

GENERAL CURRICULAR STRUCTURE of FIRST 3 YEARS (WITH MAJOR) OF FYUGP

Total “CREDITS” to be acquired by a student (including MAJOR + MINOR + SEC/VAC/MDC/AEC + Internship) in the first 03-year period = 120 credits

“MAJOR” courses to be opted by a student in the period of 03 years = 11

Semester-1			Semester-2		
Type	Course	Credit	Type	Course	Credit
Major	Major-1	4	Major	Major-2	4
Minor	Minor-1	4	Minor	Minor-2	4
SEC	SEC-1 (Major oriented)*	3	SEC	SEC-2 (Major oriented)*	3
AEC	AEC-1	4	AEC	AEC-2	4
MDC	MDC-1	3	MDC	MDC-2	3
VAC	VAC-1	2	VAC	VAC-2	2
TOTAL		20	TOTAL		20
Semester-3			Semester-4		
Type	Course	Credit	Type	Course	Credit
Major	Major-3	4	Major	Major-5	4
	Major-4	4		Major-6	4
Minor	Minor-3	4		Major-7	4
SEC	SEC-3 #	3		Major-8	4
MDC	MDC-3	3	Minor	Minor-4	4
VAC	VAC-3	2			
TOTAL		20	TOTAL		20
Semester-5			Semester-6		
Type	Course	Credit	Type	Course	Credit
Major	Major-9	4	Major	Major-12	4
	Major-10	4		Major-13	4
	Major-11	4		Major-14	4
Minor	Minor-5	4		Major-15	4
Internship		4	Minor	Minor-6	4
TOTAL		20	TOTAL		20

NOTE

Boxes indicate the number of MAJOR courses for ONE SUBJECT as MAJOR per Semester

COURSE STRUCTURE OF THE FIRST THREE YEARS OF FYUGP WITH ZOOLOGY AS ONE OF THE MAJOR SUBJECTS

Semester	Course Name	Code	Credit
1	Major-1	ZLG0100104	3
	Diversity of Non-chordates		
	Practical		1
2	Major-2	ZLG0200104	3
	Diversity of Chordates		
	Practical		1
3	Major-3	ZLG0300104	4
	Basic Genetics (To be adopted from SWAYAM)		
	Practical		
	Major-4	ZLG0300204	3
	Entomology & Fisheries		
	Practical		1
4 (Any one of the Optional DSE papers to be opted)	Major-5	ZLG0400104	3
	Animal Taxonomy, Systematics & Biostatistics		
	Practical		1
	Major-6	ZLG0400204	3
	Animal Physiology & Endocrinology		
	Practical		1
	Major-7	ZLG0400304	4
	Fundamentals of Ecology (To be adopted from SWAYAM)		
	Practical		
	Major-8	ZLG0400404 (DSE-I/ DSE-II/ DSE-III)	3
	DSE-I: Comparative Anatomy of Vertebrates		
	Practical		1
	DSE-II: Animal Behaviour and Chronobiology		3
	Practical		1
	DSE-III: Parasitology		3
	Practical		1
5 (Any one	Major-9	ZLG0500104	3
	Cell Biology		

SEMESTER III

MAJOR-3
BASIC GENETICS
Code: ZLG0300104
Credit: 3(T) + 1(P)

TO BE ADOPTED FROM SWAYAM

By Prof. Richa Arya, Prof. Madhu G Tapadia, Prof. J K Roy (retired); Banaras Hindu University

Course Outcomes:

Upon completion of the course, students should be able to:

The course provides a fundamental understanding of heredity and variation principles. It covers basic Mendelian genetics, extensions of Mendelian concepts, and cytoplasmic inheritance. Students will learn how genetic information is transmitted in eukaryotes and prokaryotes, the interactions of genes within biological systems, and the molecular basis of these processes. Additionally, the course explores the role of chromosomes in determining sex and discusses various chromosomal anomalies that can impact human development.

Course Layout:

Week 1: Elements Of Heredity and Variations

1. Historical Background and Mendel's Laws of Inheritance: Part 1
2. Historical Background and Mendel's Laws of Inheritance: Part 2
3. Understanding Mendel's Data: Methods & Applications (Probability, Product Rule, Sum Rule, Binomial Expansion and Factorial)
4. Understanding Mendel's Data: Methods & Applications (Punnet Square, Forked Line Method, Statistical Test to Analyse Data)
5. Chromosomal Basis of Inheritance (Post Mendel's laws, chromosome behaviour during meiosis, theory by Sutton and Boveri, Work of Morgan and team)

Week 2: Extension of Mendelism

1. Dominance Relationships, Multiple Allelism
2. Multiple Allelism, Conditional Alleles, Lethal Alleles
3. Pleiotropy, Phenocopy, Polygeny
4. Epistasis
5. Gene Interaction

Week 3: Various Ways to Determine Sex and Inheritance of Sexual Traits

1. Discovery of Sex Chromosomes: From History to Systems (XX/XY system in *Drosophila* and Human)
2. Discovery of Sex Chromosomes: From History to Systems (XX/XO, ZZ/ZW, haploidy/diploidy)
3. Environmental and Hormonal control of sex determination
4. Sex Influenced, Sex-Limited and Sex-Linked Traits
5. Dosage Compensation in *Drosophila* and Human

