. Define nanopores.
8. Define Bioavailability.
9. What is the role of nanobiotechnology.
10. Define drug designing.

**Section-B (5X10=50)**

**Answer All The Questions**

- 1.a) Give an account on the topology of DNA. (or)  
b) Write shortly on Nanoparticles.
- 2.a) How can you analyze the biomolecular structures of nanoparticles by AFM. (or)  
b) Define lithography and its role with its types.
- 3.a) Give an account on the potentials of biosensors. (or)  
b) Write shortly on Imaging techniques.
- 4.a) Define polymer therapeutics and its role. (or)  
b) Explain Elasticity of the property in the drug.  
5.a) Give an account on the role of nanobiotech in drug designing. (or)  
b) Write a note on nanotechnology in tissue engineering.

**Section-C (3X10=30)**

**Answer Any Three Questions**

1. What are the challenges of nanobiotechnology.
2. Discuss in detail about Scanning Probe Electron Microscopy and its advantages.
3. What are the types of biosensors? Explain Biomembrane based sensors.
4. How can you determine the mechanical properties of the drug delivery system.
5. Give an account on economic status of Nanobiotechnology.

**SEMESTER-VI**  
**CORE PAPER-IX**  
**BIOPROCESS TECHNOLOGY**

<b>PAPER CODE:</b>	<b>14U5BTC05</b>	<b>TOTAL HOURS:</b>	<b>75</b>
<b>CREDIT:</b>	<b>5 (Five)</b>	<b>Hrs./Week:</b>	<b>5 Hours</b>

**Subject description:**

The Bioprocess Technology is designed to prepare individuals to work as Process Operators in biological products manufacturing facilities. Unit I help the students to understand the isolation, screening, preservation and types of fermentation used. Unit II help the students to know about the different types of fermentor used in the industry and their control systems. Unit III describes different types of process involved in fermentation of products using microbes. Unit IV and V helps the students to know about microbial production for different products in industries.

**Goal:**

Empower students' knowledge in bioprocess technology and its industrial application

**Objectives:**

1. To introduce bioprocess technology
2. To develop a basic science foundation towards bioprocess technology employed in industry.
3. Empower students on basic knowledge on industrial production
4. Enhance students' knowledge on large scale production of biomass and downstream process
5. Develop skills on different industrial products and associated government policies

UNIT	CONTENTS	HOURS
I	Importance of bioprocess technology, Evolution bioprocess technology at micro, small and medium scale industries. Introduction to fermentation and downstream processing technology.	15
II	Screening and Isolation industrial important microorganisms, Strain improvement, Culture preservation and stability, Preparation and Sterilization of fermentation media. Types of fermentation – Batch, Fed batch and Continuous. Immobilization techniques.	15
III	Fermentor Design and Scale-up, Mixed Bioreactor Systems, Dynamic Modelling of fermentation systems, Instrumentation for Monitoring and Controlling Bioreactors, Instrumentation for Process Control, Systems for Fermentation process control.	15
IV	Downstream Processing, Disruption of Microbial Cells, Centrifugation, Filtration of Fermentation Broths, Cell Processing & Cell separations, Ultra filtration, Liquid-Liquid Extraction, Chromatography - Ion Exchange, Molecular Sieve, Affinity, HPLC. Distillation, Fluid Extraction & Electro dialysis.	15
V	Wine, Ethanol. Organic acids - Citric acid and Lactic acid, Acetic acid. Amino acid – Lysine. Enzyme - Alpha amylase. Vitamin B12 – Antibiotics – Penicillin, Streptomycin. Policies and programmes on industrial development of the State / Central Governments.	15

**TEXT BOOKS**

1. Agrawal, A.K. and Pradeep Parihar. 2006. Industrial Microbiology, Student edition, Jodhpur.
2. Bryan,W. and Keith,W. 1975. A Biologist guide to principles and techniques of practical biochemistry.
3. Patel, A.H. 2005. Industrial microbiology, Published by Mac Millan India Ltd, Chennai.
4. Purohit, S.S., Saluja, A.K and Kakrani, H.N. 2004. Pharmaceutical Biotechnology. First edition, Agrobios (India).

