CMS COLLEGE OF SCIENCE AND COMMERCE
(AUTONOMOUS)
Chinnavedampatti, Coimbatore - 641 049

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DEPARTMENT OF BIOTECHNOLOGY

I Year B.Sc., Biotechnology

CURRICULUM, SCHEME OF EXAMINATION AND SYLLABI (CBCS)
(2011)
(FOR THE STUDENTS ADMITTED DURING THE ACADEMIC YEAR 2011)

DEPARTMENT OF BIOTECHNOLOGY
B.Sc., Biotechnology

REGULATIONS

INTRODUCTION

BIOTECHNOLOGY
Any technology application that uses biological systems, living organisms or derivatives thereof, to make or modify product and processes for specific use.

OBJECTIVES
On successful completion of the course, the students will thoroughly understand "What is Biotechnology?", as well as basic techniques used in Biotechnology, various Biotechnological processes, applications of Biotechnology in various fields, such as Medical Biotechnology, Pharmaceutical Biotechnology, Animal Biotechnology, Plant Biotechnology, Immunology, Molecular Biology, Genetic Engineering and Recombinant DNA Technology, Microbial Biotechnology, Fermentation and Bioprocess Technology, Genomics & Proteomics. Students will also appreciate IPR and Patenting of live forms, Germplasm preservation & Cloning of animals, and Nanobiotechnology. The students will also understand the recent advancements & developments in Biotechnological research.

ELIGIBILITY
A pass in Higher Secondary Examination with one of the subjects as Biology/Botany/Zoology (Academic).

DURATION OF UG COURSE
The course shall extend over a period of three years comprising of six semesters, with two semesters per year. There shall not be less than ninety instructional days (five hours/day) during each semester. Examination shall be conducted at the end of each semester for the theory subjects and practical examinations will be conducted at the end of the even semester.

DISTRIBUTION OF THE MARKS AND CREDITS UNDER CBCS

PART	SUBJECT	No of Papers	Marks @	Credits
I	**Language – I** Tamil /Malayalam/Hindi/French	4	400	16
II	**Language – II** English	4	400	16
III	**Core** Subjects	15 $	1450	58
	Allied Subjects	6**	400	16
	Elective Subjects	3	300	12
IV	**1 - Non-Major Elective** **Elective – I** Tamil£/Advanced Tamil/ Communicative English **Elective – II** Tamil£/Advanced Tamil/ General Awareness	2	100 #	4
	2 – Skill Based Subjects	4	300	12
	3 – Foundation Course I	1	50 #	2
	4 – Foundation Course II	1	50 #	2
V	**Extension Activities**	-	50!!	2
	Total		**3500**	**140**

Note: I

@ Includes 25/40 % continuous assessment marks for theory and practical subjects respectively.

$ In core subjects both theory and practicals should be included wherever applicable.

** In allied subjects both theory and practicals should be included wherever applicable.

No Continuous Internal assessment for these subjects

!! The Evaluation of extension activities will be based on NSS/ NCC/ SPORTS/ Red Cross

£ Continuous Internal assessment for these subjects

The following parameters are considered throughout study period.

- **i)** Regularity of Attendance
- **ii)** Active participation in classes/Camps/Games (College/District//University)
- **iii)** Exemplary awards/certificates/prizes
- **iv)** Other Social Components (Blood Camp, Fine Arts etc)

Note: II

The Credit points, Lecture Hours, Marks are not linked.

Annexure No.UEC5
BOS.DT:05-08-2011

CMS COLLEGE OF SCIENCE AND COMMERCE
COIMBATORE – 641 049
(AUTONOMOUS)
B.Sc., BIOTECHNOLOGY DEGREE COURSE
SCHEME OF EXAMINATION - CBCS PATTERN
(FOR THE STUDENTS ADMITTED DURING THE ACADEMIC YEAR 2011)

