

**PAPER AST 01 – GENETICS -I****1. Linkage, Crossing Over and Chromosome Mapping****a. Crossing Over:**

- i. Cytological basis of Crossing over and Types of crossing over: Single, Double & Multiple.
- ii. Theories of Crossing Over at Chromosomal and Molecular Level (Chiasma Type or precocity, Belling's Theory, White house & Holiday Model).

**b. Linkage & Chromosome Mapping:**

- i. Complete and Incomplete Linkage, ii. Measurement of Linkage from F2 and Backcross data iii. Construction of genetic maps based on genetic analysis iv. Interference & Coincidence.

**2. Mutation:**

- a. Types of Mutation (Gene Mutation: Transition, Transversion, Frame-shift mutation, UV and Thymine Dimerisation, Peroxide Formation, Chemical Mutation),
- b. Molecular mechanism of Mutation,
- c. Detection of mutations in Drosophila,
- d. Chromosomal Aberrations (Structural Changes): Deficiencies, Duplications, Inversion, Translocation and Position effects.

**3. Polyploidy:**

- a. Classification & Cytological and genetical methods of identification of Haploids,
- b. Autopolyploids, Allopolyploids, Auto-allopolyploids Segmental Allopolyploids.
- c. Aneuploids: Classification & Identification and Meiotic behaviour of Monosomics, Nullisomics, Tetrasomics.

**4. Sex Determination:**

- a. Theories of sex determination: Genetic Balance theory in Drosophila, XX-XY Mechanism of Sex Determination, Single gene control of sex, Hormonal control of sex, Environmental Factors & Sex determination, Role of Y Chromosome in sex determination in Mammals
- b. Sex Anomalies: Klinefelters Syndrome (Human) Turners Syndrome (Human) Gynandromorphs, Sex Reversal.
- c. Sex Linked Inheritance: Sex Linkage & Inheritance Pattern of Colour Blindness & Haemophilia.

**Suggested Reading Material:**

<b>S. No.</b>	<b>Name of the Book</b>	<b>Authors</b>
1.	Principles of Genetics	Gardner, Simmons & Snistad
2.	Molecular Biology	David Friedlander
3.	Genetics	Strickberger
4.	Genetics-A Molecular Approach	T.A Brown
5.	Genetics	Altenberg
6.	Genetics	Russell

**PAPER AST 02 - BIOCHEMISTRY - I****1. Property of Molecules:**

- a. Diffusion, osmosis, Acidity, basicity, pH and buffer action.
- b. Energy Metabolism: High energy molecules.
- c. Redox potential, Mitochondrial electron transport,
- d. Oxidative phosphorylation.

**2. Laws of thermodynamics:**

- a. Concepts of matter, system and energy
- b. First and second law of thermodynamics.
- c. Concept of enthalpy and entropy,
- d. Entropy in biological systems.
- e. Concept of free energy and calculations based on free energy changes

**3. Carbohydrates:**

- a. Definition and classification,
- b. Structure and properties of Mono, di-and Polysaccharides.
- c. Concept of isomers. Epimers. Mutarotation and conformational formula.
- d. Physicochemical properties and biological significance.

**4. Lipids: Classification and general properties:**

- a. Definition and classification,
- b. Saturated and unsaturated fatty acids,
- c. Simple and compound lipids,
- d. Non saponifiable lipids.

**Suggested Reading Material:**

<b>S. No.</b>	<b>Name of the Book</b>	<b>Authors</b>
1	Lehninger Principles of Biochemistry :(3rd ed 2006, MacMillan Worth)	Nelson et al.
	Berg et al: Biochemistry (6th ed 2007, Freeman)	
	Murray et al: Harper's Illustrated Biochemistry (27th ed 2006, McGraw Hill)	
	Mathews et al.: Biochemistry (6th ed 2006, Pearson)	
	Zubay et al: Biochemistry (4th ed 1998, WCB)	
	Horton et al: Principles of Biochemistry (4th ed 2006, Prentice Hall)	
	Rawn: Biochemistry (1989, Neil Patterson)	
	Price & Stevens: Fundamentals of Enzymology (2nd ed 1988, Oxford University Press)	
	Engel: Enzyme kinetics: The steady state approach(1981, Chapman and Hall)	
	Segal: Biochemical calculations (2nd ed 1976, John Wiley)	
	Fersht: Enzyme Structure and Mechanisms (2nd ed 1985, Freeman)	

