

**SYLLABI AND SCHEME OF
EXAMINATIONS
FOR
SKILL ENHANCEMENT COURSES
FOR UNDERGRADUATE
PROGRAMS OFFERED BY THE
Department of Genetics
(Based on Curriculum and Credit Framework for UG Programs under NEP)**



**MAHARSHI DAYANAND UNIVERSITY
ROHTAK (HARYANA)**

SYLLABI AND SCHEME OF EXAMINATIONS FOR SKILL ENHANCEMENT COURSES FOR UNDERGRADUATE SINGLE MAJOR/MULTIDISCIPLINARY PROGRAMS/ SINGLE MAJOR PROGRAM AFTER 2nd SEMESTER OF MULTIDISCIPLINARY PROGRAM

Skill Enhancement Course (SEC)	Nomenclature of Course	Course Code	Credits Distribution			Total Credits	Workload			Total Workload	Total Marks	
			L	T	P		L	T	P			
SEMESTER I (2024-25)												
SEC 1 @ 3 credits	Basic Techniques in Biology	24GENS401SE01	0	0	3	3	0	0	6	6	75	
SEMESTER II (2024-25)												
SEC 2 @ 3 credits	Cytogenetic Techniques	24GENS402SE02	0	0	3	3	0	0	6	6	75	
SEMESTER III (2024-25)												
SEC 3 @ 3 credits	Tools and Techniques	25GENS403SE03	0	0	3	3	0	0	6	6	75	
SEMESTER IV (2024-25)												
Internship @ 4 Credits	Internship/optional	26GENS404IN01	0	0	4	4	0	0	8	8	30 Internal	70 External
SEMESTER V (2024-25)												
Internship @ 4 Credits	Internship	26GENS405IN01	0	0	4	4	0	0	8	8	30 Internal	70 External
SEMESTER VI (2024-25)												
SEC 4 @ 2 credits (offered only in case of Single Major Programme)	Research Methodology	24GENS406SE04	0	0	2	2	0	0	4	4	50	
SEMESTER VII (2024-25)												
SEC 5 @ 4 credits (if offered as an option)	Techniques in Genetics	24GEN201SE01	0	0	4	4	0	0	8	8	100	
SEMESTER VIII (2024-25)												
SEC 6 @ 4 credits (if offered as an option)	Molecular Techniques in Genetics	24GEN202SE01	0	0	4	4	0	0	8	8	100	

L: Lecture; T: Tutorial; P: Practical

Syllabi for Skill Enhancement Course

Semester I

Name of Program	BSc Genetics Single Major	Program Code	USGEN4
Name of the Course	Basic Techniques in Biology	Course Code	24GENS401SE01
Hours per Week	06	Credits	3
Total Marks	75	Time of Examinations	3 hrs
Max. Marks –75		Credits – 0+0+3	
Course Learning Outcomes (CLO): CLO1: To familiarize the students about instruments used in biological laboratories. CLO2: Understanding of working of different types of microscopes. CLO3: Understanding of electrophoresis and different types of centrifuges.			
1. Demonstration of sterilization techniques used in biological laboratories (autoclaving, filtration, dry heat, chemical methods) 2. Preparation of sodium chloride solutions at different concentrations (0.9%, 1%, 10%, etc.) 3. Preparation and sterilization of buffer solutions. 4. pH adjustment using indicators and pH meter 5. Demonstration of different types of microscopes: compound, phase contrast, fluorescence, electron microscope demo 6. Demonstration of centrifuge working and operation: bench-top and high-speed centrifuges. Identification and explanation of centrifuge parts (rotors, tube holders, speed/time settings) 7. Identification and labeling of microscope parts and learning focusing techniques 8. Demonstration of simple and differential staining techniques (methylene blue, Gram staining, safranin) 9. Demonstration of Thin Layer Chromatography (TLC) for dye/lipid separation			
References: 1. An Introduction to Practical Biochemistry, 3rd Edition by David Plummer, McGraw Hill, London 2. Hofman A. and Clokie S., Keith Wilson and John Walker: Principals and Techniques of Biochemistry and Molecular Biology, Edited by Eighth Edition (2018), Cambridge University Press. 3. Essentials of Practical Microbiology by R.C. Dubey and D.K. Maheshwari, S. Chand & Company Ltd., New Delhi. 4. Biotechnology: A Laboratory Course by Smith and Wood, Academic Press.			

