

## Syllabus of Theory

PART 'A' – Introduction			
Program: Honours / Research	Class: B.Sc.	Year: IV	Session: 2024-25
Subject: Zoology			
1	Course Code:	S4-ZOOLIT	
2	Course Title:	Genetics and Molecular Biology (Paper I)	
3	Course Type:	Core TH-1	
4	Pre-requisite:	To study this course, a student must have had the subject Zoology in B.Sc. III Year / Degree	
5	Course Learning Outcome (CLO):	<p>Upon completion of the course students will be able to</p> <ol style="list-style-type: none"> <li>1. Gain knowledge of basic principles of inheritance and variations.</li> <li>2. Deeper understanding of linkage, Sex determination, Chromosomes, Mutations and mutagens.</li> <li>3. Gain knowledge of Human karyotype, Human Genome project, gene therapy,</li> <li>4. Structure and function of cell organelles.</li> <li>5. Membrane system and Cell signaling.</li> <li>6. DNA replication, repair and recombination and Gene expression (transcription and translations)</li> <li>7. Common career options for Genetics and Cellular and Molecular Biology graduates are: - Biotechnologists, Biochemist, Lab technician, Clinical research specialist, Geneticist, Molecular biologist, pharmaceutical researcher, Forensic scientist and Toxicologist.</li> </ol>	
6	Credit Value:	4	
7	Total Marks:	Max Marks: 30+70	Min. Passing Marks: 35

*[Signature]*  
31.7.24  
Dr. Shampa Jain

*[Signature]*  
31/07/24  
Ms. Amita Saxena

*[Signature]*  
31/7/24  
Dr. P. S. Jain

*[Signature]*  
31/7/24  
Dr. Manju Dixit

*[Signature]*  
31/07/24  
Dr. P. S. Jain

*[Signature]*  
31/07/24  
Dr. Anand Singh Bisht

*[Signature]*  
22.01.24  
(Dr. U. S. PARMAR)

**PART 'B' - Content of the Course**

**Total No. of Lectures - Tutorials - Practical (02 hours /Week)**

**L - T - P Total No. of Lectures = 60**

Unit/ S.NO.	Topics	No. of Lectures (1 Hour Each)
I	<p><b>Overview of Genetics</b></p> <ol style="list-style-type: none"> <li>1. Introduction, Historical background and Importance of Genetics</li> <li>2. Mendel's Law of Heredity</li> <li>3. Nucleocytoplasmic Interaction</li> <li>4. Variations: Types and genetic basis of variations</li> </ol> <p><b>Keywords:</b> Heredity, Variations, Genetics, Nucleocytoplasmic Interaction</p>	10
II	<p><b>Linkage and Human Genetics</b></p> <ol style="list-style-type: none"> <li>1. Gene linkage and recombination</li> <li>2. Sex Determination</li> <li>3. Sex -Linked Inheritance</li> <li>4. Mutation: Types of Mutation and mutagens</li> <li>5. Human karyotype and Human Genome Project</li> <li>6. Gene Therapy</li> <li>7. Transgenic and Knockout animals and their applications</li> </ol> <p><b>Keywords:</b> linkage, Recombination, Sex Determination, Sex-Linked Inheritance, Mutation, Mutagens, karyotype, Human Genome Project, Gene Therapy, Transgenic animals</p>	14
III	<p><b>Membrane system and Cell Signaling:</b></p> <ol style="list-style-type: none"> <li>1. Plasma membrane:               <ol style="list-style-type: none"> <li>1.1. Structure and models of plasma membrane</li> <li>1.2. Modifications of plasma membrane</li> <li>1.3. Intracellular junctions</li> <li>1.4. Cell- cell adhesion</li> </ol> </li> <li>2. Transport across the membranes:               <ol style="list-style-type: none"> <li>2.1. Membrane permeability</li> <li>2.2. Solute transport by simple diffusion</li> </ol> </li> </ol>	12

*ASARENG*

*[Signature]*

*[Signature]*

*[Signature]*  
22.01.24.  
(Dr. U. S. PARMAR)

	<p>2.3. Facilitated diffusion</p> <p>2.4. Active transport</p> <p>3. Cell signaling:</p> <p>3.1. Hormones and their receptors</p> <p>3.2. Cell surface receptors</p> <p>3.3. G-protein coupled receptors</p> <p>3.4. Signal transduction</p> <p>3.5. Second messengers</p> <p><b>Keywords:</b> Plasma membrane, Intracellular junctions, Diffusion, Active transport, Cell signaling, Second messenger</p>	
IV	<p><b>Structure and Organization of nucleus, chromosomes and nucleic acids</b></p> <p>1. Structure and organization of nucleus: nuclear membrane, nucleoplasm and chromatin material</p> <p>2. Structure and organization of chromosomes: Classical concept and molecular structure of gene</p> <p>3. Chemical composition of nucleic acids: DNA and RNA</p> <p>3.1. DNA: Double helical model (Watson and Crick), A, B and Z forms of DNA, Super coiling in DNA</p> <p>3.2. DNA replication: Unit of replication, enzymes involved in replication, origin and replication fork, fidelity of replication</p> <p>3.3. DNA damage and repair: Types and causes of DNA damage, DNA repair- mismatch repair, base excision, Nucleotide excision and SOS repair</p> <p>3.4. Types of RNA</p> <p><b>Keywords:</b> Nucleus, Chromosome, Gene, DNA damage, DNA Replication, DNA Repair, Base excision, SOS repair</p>	12
V	<p><b>Gene organization and Gene Expression</b></p> <p>1. Genome organization in Eukaryotes and Prokaryotes</p> <p>2. Genetic code</p> <p>3. Gene Expression</p> <p>3.1. Central Dogma</p> <p>3.2. Transcription: RNA polymerases - Capping, elongation and termination, RNA processing, RNA editing, splicing, polyadenylation,</p>	12

*[Handwritten signatures]*

*[Handwritten signature]*  
 22.01.24.  
 (Dr. U. S. PARMAR)

	<p>nuclear transport of mRNA, mRNA stability, inhibitors of transcription.</p> <p>3.3. Translation - Ribosome formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, aminoacylation of tRNA, t-RNA identity, aminoacyl tRNA synthetase, translational proof-reading, translational inhibitors, post translational modification of proteins.</p> <p>4. Gene regulation: Operon model of gene regulation, lac operon.</p> <p><b>Keywords:</b> Genome, RNA-polymerase, Transcription, Translation, Genetic code, Lac operon, Genome</p>	
--	---	--

*A. S. Saxena*

*[Signature]*

*[Signature]*  
 22.01.24.  
 (Dr. U. S. PARMAR)

*[Signature]*

## PART 'C' - Learning Resources

### Text Books, Reference Books, Other resources

#### Suggested Readings:

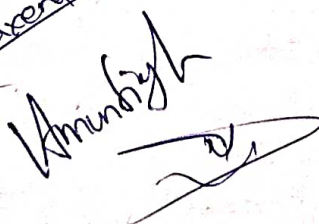
1. Karp G, "Cell and Molecular Biology: Concept and Experiments" John Wiley & Sons, 7<sup>th</sup> Edition, 2013
2. DeRobertis, E.D.P and DeRobertis, E.M.F "Cell and Molecular Biology", Lippincott Williams & Wilkins, Philadelphia, 8<sup>th</sup> Edition, 2006
3. Lodish, H, Berk, A. "Molecular & Cell Biology", W.H. Freeman, 6<sup>th</sup> edition, 2007
4. Freifelder D, "Molecular Biology", Narosa Publishing House, India. 5<sup>th</sup> edition, 2012
5. Allison A. Lizabet, "Fundamentals of Molecular Biology", J. Willey & Sons, Hoboken New Jersey. 2<sup>nd</sup> Editions 2012
6. Verma P.S. Agrawal V.K. "Text book of Cytology", S. Chand & Company Ltd. New Delhi.
7. "Gardner, MJ: "Principles of Genetics
8. "Singh B.D., Gupta P.K., Verma, PS and Agrawal, VK.: "Genetics
9. "Singh B.D., Purohit: "Biotechnology
10. "Gupta P.K: "Molecular Biology and Genetic Engineering
11. "Khanna Pragya, Pal Ajay: "Cell and Molecular Biology

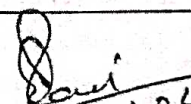
#### Suggested equivalent online courses:

1. <https://www.easybiologyclass.com>- molecular Biology lecture notes and study material
2. <https://www.cellbiog.com>
3. <https://www.edx.org>
4. <https://onlinecourses.swayam2.ac.in>-Molecular Biology-course-Swayam
5. <https://nptel.ac.in>- web course on Cell and Molecular Biology
6. <https://mppgscience-e-content>



 ~~A. Saxena~~

 Khunbyh

  
22.01.24.  
(Dr. H. S. PARMAR)

**Part D: Assessment and Evaluation (Theory)**

**Suggested Continuous Evaluation Methods:**

**Maximum Marks: 100**

**Continuous Comprehensive Evaluation (CCE): 30    University Exam (UE): 70**

<b>Internal Assessment:</b> Continuous comprehensive Evaluation (CCE): 30	Class Test	30
	Assignment/Presentation	
<b>External Assessment:</b> University Exam Section: 70 Time: 03:00 Hours	Section (A): Very Short Questions	
	Section (B): Short Questions	
	Section (C): Long Questions	
	<b>Total</b>	<b>70</b>
<b>Any remarks/Suggestions:</b>		

*A. Saxena*  
*[Signature]*

*[Signature]*  
*[Signature]*

*[Signature]*  
22.01.24.  
(A. L. S. PARMAR)

## Syllabus of Practical

Part - A: Introduction			
Program: Honours/Research	Class: B.Sc.	Year: IV	Session: 2024 -25
Subject: Zoology			
1	Course Code:	S4-ZOOL1P	
2	Course Title:	Genetics and Molecular Biology	
3	Course Type:	CORE PR1	
4	Pre-requisite:	To study this course, a student must have had the subject Zoology in B.Sc. III Year / Degree	
5	Course Learning Outcome (CLO):	<p>Upon completion of the course student will learn to demonstrate and perform common and advanced laboratory practices in genetics and cell and molecular Biology.</p> <ol style="list-style-type: none"> <li>1. Basic principles of inheritance and variations.</li> <li>2. Deeper understanding of linkage, Sex determination, Chromosomes, Mutations and mutagens.</li> <li>3. Gain knowledge of human karyotype, Genome project and gene therapy,</li> <li>4. Process of isolation of DNA.</li> <li>5. Estimation of RNA and DNA</li> <li>6. Common career options for Genetics and Cellular and Molecular Biology graduates are: - Biotechnologists, Biochemist, Lab technician, Clinical research specialist, Geneticist, Molecular biologist, pharmaceutical researcher, Forensic scientist and Toxicologist, Genetic Laboratory Technician</li> </ol>	
6	Credit Value:	2	
7	Total Marks:	Max Marks: 100	Min. Passing Marks: 35

*Aswery*

*[Signature]*

*[Signature]*  
22.01.24.  
(Dr. W. S. PARMAR)

Part B - Content of the course

Total No. Of Lectures-Tutorials-Practical (2 hours per week)

L-T-P Total Number of Lectures: 30

Unit/ S.NO.	Topics	No. of Lectures. (2 Hours Each)
I	Study of chromosomes through model, charts and photographs	02
II	Study of DNA and RNA through model, charts and photographs	02
III	<b>Mendelian Experiments:</b> 1. Monohybrid and Dihybrid Cross 2. Verification of Mendelian Ratio	04
IV	Problems related to sex-linked inheritance (Colour blindness and Haemophilia)	04
V	Problem related to Genetics	04
VI	Isolation of DNA	04
VII	Quantification of DNA/RNA through spectrophotometer	04
VIII	Separation of different sized DNA fragments on agarose gel	02
IX	Estimation of RNA by Orcinol method	02
X	Estimation of DNA by diphenyl amine method	02

Keywords: Chromosome, DNA, RNA, Sex-linked Inheritance

*Saxena*

*Amrith*

*Daur*  
22.01.24.  
(Dr. U.S. PARMAR)



## PART 'C' - Learning Resources

### Text Books, Reference Books, Other resources

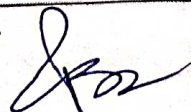
#### Suggested Readings:

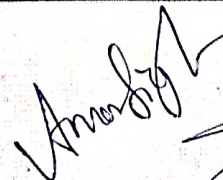
1. David T. Plummer; "An Introduction to Practical Biochemistry "3<sup>rd</sup> Edition
2. De Robertis, E.D.P and De Robertis, E.M.F "Cell and Molecular Biology", Lippincott Williams and Wilkins, Philadelphia, 8th Edition, 2006
3. Gakhar, S.K., Miglani Monika, Kumar Ashwani, "A Laboratory Manual of Molecular Biology"
4. English Paperback Publisher: Dreamtech Press
5. Gupta Renu, Makhija Seema, Toteja Ravi, "Cell Biology": Practical Manual", Prestige
6. Publisher, 2018
7. Gupta Amit, Sati Bipin Kumar, "Practical Laboratory Manual Cell Biology", Paperback-Lambert Publication, 2019
8. Verma P.S. Agrawal V.K. "Cell Biology, Genetics, Molecular Biology", S. Chand and Company Ltd. New Delhi, 14th edition, 2018
9. Gupta P.K., "Cell Biology and Genetics Rastogi Publications
10. Kapur and Suri, "Basic Human Genetics Universal Books
11. .Singh BD, Bansal Payal, "Fundamentals of Genetics", Kalyani Publishers
12. Bahar Taneri, Esra Asilmaz, Türem Delikurt, Pembe Savas, Seniye Targen, Yagmur Esemen Human Genetics and Genomics: A Practical "Guide" ISBN February 2020 8-68263-527-3-978 : 160 Pages
13. Gregore Koliantz and Daniel B. Szymanski "Genetics: A Laboratory Manual", 2nd edition, First published: 15 August 2009 Print ISBN: 9780891185611

#### Suggestive digital platforms web links:

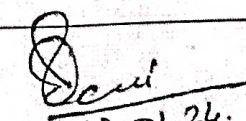
1. <https://www.classcentral.com>,
2. <https://www.coursera.org/cellbiology>
3. <https://www.mooc.org>
4. <https://swayam.gov.in>
5. <https://www.mptel.ac.in>
6. <https://www.udacity.com>

  
A. Saxena








  
22.01.24.  
(S. U. S. PARMAR)

**Part -D: Assessment & Evaluation (Practical)**

Suggested Continuous Evaluation Methods:				
	Internal Assessment	Marks	External Assessment	Marks
1	Class interaction/quiz		Viva Voce on Practical	
2	Attendance		Practical Record File	
3	Assignments (Charts/Model Seminar/Rural Service /Technology Dissemination/ Report of Excursion /Lab Visits Survey/ Industrial visit)		Table work/Experiments	
	<b>Total</b>	<b>30</b>		<b>70</b>
Any remarks/Suggestions:				


  
 22.01.24.  
 (S. U. S. PARMAR)