**REFERENCES**

1. Wulf Crueger and Anneliese Crueger. Biotechnology: A Text Book of Industrial Microbiology Science Tech Publishers, USA.
2. Murry Moo-Young. Comprehensive Biotechnology, 1-4 Volumes, Pergamon Press Ltd.
3. Henry, C. Vogel and Celeste L. Torado. 2005. Fermentation and Biochemical Engineering Handbook, Standard Publishers Distributors, New Delhi.
4. Hugo, W.B. and Russel, A.D. 1998. Pharmaceutical Microbiology, Sixth edition, Black Well Scientific Company Ltd.
5. Jayanto, A. 2006. Fermentation Biotechnology, Dominant Publishers and Distributors, New Delhi.
6. Cassida, J.R. 2005. Industrial Microbiology, New Age International (P) Ltd, New Delhi.
7. Peter F. Stanbury. Butterworth-Heinemann, Principles of Fermentation Technology. Elsevier Science Ltd.
8. Juan, A. and Senjo, A. 2007. Separation Process in Biotechnology, Taylor & Francis group.
9. Sivakumar, P.K., Joe, M.M. and Sukesh, K. 2010. An introduction to Industrial Microbiology, First edition, S. Chand & Company Ltd, New Delhi.
10. Stanbury, P.F., Whitaker, A. and Hall, S.J. 1997. Principles of Fermentation Technology, Second edition, Pergmon Press.
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PAPER CODE: 14U6BTC09

VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN  
(AUTONOMOUS)  
B.Sc., DEGREE BIOTECHNOLOGY  
SIXTH Semester

BIOPROCESS TECHNOLOGY-CORE PAPER-IX

Time: 3hrs

Max.Marks:75

Section-A (2 x 10 = 20)

Answer All The Questions:

1. Define the role of chelators in fermentation media
2. Describe importance of immobilization
3. What is diauxic growth?
4. Define the term Containment
5. What are the factors to be considered in designing a fermentor for plant cell culture
6. Comment on membrane fouling and the strategies to overcome it.
7. Write about importance of pH in wine
8. Explain the principle behind supercritical fluid extraction
9. What are antibiotics give example
10. Comment on membrane fouling and the strategies to overcome it

Section-B (5 X5 = 25)

Answer All The Questions

- 11.a). Explain optimization of media using Plackett-Burman design. (or)  
b) With the help of diagram explain the basic design of fermentor.
- 12.a) How is pH measured and monitored in a fermentor (or)  
b) Differentiate Solid state fermentation and submerged fermentation.
- 13.a). Explain in briefly Affinity chromatography and Molecular sieve chromatography. (or)  
b) Write short notes on different chemical methods of cell disruption.
- 14.a). Describe the preservation procedures followed in maintenance of microbial culture(or)  
b) Explain wine production
- 15.a).Explain microbial production of amino acids (or)  
b).Expalin microbial production of antibiotics

Section-C (3X10=30)

Answer Any Three Questions

5. Explain the various phase of microbial growth in detail.
6. Discuss in detail,the techniques of improving the efficiency of industrially important bacterial strains.
7. Discuss in detail, the methods in sterilization of fermentation media.
8. Explain the basic design and operation of enzymatic membrane reactors and rotating disc fermentor.
9. With neat diagram,explain the different drying devices in detail.