Syllabi for Skill Enhancement Course

Semester II

Name of Program	BSc Genetics Single Major	Program Code	USGEN4
Name of the Course	Cytogenetic Techniques	Course Code	24GENS402SE02
Hours per Week	06	Credits	3
Total Marks	75	Time of Examination	3 hrs
Max. Marks –75		Credits – 0+0+3	
Course Learning Outcomes (CLO): CLO1: To know the technique of mitotic & meiotic slide preparation CLO2: To understand the mechanism of crossing over. CLO3: To know the chromosomes and chromosomal abnormalities.			
1. To prepare metaphase slide from onion root tip (mitosis) 2. To prepare meiosis slide from flower buds or grasshopper testis 3. To count the number of chromosomes from a given metaphase (permanent slide) 4. Demonstration of Inversion 5. Demonstration of Translocation 6. Demonstration of Duplication 7. Demonstration of Sister chromatid exchange 8. Identification of chromosomal abnormalities from provided permanent slides (e.g., Down syndrome, Turner syndrome) 9. Study of G-banding and R-banding from provided permanent slides			
References: • Sambamurty A.V.S.S. – Genetics • Tamarin R.H. – Principles of Genetics • B.D. Singh – Genetics • C.S. Shukla & V.B. Agarwal – Cytogenetics, Evolution, Biostatistics and Plant Breeding			

Syllabi for Skill Enhancement Course

Semester III

Name of Program	BSc Genetics Single Major	Program Code	USGEN4
Name of the Course	Tools and Techniques	Course Code	24GENS403SE03
Hours per Week	06	Credits	3
Total Marks	75	Time of Examination	3 hrs
Max. Marks –75		Credits – 0+0+3	
Course Learning Outcomes (CLO):			
CLO1: Understand the principles and applications of essential tools and techniques used in laboratories.			
CLO2: Gain practical skills in using instruments like micropipettes, spectrophotometers, and gel documentation.			
CLO3: Apply cytogenetic and molecular methods to analyze DNA, proteins, and chromosomes			

Syllabi for Skill Enhancement Course

Semester VI

Session: 2025-26

Name of Program	BSc Genetics Single Major	Program Code	USGEN4
Name of the Course	Research Methodology	Course Code	24GENS406SE04
Hours per Week	04	Credits	2
Total Marks	50	Time of Examinations	3 hrs
Max. Marks –50		Credits – 0+0+2	
Course Learning Outcomes (CLO): CLO1: Basic understanding and skilling in genetic research. CLO2: Awareness about conferences, seminar, funding agencies etc.			
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Semester VII

Name of Program	B.Sc. Genetics Single Major	Program Code	USGEN4
Name of the Course	Techniques In Genetics	Course Code	24GEN201SE01
Hours per Week	4	Credits	4
Total Marks	100	Time of Examination	3 Hrs
Max. Marks – 100		Credits – 0+0+4	
Course Learning Outcomes (CLO):			
CLO1: Students will be able to learn about basic instruments used in the laboratories.			
CLO2: Familiar with the model organisms such as <i>Drosophila melanogaster</i> , <i>C. elegans</i> , <i>E. coli</i> etc.			
CLO3: Students will be skilled to isolate and analyse DNA from different biological samples.			
CLO4: Able to understand the different stages of life cycle in frogs, chicks etc.			
• To be familiar with the basic instrumentation of a genetics/molecular biology laboratory. • To perform cleaning and sterilization of glassware and plasticwares. • To prepare solutions for biological laboratories. • To sterilize culture media and solutions. • To study of life cycle of <i>Drosophila melanogaster</i>. • To study life cycle of the <i>C. elegans</i>. • To examine permanent slides of various stages of frog development. • To examine permanent slides of various stages of chick development. • To study the various stages of mitosis shown in permanent slides. • To study various stages of meiosis shown in permanent slides. • To study differential method in embryonic development. • To examine permanent slides of various stages of mammalian development. • To demonstrate germ layers (ectoderm, endoderm, mesoderm) in the human embryo. • To demonstrate homeobox gene arrangement in <i>Drosophila</i>. • To perform agarose gel electrophoresis. • To isolate genomic DNA from human peripheral blood. • To isolate the genomic DNA from mosquitoes • To isolate the genomic DNA from <i>E. coli</i> cells. • To isolate the plasmid DNA using alkaline lysis method • To grow <i>E. coli</i> on LB agar and broth culture media. • To perform Gram-staining of given bacterial culture. • To study different types of plasmids e.g. pBR322 and F-plasmids. • To study pedigree symbols and different inheritance patterns and their hallmarks. • To study genetic variability in human population for behavioral, morphogenetic and serogenetic factors. • To study genetic variability in human population through thumb impression. • To calculate bleeding and clotting time of your own blood. • To calculate the number of RBCs of your own blood via hemocytometer technique • To perform nucleotide search by using BLAST.			

Syllabi for Skill Enhancement Course

Semester VIII

Name of Program	BSc Genetics Single Major	Program Code	USGEN4
Name of the Course	Molecular Techniques in Genetics	Course Code	24GEN202SE01
Hours per Week	4	Credits	4
Total Marks	100	Time of Examination	3 Hrs
Max. Marks – 100		Credits – 0+0+4	
Course Learning Outcomes (CLO):			
CLO1: Learn the techniques used for population genetics.			
CLO2: Learn the advance technique for gene amplification from whole genome.			
CLO3: Learn blood sample handling and determination of blood cell count.			
CLO4: Understand the conservation and relevance of genetic resources.			
• To study plant population density using quadrat method. • To determine the frequency of a species in a population using quadrat method. • To study abundance in a plant population using quadrat method. • To derive the formula of Hardy Weinberg principal, $p^2 + 2pq + q^2=1$. • To solve problem based on population genetics. • To analyze phylogeny of an organism using a given sequence. • To design primers and perform polymerase chain reaction. • To separate and visualize the PCR product using agarose gel electrophoresis. • To isolate RNA from mosquitoes. • To determine concentration and purity of RNA extracted from mosquito using spectrophotometer • To know titre value of antibody with help of Ouchterlony Double Immunodiffusion (ODD). • To quantitatively estimate antigen (Ag) concentration using Rocket Immuno-electrophoresis (Laurell technique). • To calculate Total Lymphocyte Count (TLC) and Differential Leukocyte Count (DLC) of your own blood. • To estimate the amount of antibody (Ab) in antiserum using quantitative precipitin assay. • Demonstration the Enzyme-Linked Immunosorbent Assay (ELISA). • To perform Radial Immunodiffusion (RID). • To demonstrate lymphocyte culture from peripheral blood. • To study chromosomal abnormality associated with Down syndrome, Turner syndrome and Klinefelter syndrome. • To prepare case Performa and discuss prenatal, neonatal, and postnatal aspects in genetic counselling. • To prepare sulphate standard solutions (1-1000 ppm) from $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$. • To determine the concentration of sulphate in a given water sample. • To study biodiversity in a given field using quadrat method. • To determine and compare the pH of the given soil and water samples. • To determine the Total Dissolved Solids (TDS) level of different water samples. • To visit a conservation site and demonstrate in-situ/ex-situ conservation techniques used.			