Week 4: Different Types of Inheritance Patterns

1. Quantitative Inheritance
2. Quantitative Inheritance (Cont.)
3. Extra nuclear inheritance
4. Infective Inheritance
5. Maternal Inheritance

Week 5: Gene Mutations

1. Spontaneous Mutations
2. Induced Mutations
3. Molecular basis of mutations
4. Detections of mutations, Ames test, CIB technique, Nutritional Mutations in *Neurospora*
5. DNA repair mechanisms

Week 6: Gene Mapping in Prokaryotes

1. Bacterial Growth and Conjugation
2. Conjugation And Sexduction: Gene Mapping in Bacteria
3. Transformation: Gene Mapping in Bacteria
4. Transduction and Gene Mapping in Bacteria
5. Gene mapping in Phages: Mapping the rII Locus – History, Concepts & Applications

Week 7: Gene Mapping on Eukaryotic Chromosomes

1. Linkage and crossing over: Concepts in Classical & Molecular Genetics
2. Recombination and Cytological Determination of Crossing over
3. Gene Mapping Using Two point and three Point Test Cross
4. Interference and Coincidence
5. Gene Mapping in yeast and Neurospora Using Tetrad Analysis Methods

Week 8: Chromosomal alterations

1. Anomalies in chromosome number: Aneuploidy
2. Anomalies in chromosome number: Polyploidy
3. Anomalies in chromosome structure: Deletions and duplications
4. Meiotic consequences in inversion heterozygotes
5. Meiotic consequences in inversion heterozygotes

Week 9: Human Genetics: Pedigree Analysis

1. Making A Pedigree Chart and showing dominant and recessive traits
2. Study Of Autosomal Traits in A Pedigree
3. Study Of Sex-Linked Traits in A Pedigree
4. Study Inheritance of Mitochondrial Traits in A Pedigree
5. Genetic Counselling

Week 10: Human Genetics: Chromosome Analysis

1. Human karyotyping
2. G-banding
3. Chromosome bandings other than G-banding
4. Fluorescence in situ hybridization
5. Nomenclature of G-ban

Week 11: Human Genetics: Genetic Disorders

1. Human genetic disorders: Gene mutations
2. Human genetic disorders: Chromosomal aneuploidy
3. Human genetic disorders: Chromosome translocations
4. An introduction to cancer
5. An introduction to cancer with special reference to Human papilloma virus papilloma virus

Week 12: Regulation Of Gene Activity in Eukaryotes

1. Regulation of gene activity in eukaryotes: Transcription unit
2. Regulation of gene activity in eukaryotes: Initiation, elongation and termination of transcription
3. Regulation of gene activity in eukaryotes: Activators, enhancers and boundary elements
4. Regulation of gene activity in eukaryotes: RNA processing

5. Regulation of gene activity in eukaryotes: RNA editing, epigenetic modifications

BASIC GENETICS Code: ZLG0300104 Credit: 01	
Practical	Hours
1. To study Mendelian laws and gene interactions and their verification by Chi-square analyses using seeds/beads/ <i>Drosophila</i> .	30
2. Study of linkage maps based on data from <i>Drosophila</i> crosses.	
3. Identification of various mutant types of <i>Drosophila</i> (through culture/photomicrograph)	
4. Study of human karyotype (normal and abnormal) using photomicrograph.	
5. Preparation of polytene chromosomes from <i>Chironomus/Drosophila</i> larvae.	
6. Preparation of metaphase chromosome from fish/mammal.	

Suggested Readings:

- Snustad and Simmons: Principles of Genetics (2019, 7th ed. John Wiley)
- Hartl and Jones: Essential Genetics- A Genomic Perspective (2009, Jones and Bartlet)
- Pierce: Genetics - A Conceptual Approach (2012, Freeman) Suggested Readings
- Griffith et al.: An Introduction to Genetic Analysis (Freeman 11th ed, 2015)
- Brooker: Genetics - Analysis and Principles (2012, 4th ed McGraw Hill)
- Russell: Genetics (2010, Benjamin Cummings)
- Gersen & Keagle: The Principles of Clinical Cytogenetics (2005, Humana)
- Hawley & Walker: Advanced Genetic Analysis (2003, Blackwell)
- Resonance Journal for Science education (<https://www.ias.ac.in/listing/issues/reso>)
- What is a Gene? A Question with Variable Answers
<https://www.ias.ac.in/describe/article/reso/002/04/0038-0047>
<https://www.ias.ac.in/describe/article/reso/002/05/0044-0053>
- Tracing the Roots of Molecular Biology: Part 1/2/3: Genesis of Cell Theory
<https://www.ias.ac.in/describe/article/reso/030/03/0379-0409>,
<https://www.ias.ac.in/describe/article/reso/030/01/0077-0095>,
<https://www.ias.ac.in/describe/article/reso/029/12/1669-1687>
- Pedigree Analysis in Medical Genetics: History and Diagnostic Efficacy
<https://www.ias.ac.in/describe/article/reso/030/05/0601-0620>
- Chromatin is a Dynamic Structure: <https://www.ias.ac.in/describe/article/reso/027/06/0983-1002>
- Dosage Compensation: <https://www.ias.ac.in/article/fulltext/reso/026/05/0649-0669>

