Govt. Degree College Baramulla

Syllabus of Zoology for U.G 5th Semester (Major / Minor)

Course Title: Principles of Animal Genetics

Course code:

Total Credits: 6 (4T+ 2P) **Maximum Marks: 150**

Learning Objectives: The syllabus outlines a broad spectrum of learning objectives aimed at providing students with a comprehensive understanding of genetics. Core areas include inheritance biology, genomics, mapping, population genetics, and applied genetics. Students will delve into Mendelian genetics, exploring gene interactions and chromosomal organization. Additionally, they will grasp population genetics principles essential for comprehending genetic diversity and evolution. Modern genetic techniques such as PCR, RFLP, DNA fingerprinting, gene cloning, and transgenic animal technology will be thoroughly covered, equipping students with practical skills crucial in contemporary genetic research and applications.

Course Outcomes: Upon completing the course, students are expected to achieve proficiency in various facets of genetics. They will demonstrate a sound understanding of Mendelian genetics, gene interactions, and chromosomal organization. Furthermore, they will be adept in applying population genetics principles to analyze genetic variation and evolutionary processes. Practical skills in modern genetic techniques like PCR, RFLP, DNA fingerprinting, gene cloning, and transgenic animal technology will be honed, empowering students to engage effectively in genetic research and its practical applications in diverse fields.

Unit No.	Name of the Topic	Credits Allotted
1	**INHERITANCE BIOLOGY** 1.1 Mendelian inheritance: Laws of heredity and their practical applications. 1.2 Gene interactions: complementary and supplementary ratios; pleiotropy. 1.3 Concept of gene: Allele, multiple alleles, pseudoallele, and Lethal Allele 1.4 Sex determination, Sex Linked Inheritance, cytoplasmic inheritance, and Dosage compensation	16 hours
2	**GENOMICS AND MAPPING** 2.1 Chromatin-Organization, Morphology, and classification of Chromosomes 2.2 Mutations: gene and chromosomal 2.3 Genetic Disorders (Autosomal and Sex Linked), Pedigree Analysis 2.4 Concept of Linkage and Linkage Maps	16 hours
3	**POPULATION GENETICS** 3.1 Population, gene pool and allelic frequency. 3.2 Hardy-Weinberg method & its applications – calculating allelic frequencies; assumptions of Hardy-Weinberg equilibrium. 3.3 Changes in genetic structure of population (Mutation, genetic drift (causes and effect), migration, natural selection.) 3.4 Inbreeding and outbreeding	16 hours
4	**APPLIED GENETICS** 4.1 Polymerase Chain Reaction and its Applications. 4.2 RFLP, DNA-finger printing- procedure and its applications 4.3 cDNA and Genomic Library. 4.4 Applications of transgenic animals.	16 hours

Practical

1. Preparation of normal human karyotype from picture of metaphase chromosomal spread
2. Study of monohybrid ratio and dihybrid ratio by providing hypothetical data and deducing the applicability of Mendelian laws (three examples of each ratio).
3. Preparation of culture media and maintenance of Drosophila culture.
4. Mounting of Sex Comb in *Drosophila melanogaster*.
5. Study of blood groups in Humans. (ABO and Rh).
6. Barr body analysis in cheek epithelium.
7. Demonstration of PCR.
8. Visit to IIIM, Sanat Nagar, Srinagar/ Kashmir University/SKAUST.

Suggested Readings:

1. Genes IX by Benjamin Lewin Jones and Bartlett Publishers
2. Genomes by Brown, T.A Garland Science Publishing, London, UK
3. Molecular Biology of Gene by Watson et al Pearson Education, Delhi, India
4. Principle of Genome Analysis & Genomics by Primrose and Twyman R.M. Blackwell Publishing
5. Principles of Genetics by Gardner et al John Wiley Science of Genetics by Atherlay
6. Biotechniques: Theory and Practice by S. V. S. Rana, Rastogi Publishers
7. Principles and techniques of Biochemistry and Molecular Biology by Wilson and Walker
8. Genetics: Verma, P S. and Agrawal, V K., S. Chand and Co., New Delhi
9. Fundamentals of Genetics: B.D. Singh, Kalyani Publishers, New Delhi.
10. Principle of Genetics: Sinnott, Dunn and Dobzhansky, Tata McGraw Hill Edition, New Delhi.
11. Genetics: Gupta, P K., Rastogi Publication, Meerut.
12. Genetics: Sarin, C., Tata McGraw Hill, New Delhi.
13. Principles of Genetics: Gardner, EJ. Simmons, MJ. and Snustad, DP. John Wiley and Sons.
14. Cytology and Genetics: Dyansagar VR. Tata McGraw Hill Pub. Co. Ltd., New Delhi.
15. Genetics – Principle and Analysis – Hart and Jones.
16. Genetics – Peter J. Russell.