**B.Sc. BIOTECHNOLOGY**  
**SEMESTER-VI**  
**FOOD BIOTECHNOLOGY**  
**ELECTIVE - II**

<b>PAPER CODE:</b>	<b>14U5BTE02</b>	<b>TOTAL HOURS:</b>	<b>75</b>
<b>CREDIT:</b>	<b>5 (Five)</b>	<b>Hrs./Week:</b>	<b>5 Hours</b>

**Subject description:**

The food biotechnology is designed to prepare individuals to know about the process in food biotechnology. Unit I help the students to types of contamination and spoilage in food materials. Unit II help the students to know about the different types of methods used in preparing beverages and baking. Unit III describes different types food adulterations. Unit IV helps the students to know about food safety and regulations and Unit V helps the students to know about food safety acts..

**Goal:**

Enhance students' knowledge and awareness in food biotechnology

**Objectives:**

1. To impart basic knowledge on food biotechnology, contamination and spoilage in food materials.
2. To inculcate different types of beverage and their preparation, baking and confectionary technologies
3. To create awareness on food adulteration and contamination by microbes
4. Impart enhance knowledge on food processing technology
5. To create knowledge on safety regulation in food safety and their acts



UNIT	CONTENT	HOURS
I	Introduction to food biotechnology, Sources of contamination, spoilage and preservation of general food materials (meat, fruits, milk, vegetables)	10
II	Introduction to beverages. Types of wine (red wine, white wine and wine from other fruits). Introduction to fermentation. Fermentation of fruits by microorganisms. Principles of baking. Role of microorganisms in baking. Introduction to cookies and its types (Cereal based and dough based cookies). Basics of preparation of homemade chocolates and dark chocolates. Cereals based chocolates. Preparation of ice-creams and its preservation.	20
III	Definition for food adulteration and adulterant. Types food adulterated (Spices varieties, Honey, Sugar, Cooking oil). Impact of food adulteration in human health. Filth and foreign matter adulteration. Economic adulteration. Microbial contamination in adulteration of food. Enforce actions (FDA & FSIS)	15
IV	Natural and chemical preservatives in food industries, Pickle making, Preparation of health drinks and health mix powder from agro products, Dairy products, etc.	10
V	General food safety regulations. Food safety measures. Indicators of food safety. Food plant sanitation & cleaning inspection. Hazard analysis critical control point (HACCP) in food industry. Regulatory agencies for food safety (WHO and FAO). Food safety act (FSA-1990). Indian Food safety and standards act-2006. Federal acts (Food drug and cosmetic act, meat inspection act, poultry products inspection act.	20

### TEXT BOOKS

1. Rita Singh. 2004. Food Biotechnology, Global Vision Publishers, New Delhi.
2. Frazier, W.C. and Westhoffs, D.C. 1993. Food Microbiology, IV Edition, TMH.

### REFERENCES

1. Eliasson. 1993. Cereals in Bread making: A molecular approach, Taylor Francis publishers.
2. Duncan Manley. 2011. Manley's Technology of Biscuits, Crackers and Cookies, IVth edition, Elsevier science publishers.
3. Edward Lambert. 2011. The art of confectionary – New century edition with direct link technology, New century books publishers.
4. Wilhelm Holzapfel. 2014. Advances in fermented foods and Beverages: Improving quality, technologies and health benefits, Wood head publishing series in food science, technology and nutrition.
5. Jasper Womach. CRS = Report for Congress: Agriculture: A Glossary of Terms, Programs, and Laws, 2005 Edition
6. Ellis, D.I. Brewster, V.L. Dunn, W.B. Allwood, J.W. Golovanov, A. and Goodacre, R. 2012. Fingerprinting food: current technologies for the detection of food adulteration and contamination, Chemical Society Reviews, 41, 5706–5727.