MAJOR-4
ENTOMOLOGY AND FISHERIES
Code: ZLG0300204
Credit: 3 (T) + 1 (P)

Course Outcomes:

Upon completion of the course, the students should be able to:

1. Identify and classify the diversity of insects and fishes based on their morphological characters
2. Interpret the body design and plan of insects and fishes in a simpler form.
3. Categorize the common vectors of human diseases and common phytophagous pests
4. Compare and contrast capture and culture fisheries resources of India
5. Appraise the importance of fish as a model organism in research and develop skills on induced breeding of Indian Major Carps, soil and water quality in aquaculture.

MAJOR-4
ENTOMOLOGY AND FISHERIES
Code: ZLG0300204
Credit: 3 (T) + 1 (P)

THEORY	Hours
Unit 1: General Features of Insects , Classification of insects up to orders, causes of success of insects on earth, role of insects in pollination, Basic concept on collection, preservation and culture techniques of insects General Morphology of insects -compound Eyes, antennae, Mouth parts and legs. Structure of integument. Molting and metamorphosis. Insects as Vectors & Pest: Insects as mechanical and biological vectors of pathogens and parasites, Common insect vectors (Aedes, Culex, Anopheles, Phlebotomus, Musca domestica), Insects as plant pests.	23
Unit 2: Introduction to fish - General description of a fish; Account of systematic classification of freshwater teleosts of NE India (up to Order) Morphology and Physiology - Types of fins and their modifications; Locomotion in fishes; Types of Scales; Structure and functions of Gills, basic mechanism of gas exchange; Swim Bladder - types, role in Respiration and buoyancy; Osmoregulation in Elasmobranchs; Electric organs	09
Unit 3: Capture Fisheries - Inland Capture Fisheries resources of India; marine fisheries; Fishing crafts and Gears; Application of remote sensing and GIS in fisheries; Fisheries rules and regulations; Climate change and its impact on fisheries; Fishery by-products Culture fisheries - Extensive, semi-intensive and intensive culture of fish; Pen and cage culture; Polyculture; Composite fish culture; Brood stock management; Induced breeding of Indian Major Carps; Management of hatcheries; Role of soil and water quality in aquaculture	13

ENTOMOLOGY AND FISHERIES

Practical	Hours
1. Study of different types of mouth parts/ antenna of insects through slides/specimens.	30
2. Study of insect vectors through permanent slides or photographs or model: <i>Aedes</i> , <i>Culex</i> , <i>Anopheles</i> , <i>Pediculus</i> , <i>Cimex</i> , <i>Phlebotomus</i> (sand fly), and <i>Musca domestica</i> (house fly).	
3. Preparation of project report on any one vector and diseases transmitted by the vector (<i>Aedes/Culex/Anopheles</i> / lice/ bed bug, sand fly/ house fly).	
4. Identification of insects belonging to different orders, common insect pest of paddy, tea, stored grain, citrus and sugarcane.	
5. Classification and characterization of commercially important food and ornamental fishes of NE India.	
6. Study of different types of indigenous/locally available fishing gears.	
7. Estimation and interpretation of pH of pond soil; dissolved oxygen (D.O.) and free carbon dioxide (fCO ₂) in pond water.	
8. Dissection and display of Pituitary Gland of Indian Major Carp.	
9. Demonstration of induced breeding of IMCs (video)	

Suggested Readings:

1. Pradhan, S. (1969). Insect Pests of Crops. National Book Trust, India Book House.
2. Atwal, A.S. (1993) Agricultural pest of India and South East Asia. Kalyani Pub., New Delhi.
3. Chapman, R. F. The Insects: Structure and Function. Cambridge University Press, UK
4. S. Hill. (2005) Agricultural Insect pests of the tropics and their management, Cambridge University press.
5. Pedigo L. P. (2002). Entomology and Pest Management, Prentice Hall Publication
6. Tembhare, D.B. Modern Entomology
7. David, B.V. and Ananthakrishnan (2004). General and Applied Entomology.
8. Bone, Q. & Moore, R. H. (2008). Biology of Fishes. 3rd edition, Taylor & Francis
9. Evans, D. H., Claiborne, J. B. & Curie, S. (2014). The Physiology of Fishes. 4th edition, CRC Press
10. Handbook of Fisheries and Aquaculture (2013). Published by the Indian Council of Agricultural Research, New Delhi
11. Khanna, S. S. & Singh, H. R. (2014). Textbook of Fish Biology and Fisheries. 3rd edition, Narendra Publishing House
12. Jayaram, K. C. (2010). The Freshwater Fishes of the Indian Region. 2nd edition, Narendra Publishing House
13. Vishwanath, W. (2021). Freshwater Fishes of the Eastern Himalayas. 1st edition, Elsevier