Semester	Part	Sub. Code	Subject Title	Inst. Hrs per week	Examination Details				Credits
					Duration in Hours.	CIA	End Semester Exam	Total Marks	
SEMESTER I									
	I		Language – Paper I	6	3	25	75	100	4
	II		English – Paper I	6	3	25	75	100	4
	III		Core paper I - Cell Biology	4	3	25	75	100	4
	III		Core Paper II- Biochemistry	4	3	25	75	100	4
	III		Core Practical I Cell biology, Genetics & Biochemistry	2	**	**	**	**	**
	III		Allied: Chemistry 1	4	3	20	55	75	3
	III		Allied Practical : Chemistry	2	**	**	**	**	**
	IV		Foundation Course I – Environmental Studies	2	3	-	50	50	2
Total				***30***				***525***	***21***
SEMESTER II									
	I		Language – Paper II	6	3	25	75	100	4
	II		English – Paper II	6	3	25	75	100	4
	III		Core paper III – Genetics	5	3	25	75	100	4
	III		Core Practical I Cell biology, Genetics & Biochemistry	4	3	40	60	100	4
	III		Allied: Chemistry II	4	3	20	55	75	3
	III		Allied Practical : Chemistry	3	3	20	30	50	2
	IV		Foundation Course II – Cultural Heritage of India	2	3	-	50	50	2
Total				***30***				***575***	***23***
SEMESTER III									
	I		Language- Paper III	6	3	25	75	100	4
	II		English - Paper III	6	3	25	75	100	4
	III		Core paper IV- Microbiology	4	3	20	55	75	3
	III		Core paper V – Molecular Biology	4	3	25	75	100	4
	III		Core Practical II Microbiology and Immunology	2	**	**	**	**	**
	III		Allied: Basic Mathematics	3	3	20	55	75	3
	IV		Skill based Subject I Microscopy & Spectroscopy	3	3	20	55	75	3
	IV		Tamil I / Advanced Tamil (OR) Non major elective-I (Communicative English)	2	3	-	50	50	2
Total				***30***				***575***	***23***

SEMESTER IV									
	III		Language – Paper IV	6	3	25	75	100	4
	III		English - Paper IV	6	3	25	75	100	4
	III		Core Paper VI- Immunology	4	3	25	75	100	4
	III		Core Practical-II Microbiology & Immunology	3	3	40	60	100	4
	III		Allied : Fundamentals of Computers & C Programming	4	3	20	55	75	3
	III		Allied Practical : Fundamentals of Computers & C Programming	2	3	20	30	50	2
	IV		Skill based Subject 2 Bioseparation Techniques	3	3	20	55	75	3
	IV		Tamil/Advanced Tamil (OR) Non-Major Elective – II (General Awareness)	2	3	-	50	50	2
Total				***30***				***650***	***26***
SEMESTER V *									
	III		Core Paper VII – Recombinant DNA Technology I	4	3	25	75	100	4
	III		Core Paper VIII - Microbial Biotechnology	4	3	25	75	100	4
	III		Core Paper IX - Plant Biotechnology	4	3	25	75	100	4
	III		Core paper X – Animal Biotechnology	4	3	20	55	75	3
	III		Core Practical-III Molecular Biology, Plant tissue culture & Animal Cell Culture	4	**	**	**	**	**
	III		Core Practical-IV * Recombinant DNA Technology, Microbial Biotechnology & Bioprocess Technology.	3	**	**	**	**	**
	III		Elective Paper I – Bioinformatics	4	3	25	75	100	4
	IV		Skill Based Subject 3 Advanced Biotechniques	3	3	20	55	75	3
				30				***550***	***22***

SEMESTER VI									
	III		Core paper XI– Recombinant DNA Technology - II	4	3	25	75	100	4
	III		Core Practical -III Molecular Biology, Plant tissue culture & Animal Cell Culture	5	6	40	60	100	4
	III		Core Practical –IV ***** Recombinant DNA Technology, Microbial Biotechnology & Bioprocess Technology.	5	6	40	60	100	4
	III		Elective Paper II- Nanobiotechnology	4	3	25	75	100	4
	III		Elective paper III – Pharmaceutical Biotechnology	4	3	25	75	100	4
	IV		Skill Based Subject 4 Bioinstrumentation Practical	5	3	20	55	75	3
	V		Extension Activities	-	-	-	-	50	2
	VI		Mini Project$^{\mu}$	3	-	-	-	-	-
				30				***625***	***25***
Total								***3500***	***140***

µ Mini Project:
Each group of students has to undergo a mini project during the 6th semester. This should be of a minimum duration of 3 hours per week at our laboratory under the guidance of the teaching staff. Maximum of 3 students per group has to perform mini project and submit a project report. The valuation of the same is to be incorporated into the internal assessment of Core Practical III (to a maximum of 5 marks).