## SEMESTER -I

### PAPER AST 03 - MICROBIOLOGY

#### 1. a. General Microbiology:

- i. Introduction to microbiology Germ theory of disease, Koch Postulates, basic concept of prokaryotes.
- ii. Ultrastructure of bacterial cell wall, difference between Gram positive and Negative cell wall mechanism of Gram staining

#### b. Acellular microbe:

- i. General characteristics of a virus, difference between bacteria and viruses. Structural composition of a typical virion and types of animal viruses
- ii. Bacteriophages - nature, structure and replication of phage.
- iii. Isolation and enumeration of phages and significance of phages

#### 2. Culture Techniques:

- a. Nutrition diversity in bacteria. Culture media - Natural and synthetic media and their significance for bacterial culture.
- b. Microbial control (Aseptic techniques): Physical (Tyndallization, Pasteurization) and chemical control of microbes
- c. Isolation and culture of bacteria and their biochemical characterization.
- d. Microbial Enumeration - Viable Cell Count (VCC) and Total Cell Count (TCC).

#### 3. Aquatic Microbiology:

- a. Waste water contaminants (Sewage and Industrial) and their microbial control,
- b. Determination of Biological Oxygen Demand (BOD).
- c. Potable water - criteria of potable water and purification.
- d. Microbial Examination of potable water - presumptive and confirmatory tests, Special Plate Count (SCP) and Most Probable Numbers (MPN)

#### 4. Microbial Biotechnology:

- a. Food Microbiology - Food preservation, Food spoilage, Food poisoning and microbial toxins - their implication for human health
- b. Industrial Microbiology - selection criterion for screening new antimicrobial agents and basic structure of the fermenter and principles of Antibiotic production.
- c. Single Cell Protein (SCP) - production, harvesting and advantages

#### Suggested Reading Materials:

##### Name of the Books

1. Microbiology
2. Microbiology
3. General Microbiology
4. Food Microbiology
5. Industrial Microbiology

##### Author

- Prescott,  
Pelezer,  
Stanier,  
Adams and Moss  
Casida

## SEMESTER - I

### PAPER AST 04 - GENERAL ENTOMOLOGY

#### 1. Classification and integumentary system:

- a. Brief classification of insects up to order level with characters and examples of each Order.
- b. Integumentary system, including morphology of insect's integument and its function.

#### 2. Digestive and Respiratory systems:

- a. Digestive system- morphology, physiology and nutritional needs of insects.
- b. Respiratory system- morphology and physiology of respiratory organs.

#### 3. Circulatory and Excretory systems:

- a. Circulatory system- morphology and physiology of different types of circulatory Organs.
- b. Excretory system - morphology of different excretory organs and their function.

#### 4. Nervous and Reproductive systems:

- a. Nervous system - structure of different sense organs of insects.
- b. Reproductive system - detailed morphology of reproductive organs of insects.
- c. Sound and light producing organs of insects.

### Suggested Reading Materials:

Name of the Books	Author
1. The insects	R F Chapman
2. An introduction to Entomology	J.H.Comstock2
3. Imm's General Text book of Entomology Vol. I&II	Richard O N.2
4. The principles of insect physiology	V.B.Wiggles

## PAPER AST 05 - CELL BIOLOGY

**1. Internal Organization of the Cell (Membrane Structure):**

- a. Lipid Bilayer, b. Membrane Proteins.
- c. Functional aspects of plasma membrane
- d. Membrane transport of molecules
- e. Principles of Membrane Transport, f. Active transport and sodium pumps, Passive permeability.

**2. Intracellular Compartments & Protein Sorting:**

- a. Nucleus: Transport of proteins in and out of Nucleus.
- b. Mitochondria & Chloroplasts:
  - i) Membrane organization,
  - ii) Transport of proteins into mitochondria and Chloroplasts,
  - iii) Genome of mitochondria and Chloroplasts,
  - iv) Molecular basis of ATP Synthesis.
- c. Endoplasmic reticulum:
  - i) Protein Glycosylation, ii) Transport of proteins, iii) Chaperone proteins
- d. Golgi apparatus:
  - i) Role in protein processing,
  - ii) Transport from ER through the Golgi apparatus.
- e. Lysosomes:
  - i) Intracellular digestion, ii) Sorting of lysosomal enzymes in Golgi,
  - iii) Lysosomal storage diseases.