PAPER CODE: 14U6BTE02

VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN  
(AUTONOMOUS)

B.Sc., DEGREE BIOTECHNOLOGY

Sixth Semester

FOOD BIOTECHNOLOGY-CORE PAPER-IX

Time: 3hrs

Max.Marks:75

**Section-A (2 x 10 = 20)**

**Answer All The Questions:**

1. Define food biotechnology
2. What are the source of food contamination
3. What is beverages?
4. Define the term fermentation
5. What is food adulteration
6. Explain about FDA.
7. Write about food safety
8. Explain the HACCP
- 9..What are food safety Acts
10. Explain food act

**Section-B (5 X5 = 25)**

**Answer All The Questions**

- 11.a). Explain preservation method of food materials. (or)  
b) Write about different types of contamination in food.
- 12.a) Explain about red wine (or)  
b) Explain about preparation of ice creams and its preservation.
- 13.a). Explain food adulteration. (or)  
b) Write short notes on different adulterants.
- 14.a). Describe about food safety regulation (or)  
b) Explain food plant sanitation
- 15.a). Explain about Food safety act 1990 (or)  
b). Explain poultry product inspection

**Section-C (3X10=30)**

**Answer Any Three Questions**

16. Explain the various types of food contamination and spoilage.
17. Explain about fermentation of fruits by microorganisms.
18. Discuss impact of food adulteration in human health.
19. Explain about indicators of food safety.
20. Write about regulatory agencies for food safety (WHO and FAO).

**SEMESTER VI  
ELECTIVE- III**

**BIOINFORMATICS, IPR AND BIOETHICS**

**PAPER CODE: 14U6BTE03**

**TOTAL HOURS: 75 hours**

**Credit : 5 (Five)**

**Hrs/Week: 5 hours**

**Subject description:**

Bioinformatics which has information about the different types of biological databases which includes nucleic acids, protein databases and data analysis can be studied in unit I. Different types of sequence alignments used in bioinformatics such as multiple sequence alignment, Scoring matrices, phylogentic analysis, BLAST analysis etc., can be studied in unit II. The molecular docking and drug designing studies can be studied unit III. The intellectual property rights, applications of patents laws in biotechnology and licensing can be studied in unit IV. Bio-safety, guidelines of rDNA technology can be studied in unit V

**Goals:**

To make the student to understand the databases in the bioinformatics, sequence analysis, phylogentic analysis, docking methods and intellectual property rights.

**Objectives:**

To know the different types of biological databases used obtain the data about the different types of sequences

To know the sequences analysis and their alignments, Phylogenetic tree analysis and BLAST analysis tool in bioinformatics

To know the structure prediction, gene prediction, molecular docking and drug designing"s

To know the different property rights, patent laws in biotechnology, licensing and cross licensing

To know the bio safety rules and guidelines for handling rDNA technology and transgenic plants

Unit	Content	Hours
I	Bioinformatics – Biological Databases- Nucleic acid sequence databases – GenBank/NCBI, EMBL, and DDBJ. Protein sequence databases – UniprotKB and PIR, Structure databases – PDB, CATH and SCOP. Specialized Databases – BLOCKS, PRINTS and Pfam, Microarrays- Microarray data analysis, Proteomic data Analysis.	15
II	Sequence Analysis- sequence alignment, Dot plot, pairwise Sequence Alignment- Local alignment and Global alignments- Dynamic programming algorithm for sequence alignment, Scoring matrices, gap penalties. Multiple sequence alignment- scoring methods-clustalW- Phylogenetic Analysis- tree construction methods- Maximum likelihood and maximum parsimony- distance methods- Database similarity search- Basic Local Alignment search tool (BLAST).	15
III	Gene prediction methods – ORF finder, Restriction site analysis. Protein secondary structure prediction – GOR and ChauFasman methods- Comparative Modeling -Drug Designing– Drug discovery pipeline- Molecular Docking; Pharmacophores-Structure-based methods to identify lead compounds; <i>de novo</i> ligand design.	15
IV	Intellectual property Right: WTO-GATT and TRIPS. Different types of Intellectual property Rights –Patents-Plant breeder’s rights. Patent application – Rules governing patents. Special application of patent laws in Biotechnology. Licensing and cross licensing.GMO’s - Golden rice and Flavr savr <sup>™</sup> tomato – regulations.	15
V	Biosafety: Definition – requirement-Bio safety for human and environment-General guidelines for rDNA research activity- Containment facilities and Biosafety practices-Guidelines for research in transgenic plants and applications. Social and ethical issue.	15

**TEXT BOOKS**

1. Patel, A. H. 2005. Industrial Microbiology. Mac Millan India Ltd, New Delhi.
2. David, H. M. 2005. Bioinformatics. Second edn. CBS Publishers, New Delhi.

