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

An ISO 9001:2000 certified institution and accredited at the 'A' level by NAAC

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DEPARTMENT OF BIOTECHNOLOGY

II Year B.Sc., Biotechnology

CURRICULUM, SCHEME OF EXAMINATION AND SYLLABI (CBCS)
(2011)
(FOR THE STUDENTS ADMITTED DURING THE ACADEMIC YEAR 2010)

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
a) Mathematics, Physics, Chemistry, and Biology
b) Botany, Zoology, Physics and Chemistry
c) Physics/Chemistry / Biotechnology

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 during each semester. Examination shall be conducted at the end of each semester for the respective subject.

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 2010)

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 & 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 – Microbiology	5	3	25	75	100	4
	III		Core Practical I Cell Biology & 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- Genetics	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 and Animal cell culture.	4	**	**	**	**	**
	III		Core Practical-IV ***** Recombinant DNA Technology, Microbial Biotechnology and 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 and Animal cell culture.	5	6	40	60	100	4
	III		Core Practical-IV ***** Recombinant DNA Technology, Microbial Biotechnology and 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
			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 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
$^{\mu}$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 III

COURSE: B.Sc. Biotechnology

SUBJECT TITLE: CORE PAPER IV: GENETICS

NUMBER OF HOURS/WEEK: 4 Hrs

SUBJECT DESCRIPTION:
This course presents the way characters get transferred through generations and methods to analyze and modify them.

GOALS:
To make the student to understand the concept of genes and their behavior.

OBJECTIVES:
On successful completion the subject student should have understand the Basic genetics, Gene mutation and methods to repair them.

CONTENTS:

UNIT I
Mendel's experiments and principle of segregation, monohybrid cross- Dominance, Recessiveness, Codominance and Lethals; Principle of independent assortment- Dihybrid crosses, multiple alleles- ABO Blood type and Rh Factor alleles, Gene Interaction – Epistasis and Non – Epistasis.

UNIT II
Mechanism of sex determination, sex differentiation, and sex-linked inheritance, linkage, crossing over and chromosomal mapping.

UNIT III
Identification of the genetic material by Hershey and Chase, Griffith experiment, Avery, Mcleod and Mccarthy, Fraenkel-Singer experiments; Chromosomal structure in prokaryotes and eukaryotes. Overview of Develpomental Genetics.

UNIT IV
Mutations- Spontaneous, physical and induced; Applications of mutations, Organization of DNA in Mitochondria and Plastids, Cytoplasmic Male Sterility in Plants.

UNIT V
Genetic Variation, Random mating and Hardy Weinberg method, Inbreeding, Outbreeding and Assortative mating, Genetic drift, Genetic Counseling, Genetic load, Genetic Equilibrium and Evolutionary Genetics

REFERENCES:

TEXT BOOKS:
1. **Principles of genetics** - Gardner John Wiley & sons Inc, 2001, New York.

REFERENCE BOOKS:

1. **Principles of genetics** - Robert Tamarin, 5th Ed WMC Brown publication, Boston, 1996.
2. **Genes VIII** - Benjamin Lewin,Pearson Education corporation, (2004), New Jersy.
3. **Basic genetics** - D.L.Hartl, (1991), Jones and Bartett public.
4. **Microbial genetics** - Friefielder (1987), Jones and Bartett public.
5. **Molecular Biology of the genes, 4th edition** (1987) Watson *et al*, the Benjamin /cummings coins
6. **Molecular cell biology**, (1994). Lodish, Baltimore scientific American books, Inc.

Semester III

COURSE: B.Sc. Biotechnology

SUBJECT TITLE: CORE PAPER V: MOLECULAR BIOLOGY

NUMBER OF HOURS/WEEK: 4 Hrs

SUBJECT DESCRIPTION:
This course presents the heredity and mechanism of genetic regulation.

GOALS:
To make the student to understand the concept of Molecular biology

OBJECTIVES:
On successful completion the subject student should have understand: What is gene? How is gene modulated and regulated?

CONTENTS:

UNIT I
Properties of Genetic Material, DNA replication and its types (Semiconservative, conservative, dispersive), Enzymes involved in replication, Replication events, Replication in Eukaryotic Chromosomes, Transposable Elements, Plasmids & its classification, Plasmid Transfer and Plasmid DNA Replication.

UNIT II
Transcription- Enzymatic Synthesis of RNA, Transcription Signals, Classes of RNA molecules, Transcription in Eukaryotes, Post transcriptional modification (RNA capping, Poly A addition, Splicing), Antisense RNA and RNA interference.

UNIT III
The Genetic Code, Wobble hypothesis, Protein Synthesis (Initiation, Elongation, Termination), Post translational processing, DNA Repair Mechanisms - Mismatch, dimer repair (Photoreactivation, Excision, Recombination, SOS repair).

UNIT IV
Principles of Regulation, Transcriptional Regulation (Lac Operon, Tryptophan Operon), Posttranscriptional Control, Feedback Inhibition and Allosteric control.

UNIT V:
Regulation of Transcription Initiation, Regulation of RNA Processing, Regulation of Nucleocytoplasmic mRNA Transport, mRNA Stability, Regulation of Translation, Regulation of Protein Activity.

REFERENCES:

TEXT BOOKS:

1. **Molecular Biology** - George. M. Malacinski & David Friefielder (1998) 3rd Edition, Jones and Bartlett Publishers**.**

REFERENCE BOOKS:

1. **Cell and Molecular Biology** - Gerald Karp 3rd Edition Published by John Wiley and Sons, New York.
2. **Molecular Biology of the Gene** - Watson, Baker, Bell, Gann, Levine, Losick, 5th Edition, Published by Pearson Education PVT, Ltd. Singapore.
3. **Principles of Genetics-** Gardner/Simmons/Snustad. 8th Edition (1991) John Wiley & Sons, Inc
4. **Molecular Cell Biology** - Harvey Lodish, Arnold Berk, Paul Matsudaira, Chris A. Kaiser, Monty Krieger, Matthew P. Scott, Lawrence Zipursky, and James Darnell, (2000) 5th Edition, Published by W.H freeman and Company, New York.

Semester III

COURSE: B.Sc. Biotechnology

SUBJECT TITLE: CORE PRACTICAL II: MICROBIOLOGY AND IMMUNOLOGY

NUMBER OF HOURS/WEEK: 2 Hrs

SUBJECT DESCRIPTION:
This course deals with the study of microorganisms and its application in various fields.

GOALS:
To learn the various microbiological techniques, Gene transfer mechanisms and applications of microorganisms in industries.

OBJECTIVES:
After the successful completion of the course the students will be aware of

i) Handling of microorganisms
ii) Various microbiological techniques – isolation and maintenance of pure cultures.
iii) Immunological techniques

CONTENTS:

MICROBIOLOGY:

1. Microscopy
2. Methods of sterilization
3. Staining of bacteria – Simple, Differential staining, Fungal wet mount preparation
4. Motility test
5. Pure culture techniques
6. Maintenance and preservation of cultures
7. Enumeration of bacteria, fungi and Actinomycetes from soil
8. MPN test
9. IMViC test
10. Mutation

IMMUNOLOGY:

11. Blood Film preparation and Identification of cells.
12. Methods of Injection
13. Immunization and Collection of Serum
14. Immunodiffusion- Double immunodiffusion
15. Haemagglutination
16. Immunoelectrophoresis- Classical and Counter current
17. Purification of IgG from serum (demonstration)
18. Separation of PMNCs from blood
19. ELISA (demonstration)

REFERENCES:

1. **Practical Immunology**- 4th Edition, Frank C. Hay, Olwyn M.R.Westwood (2002) Blackwell Science Publishing Company, USA.
2. **Biochemical Methods**- 2nd Edition- Sadasivam, S. & Manickam, A. (2004), New Age International LTD Publishers, New Delhi

3. **Microbiology: A Laboratory Manual** - 2 Edition, (1987), James G. Cappuccino &Natalie Sherman, Pearson/Benjamin Cummings (San Francisco)
4. **Experiments in Microbiology** by K.R.Aneja (2005), 4th Edition, New Age International Ltd Publishers, New Delhi.

Semester III

COURSE: B.Sc. Biotechnology

SKILL BASED SUBJECT 1:

SUBJECT TITLE: MICROSCOPY & SPECTROSCOPY

NUMBER OF HOURS/WEEK: 3 Hrs

Subject description: This course presents the Basic concepts of microscopy & spectroscopy

Goals: To make the student to understand the technical aspects of microscopy & spectroscopy

Objectives:
On successful completion the subject student should have understand the fundamentals of microscopy & spectroscopy

CONTENTS:

UNIT I
Principles and applications of Microscopy: Simple, Compound, light, TEM, and SEM.

UNIT II
Principles and applications of Phase Contrast, Fluorescence and Dark field microscope.

UNIT III
Photomicrography- Image formation & magnification, instrumentation-camera attachment, method to check picture composition & sharpness.

UNIT IV
Beer-Lambert's law, Colorimetry and Spectrophotometry- Principles and Applications of Visible, UV and IR spectroscopy.

UNIT V
Atomic Absorption Spectroscopy, Nuclear Magnetic Resonance, X-Ray Crystallography and Spectrofluorimetry.

REFERENCES:
TEXT BOOKS:

1. **An introduction to practical Biochemistry**-David T. Plummer, 3rd edition (1989), University Press.
2. **Analytical Biochemistry-** P. Asokhan (2001) Chinna Publications.
3. **Microbiology-** Pelczar, Kreig & Chan (1993), 5th edition, Tata Mc Graw Hill edition. New Delhi.

REFERENCE BOOKS:

1. **A Biologist guide to principles and Techniques of practical Biochemistry.**-Keith Wilson, Kenneth H.Goulding, 3rd (1992). Cambridge University Press.

2. **Instrumental methods of chemical analysis** -Sharma.B.K 11th edition (1981), Blackwell Publications.

Semester IV

COURSE: B.Sc., Biotechnology

SUBJECT TITLE: CORE PAPER VI: IMMUNOLOGY

NUMBER OF HOURS: 4 Hrs

SUBJECT DESCRIPTION: This course presents the defense system of the higher vertebrates against invading pathogen

GOALS: To make the student to understand the defense mechanism and their regulations

OBJECTIVES: On successful completion the subject student should have understand:
What is immunity, how it discriminates self and non-self, how it is regulated and what are the applications.

CONTENTS:

UNIT I
Introduction to Immunology, History of Immunology, Innate immunity- Different barriers involved in innate immunity and Acquired immunity, Primary and Secondary immune response, Humoral and Cell mediated immunity.

UNIT II
Antigens - Factors influencing immunogenicity, epitopes, haptens, mitogens, super antigens, Antibody: Structure and Functions of different classes of immunoglobulins, Overview of gene rearrangement for Antibody diversity. Antigen -Antibody interactions- Precipitation and Agglutination, ELISA.

UNIT III
Cells of immune system- Hematopoiesis and differentiation, Lymphocytes- T cells, B Cells and NK Cells, Monocytes and Macrophages, Neutrophils, Eosinophils, Basophils and Mast Cells, Organization and structure of primary and secondary lymphoid organs, Biology of complement system and Overview of Cytokines.

UNIT IV
MHC, antigen recognition and presentation, production and applications of Monoclonal antibodies. Basics of Hypersensitive reactions, autoimmune disorders - Rheumatoid Arthritis, Systemic lupus erythematosus, Transplantation - Graft vs Host Rejection, Overview of organ transplants.

UNIT V
Immunodeficiency diseases – SCID and AIDS. Vaccination - Killed, Attenuated, Subunit and DNA vaccines. Tumor immunology- tumor antigens, immune response to tumors, cancer immunotherapy.

REFERENCES:

TEXT BOOKS:

1. **Kuby's Immunology**- 6th Edition, Thomas J. Kindt, Richard A. Goldsby, Barbara A. Osborne (2007), W.H. Freeman & Company, New York.

REFERENCE BOOKS:

1. **Roitt's Essential Immunology**- 11th Edition- Peter J. Delves, Seamus J. Martin, Dennis R Burton & Ivan M. Roitt (2006), Blackwell Publishing, USA.
2. **Janeway's Immunobiology**- Kenneth Murphy, Paul Travers, Mark Walport (2008), Garland Science, Taylor & Francis group, New York.
3. **Essentials of Immunology** - 6th Edition, Ivan Riot (1988) Blackwell Scientific Publications, Oxford.
4. **Immunology**- 4th Edition -, Tizard (1995) Saunders College Publishers, New York.
5. **Immunology**- 7th Edition- David Male, Jonathan Brostoff, David B. Roth, Ivan Roitt (2006) Mosby/ Elsevier Science Publications.
6. **Cellular and Molecular Immunology**- Abul K. Abbas, Andrewtt, Lichtman & Jordan S. Pober (2000) W.B.Saunder's Company, A Harcourt Health Sciences Company, NY.

Semester IV

SUBJECT TITLE: CORE PRACTICAL II - MICROBIOLOGY AND IMMUNOLOGY

NUMBER OF HOURS/WEEK: 3 Hrs

Refer semester III

Semester IV

SKILL BASED SUBJECT 2:

SUBJECT TITLE: BIOSEPARATION TECHNIQUES

NUMBER OF HOURS/WEEK: 3 Hrs

SUBJECT DESCRIPTION:
This course presents the Basic concepts of separation techniques.

GOALS:
To make the student to understand the technical aspects of separation techniques.

OBJECTIVES:
On successful completion the student should have understood the fundamentals of separation techniques.

CONTENTS:

UNIT I
Principles & applications of Centrifuges: types of centrifuges- preparatory & analytical centrifuges, low speed, high speed and Ultracentrifugation.

UNIT II
Principles & applications of Chromatography- Paper, Thin layer, dialysis and Column Chromatography.

UNIT III
Principles & applications of Gel Filtration, Ion Exchange and affinity chromatography.

UNIT IV
Electrophoretic techniques: capillary, Paper, Polyacrylamide Gel Electrophoresis (Native, Non-Denaturing and Denaturing SDS-PAGE); Agarose gel electrophoresis and 2D-Gel Electrophoresis.

UNIT V
Extraction & isolation of plant constituents: Methods of disrupting cell walls, methods for extraction of plant constituents, method of distillation and high pressure extraction methods.

REFERENCES:

TEXT BOOKS:

1. **An introduction to practical Biochemistry -** David T. Plummer, 3rd Edition (1989), University Press.
2. **Analytical Biochemistry -** P. Asokhan (2001), Chinna Publications.

REFERENCE BOOKS:

1. **A Biologist guide to principles and Techniques of practical Biochemistry** - Keith Wilson, Kenneth H.Goulding, 3rd Edition (1992). Cambridge University Press.
2. **Instrumental methods of chemical analysis** -Sharma.B.K 11th edition (1981), Blackwell Publications.

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