**3. Transport from the Plasma Membrane via Endosomes (Endocytosis), Trans Golgi Network to cell surface (Exocytosis) & Vesicular Transport: Clathrin & coatomer coated vesicles, SNARE proteins.**

- 4. a, Cell to cell signaling: autocrine, paracrine and endocrine stimulation, Steroid Receptor.
- b. Signaling via G-Protein linked cell surface receptors. i. Adenylate cyclase system, ii. Inositol phosphate pathway, iii. Role of  $\text{Ca}^{2+}$  ions.
- iv. Signaling via enzyme-linked surface receptors, tyrosine kinases.

**Suggested Reading Material:**

S. No.	Name of the Book	Author
1.	Cell Biology	B. King
2.	The Cell	C.P. Swanson, T. Mertz & W.J. Young
3.	Molecular Biology of the Cell	Alberts, Bray, Lewis, Robertson
4.	Cell & Molecular Biology	De Robertis
5.	Molecular Cell Biology	Daniel, Lodish & Baltimore
6.	Genes (Latest Edition)	Benjamin Lewin

**SEMESTER-I**

**PAPER AST 06 -DEVELOPMENT BIOLOGY -I**

- 1: Gonad differentiation in embryonic development of mammal
2. Spermatogenesis:
  - a. Structure of sperm, genetic and morphological basis of spermatogenesis.
  - b. Morphology, differentiation, function and regulation of Leydig cell.
3. Oogenesis:
  - a. Morphology of ovarian follicles;
  - b. Hormonal regulation of ovarian follicular growth and differentiation.
4. Fertilization:
  - a. Mechanism of fertilization, Recognition of gametes and acrosomal reaction.  
Prevention of polyspermy and gamete fusion
  - b. Changes in the organization of egg cytoplasm caused by fertilization. c. molecular events during fertilization.
5. Cleavage:
  - a. Pattern of cleavage.
  - b. Biochemical changes during cleavage.
  - c. Mechanism of cleavage, role of egg cortex.
  - d. morphogenetic gradients in egg cytoplasm.

**Suggested Reading Material:**

<b>S. No.</b>	<b>Name of the Book</b>	<b>Authors</b>
1.	An Introduction to Embryology	Balinsky
2.	Developmental Biology	Gilbert
3.	An introduction to Embryology	Balinsky
4.	Analysis of Biological development	Kalthoff
5.	Principles of Development	Wolpert
6.	Development Biology	Muller

## PAPER AST 07 -GENETICS - II

1. **Microbial Genetics:**
  - a. Plasmids – characteristics, types and their significance.
  - b. Bacterial Recombination:
    - i. Transformation – Basic mechanism and Experimental method of transformation.
    - ii. Conjugation- sex-duction, high frequency (Hfr) recombination;
    - iii. Transduction - generalized and specialized (lambda-phage).
2. **Transposons (Jumping genes)** prokaryotic and Eukaryotic Transposons-
  - a. Cut and Paste types
  - b. Replicative types
  - c. Retroposones – LINE and SINE and their significance.
3. **Multiple Alleles and Cytoplasmic Inheritance:**
  - a. Coat colours in Rodents, eye colour in Drosophila, Self incompatibility alleles in Nicotiana.
  - b. Blood groups in humans- antigen, antibody interaction in the inheritance of A, B, AB and O blood groups.
  - c. The H antigen and MNS System, Rh- factor in human.
  - d. Cytoplasmic Inheritance – plastid inheritance in Mirabilis, male sterility in plants, Kappa particles in Paramecium and Delayed inheritance in snail.
4. **Biostatistics:**
  - a. Probability – law of probability, probability distribution and probability in term of genetics.
  - b. Statistical tools - mean, variance, standard error and test of significance  
Analysis of variance (ANOVA), Chi square test – Simple application.

### Suggested Reading Materials:

Name of the Books	Author
1. Principles of Genetics	Gardner
2. Principles of Genetics	Snustad, D. P and Simmons , M. J
3. Genetics	Strickberger, M.W.
4. Genetics: A molecular approach	Russell, P.J.
5. Molecular biology of the gene	Watson <i>et . al.</i>

**PAPER AST 08 - BIOCHEMISTRY-II****1. Chemical bonds and Hormone action:**

- a. Chemical bonds - Electrovalent, covalent, Polar covalent and hydrogen bonds. Hydrophobic interactions and Vander walls forces.
- b. Mechanism of protein/peptide hormone action.

