



**JIWAJI UNIVERSITY, GWALIOR**  
**M.Sc. in Molecular and Human Genetics**  
**(2015-2017)**



**DISTRIBUTION OF DIFFERENT PAPERS AND CREDITS IN VARIOUS SEMESTERS**

| Semester   | Paper Code           | Name of the Paper  | Type of Paper                | Credits   |
|--|----------------------|--|------------------------------|-----------|
| <i>Semester I</i>  | MHG-101              | A. Principles of Genetic Inheritance<br>B. Statistical Tests in Genetic Analysis | Core                         | 3         |
|  | MHG-102              | Basic Human Genetics and<br>Human Cytogenetics                                   | Core                         | 3         |
|  | MHG-103              | Molecular Structure & Functions of the Cell                                      | Core                         | 3         |
|  | MHG-104              | A. Molecular Organization of Chromatin and<br>Cytogenetics<br>B. Cancer Biology  | Core                         | 3         |
|  | MHG-105              | Practical based on papers 101 & 102  | Core                         | 3         |
|  | MHG-106              | Practical based on papers 103 & 104  | Core                         | 3         |
|  | MHG-107              | Seminar  | Core                         | 1         |
|  | MHG-108              | Assignment   | Core                         | 1         |
|  | MHG-109              | Comprehensive Viva Voce  | Virtual                      | 4         |
|  | <b>Total Credits</b> |  |                              |           |
| <i>Semester II</i>   | MHG-201              | Molecular Genetics and Genomics  | Core                         | 3         |
|  | MHG-202              | Human Molecular Genetics and<br>Human Genomics                                   | Core                         | 3         |
|  | MHG-203              | Immunogenetics   | Core                         | 3         |
|  | MHG-204              | Biochemistry: Structure, Function and Regulation<br>of Biomolecules              | Core                         | 3         |
|  | MHG-205              | Practical based on papers 201 & 202  | Core                         | 3         |
|  | MHG-206              | Practical based on papers 203 & 204  | Core                         | 3         |
|  | MHG-207              | Seminar  | Core                         | 1         |
|  | MHG-208              | Assignment   | Core                         | 1         |
|  | MHG-209              | Comprehensive Viva Voce  | Virtual                      | 4         |
|  | <b>Total Credits</b> |  |                              |           |
| <i>Semester III</i>  | MHG-301              | Developmental and Reproductive Genetics  | Core                         | 3         |
|  | MHG-302              | Clinical Genetics and Genetic Counseling   | Core                         | 3         |
|  | MHG-303              | Population Genetics, Human Evolutionary and<br>Behavior Genetics                 | Elective:<br>Centric         | 3         |
|  | MHG-304              | A. Recombinant DNA Technology<br>B. Molecular Diagnostic Methods                 | Elective:<br>Generic/Centric | 3         |
|  | MHG-305              | Practical based on papers 301 & 302  | Core                         | 3         |
|  | MHG-306              | Practical based on papers 303 & 304  | Elective:<br>Generic/Centric | 3         |
|  | MHG-307              | Seminar  | Core                         | 1         |
|  | MHG-308              | Assignment   | Core                         | 1         |
|  | MHG-309              | Comprehensive Viva Voce  | Virtual                      | 4         |
|  | <b>Total Credits</b> |  |                              |           |
| <i>Semester IV</i>   | MHG-401              | Bio-informatics and Bio-techniques   | Core                         | 3         |
|  | MHG-402              | Practical based on papers 401  | Core                         | 3         |
|  | MHG-403              | Seminar  | Core                         | 1         |
|  | MHG-404              | Assignment   | Core                         | 1         |
|  | MHG-405              | Dissertation Work  | Core                         | 12        |
|  | MHG-406              | Comprehensive Viva Voce  | Virtual                      | 4         |
|  | <b>Total Credits</b> |  |                              |           |
| <b>Minimum Number of Credits to be earned for the award of degree (Valid:80 + Virtual: 16)</b> |                      |  |                              | <b>96</b> |