**REFERENCES**

1. David, R., Westhead, J., Howard, P. and Richard, M., and Twyman. Instant Notes- Bioinformatics Viva Books Private Limited, Chennai.
2. Sillince, J. A. and Sillince, M. 1991. Molecular databases for protein sequence and structure studies. Springer Verlag.
3. Gribskov, M., Devereux, J. 1989. Sequence analysis primer. Stockton Press.
4. Seizberg, S. L., Searls, D. B. and Kasif, S. 1998. Computational methods in Molecular biology now comprehensive Biochemistry. Elsevier.
5. Garfield, L. I. 1992. Information theory and living systems Columbia University Press.
6. Recombinant DNA safety guidelines, Department of Biotechnology, Ministry of Sciences & Technology, Government of India.
7. Recombinant DNA safety guidelines & regulation, Department of Biotechnology, Ministry of Sciences & Technology, Government of India.
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**PAPER CODE: 14U6BTE03**

**VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN  
(AUTONOMOUS)  
B.Sc., DEGREE BIOTECHNOLOGY  
Sixth Semester  
BIOINFORMATICS, IPR AND BIOETHICS**

**Time: 3hrs**

**Max.Marks:75**

**Section-A (10x2=20)**

**Answer All The Questions:**

1. Define Bioinformatics.
2. Explain about Biosafety.
3. Define IPR.
4. Give a note on Plant Breeders Rights.
5. Explain about GATT and TRIPS.
6. Give an account on BLAST.
7. Write a note on Patent.
8. Types of gene prediction methods.
9. Explain about structural database.
10. Explain about Drug designing.

**Section-B (5X5=25)**

**Answer All The Questions**

1. a) Explain about nucleic acid sequence databases. (or)  
b) Explain about Specialized Databases.
2. a) Explain about Local alignment and Global alignments. (or)  
b) Give detail about phylogenetic analysis.
3. a) Explain about GOR and ChauFasman methods. (or)  
b) Give an account on de novo ligand design.
4. a) Explain about GATT and TRIPS. (or)  
b) Explain about Plant breeder's rights.
5. a) Give an account on General guidelines for rDNA research activity. (or)  
b) Explain about Biosafety practices.

**Section-C (3X10=30)**

**Answer Any Three Questions**

6. Give detail about Microarray data analysis.
7. Explain about BLAST.
8. Give detail about Drug discovery pipeline.
9. Explain about Golden rice and Flavr savr tomato.
10. Give detail on Guidelines for research in transgenic plants and applications.

**SEMESTER-VI**  
**SKILL BASED ELECTIVE COURSE - VI**

**GENOMICS**

**PAPER CODE: 14U6BTCO4**

**Total hours allotted : 30**

**CREDIT: 2**

**Hrs/Week: 2 Hours**

**Subject description:**

This course presents the basic biological and chemical properties of chromosomes, molecular techniques, cloning strategies and application of genomics. The human genome project reveals the locations of all genes.

**Objectives:**

To equip the students with basic knowledge and principles in genomics, genome sequence and human genome project.

**Goal:**

To enable the students to learn the various techniques in genetic analysis, To DNA sequences, and genome mapping.