**2. Protein structure:**

- a. Primary structure: amino acids and peptide bond.
- b. Secondary structure:  $\alpha$ -helix,  $\beta$ -pleated sheet and bends.
- c. Tertiary structure, forces stabilizing tertiary structure.
- d. Quaternary structure.
- e. Physical properties and biological significance of proteins

**3. Enzyme kinetics:**

- a. Lowering of activation energy.
- b. Derivation of Michaelis-Menten equation, related calculations and Michaelis-Menten and Lineweaver-Burk plots.

**4. Mechanism of Enzyme action:**

- a. Active site, substrate binding, transition state analogues and enzyme.
- b. Concepts of regulation of enzyme activity: Induction, repression, allosteric regulation, regulation by adenylate energy charge and phosphorylation, - dephosphorylation, isozymes.

**Suggested Readings:**

1. Nelson et al: Lehninger Principles of Biochemistry (3rd ed 2006, MacMillan Worth)
2. Berg et al: Biochemistry (6th ed 2007, Freeman)
3. Murray et al: Harper's Illustrated Biochemistry (27th ed 2006, McGraw Hill)
4. Mathews et al.: Biochemistry (6th ed 2006, Pearson)
5. Zubay et al: Biochemistry (4th ed 1998, WCB)
6. Horton et al: Principles of Biochemistry (4th ed 2006, Prentice Hall)
7. Rawn: Biochemistry (1989, Neil Patterson)
8. Price & Stevens: Fundamentals of Enzymology (2nd ed 1988, Oxford University)
9. Engel: Enzyme kinetics: The steady state approach(1981, Chapman and Hall)
10. Segal: Biochemical calculations (2nd ed 1976, John Wiley)
11. Fersht: Enzyme Structure and Mechanisms (2nd ed 1985, Freeman)

**PAPER AST 09 - IMMUNOLOGY****1. Introduction to immune system:**

- a. Introduction to immune system a. Resistance and immunity, b cellular vs humoral immunity.
- b. Barriers against infection, Immunological capability of host
- c. Diagnostic Immunology- i. Widal test ii Wasserman test.
- d. Immunoprophylaxis and Vaccines: Milestones, principles, routes of administration and preparation of vaccines

**2. Adjuvants and Lymphatic organs:**

- a. Adjuvants -a. Characteristics and uses of ideal adjuvants.
- b. Natural and chemically defined adjuvants, c. their role in immunomodulation.
- c. Haptens and antigenicity.
- d. Lymphatic organs: Primary (Thymus and Bursa of Fabricius) and secondary (Spleen and Lymph nodes).
- e. Antigen, a. Antigenic determinant- Physical and chemical properties of antigens.

**3. Antibody Formation and Ag -Ab interaction:**

- a. Theories of antibody formation, Structure and classification of Immunoglobulins and their properties
- b. Immunoglobulins synthesis molecular level synthesis, b. assembly, c.intracellular transport, d. secretion of immunoglobulins.
- c. *In vitro* reactions - a. phagocytosis, b. precipitation and agglutination, c. biological activity of complement fixation and cytolysis.
- d. *In vivo* reactions – hypersensitivity classification and mechanism.

**4. Transplantation and AIDS:**

- a. Tissue transplantation - a. Graft vs host reaction, b. Tissue typing, c. immunobiology of rejection, d. immuno suppression, e. Organ transplantation and selective transplantation.
- b. Autoimmunity: principles and theories.
- c. AIDS – HIV virus, transmission, mechanism of destruction of T4 cells, diagnosis and control measures.

**Suggested Reading Materials:**

Name of the Books	Author
1. Immunology	Bellanti J.A.
2. Immunology and Serology	Carpenter P.I..
3. Immunology	Weir D.M.
4. Essential Immunology	Riott I.
5. Immunology	Sethy N

**PAPER AST 10: APPLIED ENTOMOLOGY****1. Insects world:**

- a. Beneficial insects (Apiculture, Sericulture and Lac Insect culture), harmful insects and insects as pests.
- b. Common pests of sugarcane crop in India – their biology and control
- c. Common pests of paddy and their biology and control
- d. Common pests of vegetables and oil seed crops in India
- e. Common pests of stored grains and their control.