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Syllabus of Zoology for U.G 5th Semester (Major)

Total Credits: 4T+0P) **Course code** **Maximum Marks: 100**

Course Title: Introduction to Entomology

Learning Objectives: Students will learn insect classification, anatomy, and biology, including collection methods, anatomy, feeding habits, social behavior, hormonal regulation, metamorphosis, and reproduction. They will also explore the economic and medical importance of insects, as well as methods for pest control.

Course outcome: Students will learn insect classification, anatomy, and biology, including collection methods, anatomy, feeding habits, social behavior, hormonal regulation, metamorphosis, and reproduction. They will also explore the economic and medical importance of insects, as well as methods for pest control.

Unit No.	Unit Name	Credits Allotted
1	1.1. Insecta: classification with general characters. 1.2. Methods of collection and preservation. 1.3. Insect Anatomy: Digestive, respiratory, Excretory, and reproductive System 1.4. Mouthparts-their modifications and Feeding Habits.	16 hours
2	2.1 Social behavior and caste system in insects. 2.2 Insect hormones: types, biological effects, and their applications. 2.3 Metamorphosis in Insects 2.4 Hormonal regulation of metamorphosis.	16 hours
3	3.1 Bioluminescence: Light Producing Organs, Mechanism and Significance of Light production in Insects. 3.2 Development: Structure of Egg, Maturation, Cleavage, Blastokinesis, Formation of Germ Layers and Segmentation. 3.3 Different Types of Larvae and Pupae. 3.4 Polyembryony and Parthenogenesis in Insects	16 hours
4	4.1 Economically important insects: honeybee, lac, silkworm. 4.2 Medically important insects: Diptera (mosquitoes), Hemiptera (bed bugs), Phthiraptera (sucking lice), Siphonaptera (fleas), Acarina (mites, and ticks). 4.3 Parasitic and predatory insects and their roles. 4.4 Control of insect pests (natural, chemical, biological and integrated methods). Biotechnology and insect pest management.	16 hours

Suggested readings

1. Chapman, R. F. (2013). *The Insects: Structure and Function* (5th edition). Cambridge University Press.
2. Service., M (2012). *Medical Entomology for Students* (5th edition). Cambridge University Press.
3. Gillott, C. (2018). *Entomology* (3rd edition). Springer.
4. Gullan, P. J., Cranston, P. S., and Mcinnes, K. H. (2010). *Insects: An Outline of Entomology* (4th edition). Wiley-Blackwell.
5. Kotpal, R. L. (2019). *Modern Textbook of Zoology: Invertebrates* (12th edition). Rastogi Publications.

(INTERNSHIP COURSE)

UG SEMESTER-V

Course Code: **Credits: 02**

Course Title: Summer Internship **Max. Marks: 50**

The National Education Policy (NEP) in India aims to provide a holistic and multidisciplinary approach to education. In this regard the summer internship for undergraduate students of 5th Semester Zoology are advised to follow the guidelines/instructions issued by UGC under NEP 2020.

Guidelines for Summer Internship:

1. **Duration and Timing:** 64 hour's
2. **Eligibility:** Open to undergraduate students who have passed their B.Sc 4th semester and are enrolled in 5th Semester with Zoology as one of the major subject.
3. **Objectives:**
    a. Apply theoretical knowledge in practical settings.
    b. Gain hands-on experience in various aspects of Zoology.
    c. Develop research skills.
    d. Understand the professional environment and work ethics.
4. **Host Institutions :** Internships can be conducted in various settings such as:
    a. Research/Departmental labs in Colleges /Universities /Research institutions
    b. Wildlife sanctuaries and zoos
    c. Environmental NGOs
    d. Agricultural and veterinary sectors
5. **Field-based learning/minor project:** The filed-based learning/minor project will attempt to provide opportunities for students to understand the different socio-economic contexts. It will aim at giving students exposure to development-related issues in rural and urban settings. It will provide opportunities for students to observe situations in rural and urban contexts and to observe and study actual field situations regarding issues related to socioeconomic development. Students will be given opportunities to gain a first-hand understanding of the policies, regulations, organizational structures, processes, and programmes that guide the development process. They would have the opportunity to gain an understanding of the complex socio-economic problems in the community, and innovative practices required to generate solutions to the identified problems. This may be a summer term project.
6. **Mentorship:** Each intern should be assigned a mentor/supervisor from the host institution for guidance and evaluation.
7. **Monitoring and Evaluation:** The designated Internship Supervisor will monitor the progress and evaluate student's internship course at the end of semester on the basis of Internship Report/Seminar presentation/Viva-voce. In addition the student has to submit Regular progress reports to the assigned supervisor.
   After completion of summer internship students will have to produce a report related to the work carried out, signed by internship supervisor and Head of Department.
8. **Report Guidelines:** The interns shall have to write their internship report as per the format given below:
    a. Introduction
    b. Materials and Methods

c. Results
d. Discussion
e. Conclusion
f. References

9. Students are at liberty to select any subject domain pertaining to Zoology for summer Internships. The main thrust areas where students can explore and learn new advances in research through summer internship are listed below:
    a. Entomology, Ecology and Environment.
    b. Molecular Toxicology and Cancer Biology.
    c. Advances in Parasitology and Ichthyology.
    d. Biochemistry, Immunology and Animal Biotechnology.

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Syllabus of Zoology for U.G 5th Semester (Major)

Total Credits: 6 (4T +2P) **Maximum Marks: 150**

Course Title: Fundamentals of Immunology

Course Code: Credit: 4+2

Learning Objectives: To acquire knowledge about immunity, innate & acquired, complement system; understand the concept of immune deficiencies, hypersensitivity, autoimmunity, and transplantation immunology.

Learning Outcome: To understand the defense mechanism against pathogens and utilize the knowledge for human welfare; gain knowledge on undesirable immunological reactions and their complications in health management.

Unit No.	Unit Name	Lectures Allotted
1	**Overview of Immune System** 1.1. Historical background & scope of immunology 1.2. Cells, tissues and organs of the immune system 1.3. Innate immunity and acquired immunity. 1.4. Phagocytosis and its Mechanism.	16 hours
2	**Molecules of Immune system** 2.1. Antigens: nature & types, antigen processing & presentation; MHC: functions & types 2.2. Antibodies: structure, types & functions; theories of antibody formation; monoclonal antibodies 2.3. Cytokines: types, properties and functions. 2.4. Complement system: components & pathways of its activation.	16 hours
3	**Immunodeficiency and Tumor Immunology** 3.1. Immune deficiencies: primary & secondary; stem cell, T & B-cell & compliment deficiencies (General overview) 3.2. Detailed account of SCID and AIDS. 3.3. Tumor immunology: immune surveillance, tumor associated antigens & tumor escape mechanisms. 3.4. Tumor immunotherapy: antigen non-specific & antigen specific	16 hours

4	**Damaging and Defective Immune Response** 4.1. Concept & classification of hypersensitivity reactions with brief descriptions 4.2. Mechanism of type I and type II hypersensitivity reactions 4.3. Vaccines and their Types. Autoimmune (AI) diseases with emphasis on AI anemia's & rheumatoid arthritis 4.4. Transplantation immunology: types of grafts; mechanism of homograft rejection.	16 hours

Practical (2 Credits)

1. Demonstration of lymphoid organs
2. Identification of various immune cells by morphology – Leishman staining, Giemsa staining
3. Differential leukocyte counts (DLC)
4. Demonstration of phagocytosis in vivo
5. Agglutination reactions- latex agglutination reactions
6. Heam-agglutination reactions- blood grouping, Rh Typing
7. Serum electrophoresis
8. Study of Antigen-Antibody reaction via ELISA.
9. Visit to SKIMS, SKUAST-K and Kashmir University laboratories for demonstration of immunological techniques.

Suggested Books / Reading Material

1. Basic Immunology by Sharon, J. William and Wilkins
2. Immunology by F. M. Burnet
3. Immunology by Kuby, Goldsby, R., Kindt, T.J. and Osbourne, B.A., W.H. Freeman
4. Immunology by P. M. Lydyard, A. Whelan And M. W. Fanger
5. Immunology by Roitt, I.M., Brostoff, J. and Male, D. Mosby
6. Immunology: An Introduction by Ian R Tizard
7. Medical Immunology for Students by Playfair, J.H.L. and Lydyard, P.M. Churchill