UNIT	CONTENTS	HOURS
I	<b>Genes and Chromosomes:</b> Definition of genes, genomes and chromosomes, Types of Genomics – Genome Anatomies – Prokaryotic and Eukaryotic (Nuclear, Mitochondria and Chloroplast), Genome organization in Prokaryotes and eukaryotes.	6
II	<b>Gene Isolation and Sequencing:</b> Isolation and purification of genomic DNA, Sequencing of Genes by Maxam Gilbert's Method, Sanger's Method, shotgun method, Synthesis of genes by chemical method, Gene synthesis machines.	10
III	<b>Molecular Markers:</b> RFLP, RAPD, AFLP Micro satellites, Mini satellites. Chromosome walking, Chromosome jumping and Chromosome painting.	5
IV	<b>Genome Mapping:</b> Physical Mapping, Genetic mapping, Cytogenetic mapping using chromosome special markers.	4
V	<b>Human Genome Project:</b> Birth and activity of HGP, Mapping of the Human Genome, Human Genome Sequence, Genomes of other organisms sequenced, Molecular Phylogenetics.	5

## REFERENCES

1. Gardner, E.J., Simmons, M.J. and Snustad, D.P. 2006. Principles of Genetics, VIII Edition, John Wiley & Sons.
2. Snustad, D.P. and Simmons, M.J. 2009. Principles of Genetics, V Edition, John Wiley and Sons Inc.
3. Klug, W.S., Cummings, M.R. and Spencer, C.A. 2009. Concepts of Genetics, IX Edition, Benjamin Cummings.
4. Russell, P. J. 2009. iGenetics- A Molecular Approach, III Edition, Benjamin Cummings.
5. Glick, B.R. and Pasternak, J.J. 2003. Molecular Biotechnology- Principles and Applications of recombinant DNA, ASM Press, Washington.
6. Pevsner, J. 2009. Bioinformatics and Functional Genomics, II Edition, John Wiley & Sons.
7. Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. IX Edition, Introduction to Genetic Analysis,
8. Ghosh, Z. and Mallick, V. 2008. Bioinformatics-Principles and Applications.
9. Oxford Brown, T. A. 2006. Gene Cloning and DNA Analysis. 5th edition. Blackwell Publishing, Oxford, U.K.
10. Clark, D.P. and Pazdernik, N.J. 2009. Biotechnology-Appling the Genetic Revolution, Elsevier Academic Press, USA.
11. Glick, B.R. and Pasternak, J.J. 2003. Molecular Biotechnology, 3rd edition, ASM Press, Washington D.C.
12. Primrose, S.B. and Twyman, R.M. 2006. Principles of Gene Manipulation and Genomics, 7th edition. Blackwell Publishing, Oxford, U.K.



PAPER CODE: 14U6BTSO6

VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN  
(AUTONOMOUS)  
B.Sc., DEGREE BIOTECHNOLOGY  
Sixth Semester  
GENOMICS

Time: 3hrs

Max.Marks:75

**Section-A (10x2=20)**

**Answer All The Questions:**

1. Define chromosomes.
2. Draw the outline of chloroplast genome.
3. Purify DNA.
4. Define microsatellites.
5. Define cytogenetic mapping.
6. Briefly explain chromosome painting.
7. Write a short note on human genome.
8. Define molecular phylogenetics.
9. Define gene nanobiotechnology.
10. Define genomics.

**Section-B (5X5=25)**

**Answer All The Questions**

- 1.a) Explain about topology of DNA.(or)  
b) Write a note on mitochondrial genome.
- 2.a) How will you isolate genomic DNA. (or)  
b) Explain Maxam Gilbert's Method of gene sequencing.
- 3.a) Write a note on AFLP. (or)  
b) Write a note on RFLP.
- 4.a) Explain about FISH. (or)  
b) Explain about physical mapping.
- 5.a) Explain about chromosome walking. (or)  
b) Explain about molecular phylogenetics.

**Section-C (3X10=30)**

**Answer Any Three Questions**

6. Explain about genome organization in eukaryotes.
  7. Explain about gene synthesis machines.
  8. Explain in detail about RAPD.
  9. Explain about genome mapping.
  10. Explain about Human genome project.
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