**2. Pests control : Usual techniques:**

- a. Mechanical, legislative and agricultural methods.
- b. Biological control of Insects Pests.

**3. Chemical Control of Pests (Common Insecticides):**

- a. Chlorinated Hydrocarbons and Phostoxins
  - i. Different fumigants and their mode of actions
  - ii. Deterrents
  - iii. On the basis of action: respiratory poisons and nerve poisons
  - iv. On the basis of chemical nature.
- b. Botanicals and other inorganic chemicals.

**4. Integrated Pests Management (IPM):**

- a. Control by other means: Semio-chemicals: Attractants, Repellants
- b. Antifeedants, Hormones and their analogues.
- c. IPM: Biomanures (vermicompost) and biopesticides (vermiwash, vermisfilter and vermitea).
- d. Pesticide application equipments: Machines and tools used in pest control.

**Suggested Reading Materials:****Name of the Books****Author**

1.	The Insects	R F Chapman
2.	Handbook of economic entomology	L.V. R. Ayyar
3.	Indian insect life	H. Maxwell Lebroy
4.	Insect pest control	R. Kumar

## PAPER AST 11: MOLECULAR BIOLOGY

**1. Modern concept of gene.** Fine structure of gene

Genetic Material (Nucleic Acid):

- Evidence of DNA as genetic material
- Chemical and molecular structure of nucleic acids
- Different forms of Nucleic Acids (A, B & Z DNA and mRNA, tRNA & rRNA)
- Prokaryotic and Eukaryotic Genome, Organization of DNA into chromosomes  
(Nucleosome, Packaging of DNA into Chromosomes, Unique & Repetitive DNA  
Euchromatin, Heterochromatin, Satellite DNA)

**2. DNA Replication:**

- Replication Origin and Replication Forks
- Role of various enzymes and accessory proteins involved in DNA Replication
- Mechanism of DNA replication in Prokaryotes and Eukaryotes
- DNA damage and Repair Mechanisms

**3. Transcription:**

- Molecular mechanism of Prokaryotic and Eukaryotic transcription (RNA Polymerases, Transcription factors, Formation of Initiation Complex, Capping, Elongation and Termination)
- Post transcriptional modifications: 5' capping, Polyadenylation, exon intron Splicing, Structure of different types of RNA.
- c. Reverse Transcription

**Translation:**

- Genetic Code: Properties of Genetic code, Deciphering of genetic code, Anticodon
- Molecular mechanism of Protein synthesis in prokaryotes and Eukaryotes (Ribosome, Formation of Initiation Complex, Initiation Factors, Elongation Factors, Elongation, Termination)
- Post Translational Modifications of proteins

**4. Operon Concept.** Regulation of gene expression in Prokaryotes and Eukaryotes**Suggested Reading material:****S. No.**      **Name of the Book****Author**

Benjamin Lewin

De Robertis

David &amp; Freifelder

Lehninger

Gardiner Simmons &amp; Sausiad

Zubey

1. Genes

2. Cell &amp; Molecular Biology

3. Molecular Biology

4. Principles of Biochemistry

5. Principle of Genetics

6. Principles of Biochemistry

*1. 2. 3. 4. 5. 6.*

SEMESTER - II

PAPER AST 12: DEVELOPMENT BIOLOGY - I

1. Cell Differentiation  
Gene and molecular basis of cell differentiation
2. Gastrulation
  - a. Fate maps and process of gastrulation,
  - b. Formation of primary organ rudiments in frog and chick.
  - c. Gene activity during gastrulation.
3. Organizer concept –
  - a. Primary organizer,
  - b. Embryonic induction and morphogenetic movement, molecular concept of embryonic induction
  - c. Formation of extra embryonic membranes.
4. Placentation in mammal
5. Morphogenesis - Development of Eyes, Brain and Heart in mammals.

Suggested Reading Materials

Name of the Books

Name of the Books	Author
1. An introduction to Embryology	Balinsky
2. Developmental Biology	Gilbert
3. Developmental biology	Mullar
4. Analysis of Biological development	KalthoffeGraw
5. Principles of Development	Wolpert
6. Animal cell culture(Basic Principles)	Freshney,R.I
7. Culture OF Animal cell(A Practical Approach)	Freshney,R.I.
8. Animal cell culture techniques	Clyne M.