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The course for Master of Science (M. Sc.) in Molecular & Human Genetics shall comprise of four semesters of six months duration each. Each theory and practical paper will be of 3 credits. The first 3 semesters shall include 4 theory papers and 2 practical courses, while the 4th semester, will include 1 theory paper and 1 practical paper. The total marks for assessment in these papers are 100 marks, out of which 60 marks are for final examinations and 40 marks for internal assessments. All the theory papers are divided into 40 classes of 1 hr. After the completion of each topic in a particular paper, there will be a test and the maximum marks will be equivalent to the number of hours allotted to that topic. These marks will comprise the internal assessment marks (40) for each paper. The students will participate in weekly seminars (on any topic from the syllabus allotted to them by the faculty) and journal clubs (seminar on a research paper of interest), to meet the needs in their aim to become an interdisciplinary researcher. For this they will be awarded 1 credit each. Also a comprehensive viva voce examination will be held during the practical exams (4 credits).

In the last semester, the students shall formulate a short project proposal (dream project designed by the students themselves) in the subject related to the course under the supervision of the faculty involved and submit the proposal along with presentation for evaluation (2 credits). In addition, the students are required to undergo a 3 month dissertation work, to obtain professional exposure in well reputed Research Institutes/Universities or Industries and submit the final report along with a presentation for evaluation in the 4th semester (12 credits).

# Detailed Syllabus for M. Sc. in Molecular & Human Genetics

## Semester I

### Paper MHG-101: A. Principles of Genetic Inheritance

### B. Statistical tests in genetic analysis

(No. of classes of 60 mins each)

#### A. Principles of Genetic Inheritance

##### Unit I

1. Mendel's laws of inheritance 2
  - 1.1 Law of segregation
  - 1.2 Law of independent assortment
2. Chromosomal theory of inheritance 1
3. Extensions of Mendelism 5
  - 3.1 Allelic variation and gene function- Dominance relationships and Complications in the concept of dominance
  - 3.2 Multiple allelism, allelic series
  - 3.3 Testing gene mutations for allelism: complementation test
  - 3.4 Visible, sterile and lethal mutations
  - 3.5 Pleiotropy
4. Gene interactions and modifying genes 2

##### Unit II

5. Sex chromosomes and sex-linked inheritance 2
  - 5.1 Sex chromosomes and their meiotic behaviour
  - 5.2 Sex-linked inheritance in *Drosophila* and *human*
6. Linkage and crossing over 4
  - 6.1 Concept
  - 6.2 Cytological demonstration of crossing Over in *Drosophila*
  - 6.3 Genetic distance and physical distance
  - 6.4 Genetic and cytological crossing over
7. Linkage and crossing over: Preparation of Linkage map 3
  - 7.1 Genetic recombination & construction of genetic maps in *Drosophila* (3-point test Cross) & yeast (Tetrad analysis).
  - 7.2 Interference and coincidence
  - 7.3 Mitotic recombination
8. Inheritance of quantitative traits 4
  - 8.1 Continuous and discontinuous variation
  - 8.2 Genetic variance and heritability. (Narrow sense and broad sense); Quantitative trait loci (QTL)

##### Unit III

9. Polygenic inheritance, Environmental effects on gene expression 2
10. Extranuclear inheritance & maternal effects 3
  - 10.1 Organelle heredity (mitochondria & chloroplast); Petite mutations
  - 10.2 Infectious heredity (Cytoplasmic inheritance) in symbionts (*Paramecium*) & *Drosophila*
  - 10.3 Maternal inheritance: Ephestia pigmentation and snail coiling

#### B. Statistical tests in genetic analysis

##### Unit IV

11. Application of laws of probability (product rule, sum rule, binomial probability) 1
12. Measures of central tendency: Mean, Median, Mode 1
13. Measures of dispersion: Standard deviation, standard error, Variance, Coefficient of variation 2
14. Hypothesis testing and analysis of Genetic data 4
  - 14.1 Statistical & Scientific hypothesis
  - 14.2 The null and alternative hypothesis
  - 14.3 F-tests & Chi square test, Student's t test, Z test, Q test
15. General idea of Correlation and Regression Analysis 2
16. ANOVA: General idea of one way & two way analysis 2



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