***** Summer Training/ Internship
Each student has to undergo a Summer Training/ Internship during the summer vacation prior to Semester V. This should be of a minimum duration of 15 days at any off-campus site approved by the Head of the Department. Students are required to submit a written report upon completion. The valuation of the same is to be incorporated into the internal assessment of Core Practical IV (to a maximum of 5 marks)
****** Examinations will be conducted in the Even Semester

Total Credits: 140 [Part I -12, Part II -12, Part III-95, Part IV -20, Part V-1]
Each paper carries an internal component; there is a pass minimum for External component and overall.

Distribution of marks between Internal* and External assessment
Theory: Internal assessment (25)*: External assessment (75)
Practical: Internal assessment (40)*: External assessment (60)

COMPONENTS OF INTERNAL ASSESSMENT
Theory: One Internal test and One Model test in each semester
Internal Test - 10 marks*
End semester Model test - 10 marks
One Assignment - 5 marks
Core Practicals I, II:
Minimum 10 experiments to be conducted/ semester – 20 marks
Average of two tests - 15 marks
Record work - 5 marks

Core Practical III:

Minimum 10 experiments to be conducted/ semester		– 20 marks
Average of two tests	- 10 marks	
[μ]Report of Mini project	- 5 marks	
Record work	- 5 marks	

Core Practical IV:

Minimum 10 experiments to be conducted/ semester		– 20 marks
Average of two tests	- 10 marks	
Report of Summer Training/ Internship	- 5 marks	
Record work	- 5 marks	

***** Retest for internal examination to be conducted for genuine cases as per the recommendations of class in charge, subject in charge. The final decision to be made by the HOD.

Semester I

COURSE: B.Sc., Biotechnology

SUBJECT TITLE: Core Paper I: CELL BIOLOGY

NUMBER OF HOURS/WEEK: 4 Hrs

Subject description: This paper provides a thorough knowledge about structure and function of cells, cellular energetic, protein trafficking, biomolecules and cellular development.

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.

Objective: Understanding the structural and functional aspects of the cell provide the student with a strong foundation in the molecular mechanisms underlying cellular function.

CONTENTS:

UNIT I
An overview of cells: Origin and evolution of cells, cell theory, early chemical investigation in cell biology. Classification of cells: Prokaryotic and eukaryotic cells, and their comparison, Comparison of microbial, plant, and animal cells.

UNIT II
Structure and function of cell wall, plasma membrane and capsule, Transport across membranes: Diffusion, active and passive transport, ion channels, appendages- cilia, flagella and microtubules.

UNIT III
Structure and function of Endoplasmic reticulum, Golgi apparatus, Ribosomes, Lysosomes, Peroxisomes and Glyoxysomes.

UNIT IV
Structure and function of Mitochondria, Chloroplast, Cytoskeleton: Types, Intermediate filaments – structure and function.

UNIT V
Structure and function of Nucleus, Chromosomes. Cell cycle: Phases of cell cycle, Cell division in Prokaryotes and Eukaryotes; Mitosis and Meiosis; Apoptosis and cell death.

REFERENCES:

TEXT BOOKS:

1. **Textbook of Cytology** by PS Verma & VK Agarwal., S. Chand & Co. Ltd., New Delhi (January 1999).
2. **Molecular Cell Biology**- Harvey Lodish, Arnold Berk, Paul Matsudaira, Chris A. Kaiser, Monty Krieger, Matthew P. Scott, Lawrence Zipursky, and James Darnell,

5th Edition (2000), published by W.H Freeman and Company, New York.

REFERENCE BOOKS:

1. **Cell and Molecular Biology** - Gerald Karp 3rd Edition (2002) John Wiley and Sons, New York.
2. **Molecular Biology of the Gene** -Watson, Baker, Bell, Gann, Levine, Losick, 5th Edition (2005), Published by Pearson Education Pvt Ltd., Singapore.
3. **Cell and Molecular Biology** - De Robertis, Eduardo D. P., 8th Ed (2008), published by Lippincott Williams and Williams.

Semester I

COURSE: B.Sc., Biotechnology

SUBJECT TITLE: Core Paper II: BIOCHEMISTRY

NUMBER OF HOURS/WEEK: 4 Hrs

Subject description: This paper presents the study of identification and quantitative determination of the substances, studies of their structure, determining how they are synthesized metabolized and degraded in organisms, and elucidating their role in the functioning of the organism.

Goal: This paper in biochemistry has been designed to provide the student with a firm foundation in the biochemical aspects of cellular functions, which forms a base for their future research.

Objective: On the successful completion of the course the students will get an overall understanding of structure of atoms, molecules and chemical bonds, enzyme kinetics, biopolymers and metabolic reactions in a living system.

CONTENTS:

UNIT I
Carbohydrates: Classification and properties of sugars, structural aspects and biological significance of carbohydrates; Glycolysis, TCA Cycle, Gluconeogenesis, Glycogen breakdown and synthesis, HMP Shunt, Oxidative phosphorylation and electron transport chain, Photophosphorylation.

UNIT II
Lipids: Structure, function and classification of lipids; Biosynthesis of fatty acids, Triglycerides, Phospholipids and Glycolipids; β oxidation of fatty acids. Vitamins – types and their biological importance.

UNIT III
Amino acids and proteins: Classification, structure and properties of amino acids. Proteins: Structure of peptide bond, Ramachandran plot, Classification of proteins. Primary, secondary, tertiary and quaternary structure of proteins.

UNIT IV
Enzymes - Classification, nomenclature and structure of enzymes. Enzyme specificity and factors affecting enzyme activity. Enzyme kinetics- Michaelis- Menten equation, significance of Km and Vmax. Allosteric enzymes, Coenzymes, Cofactors. Types of enzyme inhibition**.** An overview of isoenzymes, ribozymes and abzymes.

UNIT V
Nucleic Acids: Structure, classification and properties of Nucleic acids, Biosynthesis of purines and pyrimidines (de novo and salvage pathways). An overview of secondary Metabolites: Antibiotics, Alkaloids, Animal pigments, Prostaglandins, leukotrienes and thromboxanes.

REFERENCES:

TEXT BOOKS:

1. **Fundamentals of Biochemistry** - Jain , J.L. (1999) S. Chand & Company, Limited
2. **Fundamentals of Biochemistry-** Deb. A. C. (1989) New Central Book Agency (P) Ltd.
3. **Essentials of Biochemistry** – U. Satyanarayana (2004) Books and Allied Publications, Kolkata.

REFERENCE BOOKS:

1. **Principles of Biochemistry** – Smith *et al*., McGraw Hill International book company 8th Ed.
2. **Principles of Biochemistry** - Lehninger, 5th Edition, Published by W.H freeman and Company, New York.
3. **Biochemistry** - Jeremy M. Berg, John L. Tynoczko, Lubert Stryer, 5th Edition, W.H. Freeman and Company, New York.
4. **Harpers Illustrated Biochemistry**- Robert K. Murray, Drayl. K. Granner, Peter. A. Victor. W. Rodwell, 26th Edition (2003), Tata McGraw-Hill companies.

Semester I &II

COURSE: B.Sc., Biotechnology

SUBJECT TITLE: Core Practical – I: CELL BIOLOGY, GENETICS AND BIOCHEMISTRY

NUMBER OF HOURS/WEEK: 2 Hrs

Subject description:
This course deals with the study of cells and biochemical analysis of various biomolecules.

Goals:
To learn the various techniques in cell biology and biochemistry for the study of biomolecules.

Objective:
After the successful completion of the course the students will be aware of various cellular organelles and Biochemical analytical techniques.

Cell Biology and Genetics:

1. Cell types-microbial, plant and animal cells
2. Mitosis
3. Microtomy - Demonstration
4. Cell fractionation– Demonstration
5. Human Karyotyping – Demonstration
6. Problems related to loss of inheritance.

Biochemistry:

7. Demonstration of pH meter, Colorimeter and Spectrophotometer
8. Preparation of buffers.
9. Enzyme assay – Protease/amylase/cellulase
10. Estimation of Proteins- Lowry's method
11. Estimation of Chlorophyll – Spectrophotometric method
12. Estimation of carbohydrates-Anthrone method
13. Estimation of DNA-Diphenylamine method
14. Estimation of RNA-Orcinol method
15. Estimation of free amino acids- Ninhydrin method
16. Analysis of lipids- Saponification of lipids, iodine number and acid number
17. Quantification of vitamin C
18. Circular Paper Chromatography
19. Ascending paper Chromatography
20. Thin Layer Chromatography

References:

1. **Practical Biochemistry- Principles and Techniques**, 2nd Edition by Keith Wilson and John Walker (2000) Cambridge University Press 2000.
2. **Laboratory Manual in Biochemistry**, Jayaraman J., (1996) Wiley Eastern Limited.
3. **Biochemical Methods** 2nd Edition, Sadasivam. S. and Manickam. A., (2004), New Age International LTD Publishers, NewDelhi.
4. **An Introduction to Practical Biochemistry**, 3rd edition, David .T .Plummer, McGraw-Hill Book Company (U.K.) Ltd., London. 1987.

Semester II

COURSE: B.Sc. Biotechnology

SUBJECT TITLE: Core Paper III: MICROBIOLOGY

NUMBER OF HOURS/WEEK: 4 Hrs

Subject Description:
This course presents the study of microorganisms

Goals:
To make the student to understand the concept of Microbiology

Objectives:
After the completion of the course the students will be aware of different types of microorganisms, its metabolism, molecular mechanisms and an overall view of viruses.

CONTENTS:

UNIT 1
History and Scope of Microbiology, Sterilization and Disinfection, Microbial nutrition, Culture methods, Microbial growth, Bacterial taxonomy and Classification of viruses.

UNIT II
General properties of viruses, nature of virion, bacterio phages (lytic and lysogenic). Overview of plant viruses, overview of animal viruses, quantification of viruses. Viroids and prions.

UNIT III
An Overview of Microbial metabolism: Microbial fermentation, aerobic respiration, anaerobic respiration, photosynthesis in blue green algae, purple non sulfur bacteria and green sulfur bacteria. Biosynthesis of sugars (Calvin cycle), assimilation of phosphorous sulfur and nitrogen, peptidoglycan biosynthesis patterns of cell wall.

UNIT IV
Griffith's Transformation experiments, competency, molecular mechanism of transformation, recombination mapping. Conjugation experiments, interrupted mating experiments, conjugation mapping, transduction: generalized and specialized transduction, transduction mapping.

UNIT V
Essentials of Chemotherapy, Antimicrobials: Antibiotics - Classification, structure and uses, antifungal agents, antiparasitic and antiviral agents. Overview of multidrug resistant Bacteria.

REFERENCES:

TEXT BOOKS:

1. **Microbiology** 6th edition Prescott *et al*. (2005) Mc Graw- Hill companies.

REFERENCE BOOKS:

1. **Brock Biology of Microorganisms**. 9th edition, Madigan *et al*. (2000) Prentice- Hall, Inc. publishers.
2. **Microbiology** - Tortora, Funke and Case 9th edition (2007) Pearson education san Francisco.
3. **Microbiology**- Michael Pelczar, Chan & Krieg 5th edition (1993) Tata Mc Graw Hill, New Delhi.

Semester II

COURSE: B.Sc. Biotechnology

SUBJECT TITLE: CORE PRACTICAL I: CELL BIOLOGY, GENETICS AND BIOCHEMISTRY

NUMBER OF HOURS/WEEK: 4 Hrs

- Refer Semester I –