Endurin - 12

- 10 A.

**PAPER AST 13 - MAMMALIAN ENDOCRINOLOGY- I****1. Mechanism of hormone action:**

- a. Protein hormones
  - i. Cyclic AMP signaling cascade.
  - ii. G-proteins,
  - iii. PKC signaling pathway,
  - iv. Importance of IP<sub>3</sub>, DAG, and cellular Ca<sup>2+</sup>/calmodulin.
- b. Mechanism of lipophilic hormone's action.
- c. Termination of hormone action.

**2. Hypothalamo-hypophyseal System:**

- a. General organization
- b. Hypophysiotropic hormones: chemistry, localization and actions
  - i. Thyrotropin releasing hormone (TRH).
  - ii. Somatostatin (SST),
  - iii. Growth hormone releasing hormone (GnRH),
  - iv. Corticotropin releasing hormone (CRH).
- 3. a. **Adenohypophyseal hormones:** chemistry and physiological roles of
  - i. Somatotropin and prolactin.
  - ii. Glycoprotein hormones (FSH, LH and TSH).
  - iii. Pro-opiomelanocortin (ACTH, MSH, β-LPH and β-endorphin).
  - iv. Neural control of adenohypophysis.
- b. Hypophysiotropic hormones: chemistry, localization and actions.
  - i. Oxytocin,      ii. Vasopressin.
- 4. **Thyroid and Parathyroid glands:**
  - a. Structural organization,
  - b. Control and secretion c. Physiological roles and pathophysiology
  - d. Thyroid hormones biosynthesis,
  - e. Importance of Vitamine D in calcium homeostasis by Parthormone.

**Suggested Readings:**

1. Hadley: Endocrinology, Prentice Hall (2000, International Edition)
2. Turner and Bagnara: General Endocrinology (1984, Saunders)
3. Larson: Williams Textbook of Endocrinology (10th ed 2002, Saunders)
4. Wilson and Foster, Williams Text Book of Endocrinology 10th edition.
5. Chester-Jones et al: Fundamentals of Comparative Endocrinology
6. Brooks and Marshall: Essentials of Endocrinology (1995, Blackwell Science)
7. Bentley: Comparative Vertebrate Endocrinology
8. Norris: Vertebrate Endocrinology (4th ed 2007, Elsevier)
9. Schreibman & Pang: Vertebrate Endocrinology Vol I-IV.

**PAPER AST 14 - BIOTECHNOLOGY - I**

1. Recombinant DNA Technology & Gene Cloning  
Enzymes used in Molecular cloning  
a. Restriction enzymes, b. Ligases c. Other enzymes  
d. Isolation of Genomic and Plasmid DNA
2. Vectors:  
a. Plasmid: Plasmid Biology, Structural and functional Organization, Plasmid replication, Construction of an ideal vector pBR 322  
b. Phages: Biology of Bacteriophage lambda, Phage as natural in vivo vector, in vitro construction of vector, Importance in rDNA techniques  
c. Cosmids: Construction and their uses  
d. Animal viruses: Simian Virus 40  
e. Plant viruses: Gemini virus, Cauliflower mosaic virus
3. Introduction of Plasmid DNA into *E.Coli*  
a. Identification of Recombinant clones  
b. Analysis of recombinant clones  
c. Synthesis of complementary DNA  
d. Gene Amplification - Polymerase Chain reaction & Real Time PCR
4. DNA Sequencing Methods:  
a. Maxam Gilbert's Chemical Method b. Sanger's Method  
d. Southern Blotting, Northern Blotting and Western Blotting  
e. Chemical synthesis of genes, f. Gene transfer using vectorless Systems  
g. Role of Biotechnology in Agriculture and Medicine

**Suggested Reading Materials:**

	Name of the Books	Authors
1.	Modern Biotechnology	S.B. Primrose.
2.	Molecular Biology of the Gene	Watson
3.	Biotechnology	John.P.Smith
4.	Elements of Biotechnology	P.K. Gupta.
5.	Genetic Engineering:Principles & Practice	Sandhya Mitra
6.	Molecular Cloning Vol1,2,&3	Sambrook,Fritsch & Mani

## PAPER AST 15 - ENVIRONMENTAL BIOLOGY

### 1. Concept of ecosystem:

- a. Concept of ecology, environmental biology and environmental science, their scope and practical applications.
- b. Concept of energy flow.

### 2. Bioenergetics:

- a. Bioenergetics (productivity, food web, food chain, trophic levels, energy quality).
- b. Energies of scale, the law of diminishing returns and the concept of carrying capacity.

### 3. Ecosystem development:

- a. Biological control of Geo-chemical environment. The Gaia hypothesis and its Cybernetic nature.
- b. Strategies and concepts of ecological climax.
- c. Evaluation of biosphere, natural selection and co-evolution.  
Environmental policies of India.

### 4. Community interaction:

- a. Basic structure and organization of community.
- b. Interspecies interactions (competition, coexistence, predation, parasitism, allelopathy and positive interaction).
- c. Concept of ecological Niche.
- d. Species diversity.

### Suggested Reading Materials:

	Name of the Books	Author
1.	Fundamentals of Ecology	Odum, E.P.
2.	Basic Ecology	Odum, E.P.
3.	Ecology: principles and applications	Chapman, J.L. and Resis, M.J.

## ANIMAL

## PAPER AST 16 - PHYSIOLOGY - I

1. **Digestive Physiology:**

- a. Detailed structure of the gastrointestinal tract.
- a. Associated digestive glands and their secretions.
- b. Digestive enzymes and regulations of their secretion in mammals.
- c. Mechanism of digestion and absorption of different foodstuffs.

2. **Respiratory Physiology:**

- a. Different respiratory organs.
- a. Mechanisms of breathing and its regulation in mammals.
- b. Various respiratory pigments.
- c. Metabolic pathways- Glycolysis, TCA Cycle and Oxidative phosphorylation.

3. **Excretory Physiology:**

- a. Different excretory products.
- b. Structure of kidney and a nephron
- c. Formation of urine, its regulation (hormonal control) and excretion
- d. Renal clearance, micturition, acid-base balance and its major disorders

**Suggested Reading Materials:****Name of the Books****Author**

1.	Human Physiology	C.C. Chatterjee (Vol. I & II)
2.	Human Physiology	Hymen
3.	A text book of General Physiology	Dayson, H.
4.	Principles of Animal Physiology	Wood, D W
5.	Textbook of Physiology & Biochemistry	Bell,DavidsonScarborough

## UNIVERSITY - III

### PAPER AND 17 - AQUACULTURE

1. **Development and Management of Fish Farm**
  - a. Introduction - Purpose, importance and advantages of aquaculture.
  - b. Biology and taxonomy of commercially important fishes.
  - c. Fish Ponds- Basic concept of construction of ponds (bottom, bedding and Stocking). Role of Physico-chemical factors in fish culture.
  - d. Plankton - Fertilization of ponds, use and Management of plankton and other live fish feed (Rotifer & Azolla) culture.
2. **Seed Production Technology**
  - a. Fish Breeding - selection of brooders, breeding devices.
  - b. Induced Breeding (Bandh breeding) and Hypophysis culture.
  - c. Fish hatchery- Concept of development of modern Fish hatcheries (circular/Chinese hatchery).
3. **Shell Fish Culture**
  - a. Pearl culture - Pearl forming species Oyster (*Pinctada fucata*), natural and artificial Pearl formation and its importance.
  - b. Mussel (*Lamellifer marginatus*), its occurrence, biology and uses in natural and artificial Pearl formation.
  - c. Shrimp culture - life cycles (Breeding, Egg, yolk, vitelline, Metamorphosis, Larval development) and culture of shrimp (*Penaeus japonicus* and *monodon*) and freshwater prawn (*Mesocarcinus luteus*, *Macrobrachium rosenbergii* and *malcolmsonii*).
4. **Hybridization and Transgenic Fish**
  - a. Basic principle and aims, Development of Polyplasts, Androgenic and Gynogenic fish and their significance.
  - b. Basic principles, aims and application of Transgenic fish.
  - c. Fish Aquarium - Different types of aquarium fishes and their management.

#### **Suggested Reading Materials:**

Name of the Book	Author
1. Aquaculture	Felix T V M
2. Freshwater Aquaculture	Kothiyal, H. S.
3. Induced carp breeding	Chandrasekhar, S. I.
4. An introduction to Fishes	Kishore, N. N.
5. Fish Biotechnology	Karuppiah, S. M.

## SEMESTER - III

### PAPER AST 1B - GENERAL PARASITOLOGY & PATHOLOGY

#### 1. Concept of parasitism:

- a. Concept of parasitism, types of parasites and hosts.
- b. Hyperparasitism in the animal kingdom.
- c. Host parasite interactions-effects of parasites on hosts.
- d. Parasite adaptations- adaptations to transmission and infectiousness.

#### 2. Parasitological Techniques:

- a. Coprological examinations
- b. Blood examinations.
- c. Mosquitoes as vectors of parasitic diseases.
- d. Biology of culicids and their role as pathogen transmitters.

#### 3. Ecology of parasitism:

- a. Host finding
- b. Host selection.
- c. Population dynamics of parasites.
- d. Birth rate, Death rate, Regulation of population growth.

#### 4. Pathology:

- a. Introduction to Pathology - health and disease.
- b. Causes of disease: Exogenous and endogenous agents.
- c. Clinical methods for the diagnosis of diseases.
- d. Oncology: Benign and Malignant tumours, terminology, classification and causes of Cancer. Characteristic features of malignancy, metastases formation and control.

### Suggested Reading Materials

#### Name of the Books

1. General Parasitology
2. Introduction to Animal Parasitology
3. General Parasitology
4. An Introduction to the study of Disease
5. Introduction to Parasitology

#### Author

- V.A. Dogiel  
J. D. Smith  
T. C. Cheng  
W. Boyd & H. Shelde  
Sharma & Ratnu

PAPER AST 19 - MAMMALIAN ENDOCRINOLOGY - II

**1. Regulation of Testicular function:**

- a. Structural organization of testis.
- b. Steroid hormones,
- c. Spermatogenesis and hormonal regulation,
- d. physiological roles of androgen.

**2. Regulation of ovarian function :**

- a. Structural organization of ovary, Reproductive cycles (Menstrual and Oestrus cycle), Follicular development and selection.
- b. Hormonal changes during periovulatory period.
- c. Chemistry, and physiological roles of  
i. Estrogen, ii. Progesterone, iii. Relaxin and inhibin.

**3. Regulation of Adrenal Function:**

a. Adrenal cortex:

- i. Structural organization of adrenal cortex, Control of mineralocorticoid and glucocorticoid hormones.
- ii. Physiological role of glucocorticoids and mineralocorticoids.

b. Adrenal medulla:

- i. Adrenal chromaffin tissue, Synthesis and chemistry of catecholamine,
- ii. Release and physiological role of epinephrine and nor epinephrine.

**4. Endocrine pancreas:**

- a. Structural organization,
- b. Biosynthesis chemistry and metabolism of insulin and glucagon.
- c. Physiological actions of insulin and glucagon.

**Suggested Readings:**

1. Hadley: Endocrinology, Prentice Hall (2000, International Edition)
2. Turner and Bagnara: General Endocrinology (1984, Saunders)
3. Larson: Williams Textbook of Endocrinology (10th ed 2002, Saunders)
4. Wilson and Foster, Williams Text Book of Endocrinology 10th edition, W.B. Saunders Company Philadelphia, 2005
5. Chester-Jones et al: Fundamentals of Comparative Endocrinology (1987, Plenum Press)
6. Brooks and Marshall: Essentials of Endocrinology (1995, Blackwell Science)
7. Bentley: Comparative Vertebrate Endocrinology (1998, Cambridge University Press)
8. Norris: Vertebrate Endocrinology (4th ed 2007, Elsevier)
9. Schreibman & Pang: Vertebrate Endocrinology Vol I-IV, Fundamentals & Biomedical
10. Implications (1985 & onwards, Academic Press)
11. Bolander: Molecular Endocrinology (3rd ed 2006, Elsevier)
12. DeGroot and Jameson: Endocrinology (5th ed 2006, Vol 1, Elsevier-Saunders)

## SEMESTER - IV

### PAPER AST 20- BIOTECHNOLOGY -II

1. **Enzyme Immobilization:**
  - a. Adsorption, Covalent binding, Cross binding and entrapping methods
  - a. Isolation and purification of enzymes:
  - b. Extraction, Centrifugation, Dialysis, