

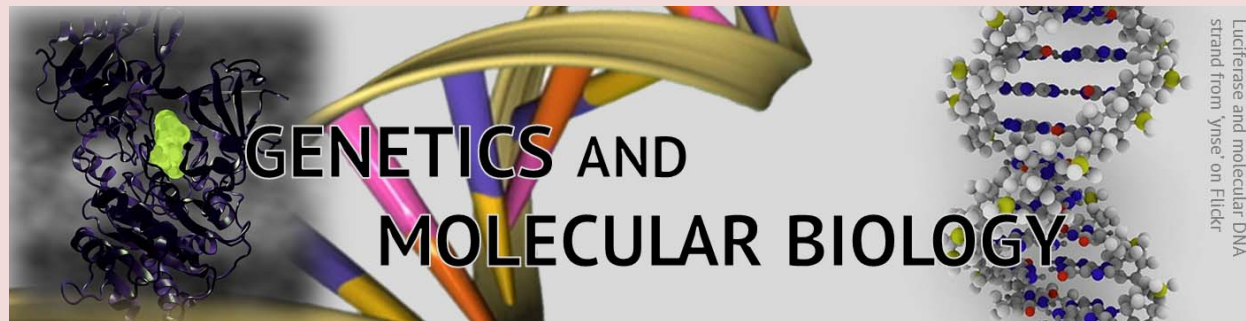
T.Y B.SC. BIOTECHNOLOGY

Semester V

2015-16

Paper: Genetics & Molecular Biology

Paper IX



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Course taught by: **Ms. Lee-Anne D'Costa**

Assistant professor

Department of Biotechnology

Parvatibai Chowgule College of Arts & Science (Autonomous)

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COURES HOME

Course Title: **Genetics & Molecular Biology**

Course Code: **Paper IX**

Course taught by: Theory: **Ms. Lee-Anne D'Costa**

Course marks: Theory: 20 (ISA) + 80 (SEE) = 100 marks & Practical: 50 marks

COURSE SCHEDULE

Number of Lectures/week: Three

Number of Practical/week: One

Classrooms: B - 305

Timings & Days of the week: **Theory**

Thursday, Friday, Saturday – 09:30 – 10:30 a.m

Timings & Days of the week: **Practical**

Biotechnology Laboratory – **Thursday 10:30 – 01:30**

COURSE OBJECTIVES

1. INTRODUCTION AND RATIONALE: Genetics is the study of genes and their application in different areas of science, it mostly deals with the study of genes, heredity, and genetic variation in living organisms. It is generally considered a field of biology, but it intersects frequently with many of the life sciences and is strongly linked with the study of information systems. Molecular Biology is the branch of biology that deals with the molecular basis of biological activity. This field overlaps with other areas of biology and chemistry, particularly

genetics and biochemistry. The paper Genetics and Molecular Biology is a beautiful culmination of the biological aspects of genes and the underlying mechanisms involved in same.

2. LEARNING OUTCOMES: The students will gain the knowledge of the genes and concept of heredity along with mechanisms involved in gene regulation. They will also be acquainted with the various procedures in practical to isolate genetic material and study the reason for mutagenesis and other factors associated with the regulation of genetic material.

3. INDICATIVE CONTENTS: The course starts with the Mendel's Laws & inheritance of genes, aberrations associated with genes on chromosomes, concept of chromosomes. The paper progresses towards understanding population genetics that forms an important component of understanding the evolution, mutation and migrations of genes in a given population. In Molecular biology part the main contents include transcription, translation and regulation of gene expression along with regulation of gene expression in prokaryotes and eukaryotes.

4. MAIN LEARNING AND TEACHING ACTIVITIES: The course will be taught with the help of formal lectures, along with power point presentations, quiz, assignments, seminars, surprise tests and group discussions. Video clips will be used to help students understand the various mechanisms behind processes.

5. ASSESSMENT AND EVOLUTION DETAILS:

ISA

Two ISA's: 20 marks each will be conducted and an average of the two will be taken.

First ISA will be a written examination whereas the second will be assignment.

SEE

Semester end exams: 80 marks and will be carried out by the Goa university.

PROJECT WORK: The project work will be evaluated at the end of VI semester on the following criteria's:

Internal assessment 50 marks

Project Report 20 marks

Field work/ Library work/Practical work 20 marks

Attendance of the student 05 marks

Maintenance of the record by the student of 05 marks

Field work/ Library work/Practical work

EXTERNAL EXAMINOR'S ASSESSMENT 50 marks

Project Report 25 marks

Viva Voce 25 marks

SYLLABUS

Sr.No	Topics	Sub Topics
1	Mendel's laws of Inheritance	Mendel's Experiment. Mendel's Laws of Inheritance, test cross, back cross, incomplete dominance and co-dominance
2	Multiple alleles and multiple genes	Multiple alleles and Isoalleles, blood groups in human beings, Multiple genes
3	Inheritance of Human traits	Brown Eyes, Polydactyly, Diabetes insipidus, Phenylketonuria, Sickle cell Anemia, Genetic Counselling.
4	Structure and numerical aberrations involving chromosomes	Hereditary defects- Klinefelter, Turner, Cri-du-chat and Down syndromes.
5	Population Genetics	Population, Gene pool, Gene frequency and genotype frequency, Genetic Equilibrium and Hardy Weinberg Law
6	Introduction to molecular biology	Semi-conservative replication of DNA Meselson –Stahl experiment
7	Chromosomes	Structure of eukaryotic chromosomes. Giant chromosomes-Polytene and Lampbrush
8	Genetic code	Characteristics of genetic code.
9	DNA Mutation	Spontaneous and Induced mutation, Chemical (ethidium bromide, alkylating agents, base analogs) and physical Mutagens. DNA repair systems: Mismatch, photo-reactivation repair, Excision repair.

10	DNA replication	DNA replication in prokaryotic and eukaryotic system.
11	Transcription	Transcription in Prokaryotes and Eukaryotes RNA-rRNA, m-RNA, t-RNA Promoters and transcriptional factors, RNA polymerases Initiation-Elongation-Termination .
12	Translation	Protein synthesis in prokaryotes and eukaryotes: Initiation, elongation and termination. Protein factors involved in translation.
13	Regulation of gene expression	Prokaryotes:- Operon concept - lac and trp Eukaryotes: -Role of enhancers/promoters and silencers in modulating Transcription. -Post transcriptional regulation- capping , Splicing, polyadenylation.
14	Recombination in Prokaryotes	Conjugation Transduction- specialized and generalized. Transformation - concept.
15	Mobile DNA elements	Transposons, History, IS sequences, Composite transposons, replicative transposons
		Total

Practical

1. Isolation of DNA from bacterial and eukaryotic cells (plant/animal systems).
2. Isolation of RNA from bacterial or eukaryotic cells (plant/animal systems)
3. Molecular weight determination by Agarose gel electrophoresis.
4. Spectrophotometric analysis of DNA by DPA method.
5. UV survival curve / Chemical mutagenesis for *E.coli*.
6. Preparation of Polytene chromosome from Chironomous larva/Drosophila larva.

Reference books for theory:

MANDATORY

1. Lewin B. Genes XI. 2007. Jones and Bartlett Publishers
2. Watson J.D., Hopkins N.H. *et al.* Molecular Biology of the Gene. (2008). Garland Publishing (Taylor & Francis Group), New York & London.
3. Robertis E.D.P., Robertis E.M.F., Cell Biology and Molecular Biology. 8th edition, 1998. Sauder College.
4. Nelson D.L. and Cox M.M. 2000. Lehninger Principles of Biochemistry (3d Edition). Worth Publishers, New York, USA.
5. Gerald Karp, Harris D. Cell and Molecular Biology – Concepts and Experiments. 2008. John Wiley & Sons Inc, New York.

OPTIONAL

1. Cell Biology, Genetics, Molecular Biology, Evolution & Ecology. 2004. S Chand & Company Ltd. New Delhi, India.
2. Avinash and Kakoli Upadhyay, Basic molecular Biology. 2005. Himalaya Publishing House, Mumbai.

COURSE SCHEDULE

Number of Lectures/week: Three

Number of Practical/week: One

Classrooms: As on Time Table

Timings & Days of the week: **Theory**

Thursday, Friday, Saturday – 09:30 – 10:30 a.m

Timings & Days of the week: **Practical**

Biotechnology Laboratory – **Thursday 10:30 – 01:30**

TEACHING SCHEDULE

T.Y B.Sc Biotechnology (2015-2016)

PAPER IX: Genetics & Molecular Biology

Day and Time: Thursday, Friday, Saturday – 09:30 – 10:30 a.m

Class room: B – 305

Chap.	Lec. No.	Topics	Book Reference
1	1 & 2	Mendel's laws of Inheritance	M – 1 O – 1
2	3 & 4	Multiple alleles and multiple genes	M – 1 O – 1
3	5 & 6	Inheritance of Human traits	M – 1 O – 1
	7	Revision of chapter 1, 2 & 3	
4	8, 9, 10	Structure and numerical aberrations involving chromosomes	M – 1, 2 O – 1
5	11 - 12	Population Genetics	M – 1, 2 O – 1
	13	Revision of chapter 4 & 5	
6	14	Introduction to molecular biology	M – 2, 3, 4, 5 O – 1
7	15, 16	Chromosomes	M – 2, 3, 4, 5 O – 1
8	17	Genetic code	M – 2, 3, 4, 5 O – 1
9	18, 19	DNA Mutation	M – 2, 3, 4, 5 O – 1
	20	Revision of chapters 6, 7, 8, 9	
10	20 & 21	DNA replication	M – 2, 3, 4, 5 O – 1
11	22, 23, 24	Transcription	M – 2, 3, 4, 5 O – 1
12	25, 26, 27	Translation	M – 2, 3, 4, 5 O – 1
	28	Revision of chapters 6, 7, 8, 9, 10, 11 & 12	
13	29, 30	Regulation of gene expression	M – 2, 3, 4, 5 O – 1
14	31, 32	Recombination in Prokaryotes	M – 2, 3, 4, 5 O – 1
15	33	Mobile DNA elements	M – 2, 3, 4, 5 O – 1
	34	Revision of chapters 10, 11, 12, 13, 14 & 15	
	35 - 38	Revision for final Exam	

M – mandatory reference books, as per numbered above

O – optional reference books, as per numbered above

References as prescribed in given syllabus:

1. Lewin B. Genes XI. 2007. Jones and Bartlett Publishers
2. Watson J.D., Hopkins N.H. *et al.* Molecular Biology of the Gene. (2008). Garland Publishing (Taylor & Francis Group), New York & London.
3. Robertis E.D.P., Robertis E.M.F., Cell Biology and Molecular Biology. 8th edition, 1998. Sauder College.
4. Nelson D.L. and Cox M.M. 2000. Lehninger Principles of Biochemistry (3d Edition). Worth Publishers, New York, USA.
5. Gerald Karp, Harris D. Cell and Molecular Biology – Concepts and Experiments. 2008. John Wiley & Sons Inc, New York.
6. Cell Biology, Genetics, Molecular Biology, Evolution & Ecology. 2004. S Chand & Company Ltd. New Delhi, India.
7. Avinash and Kakoli Upadhyay, Basic molecular Biology. 2005. Himalaya Publishing House, Mumbai.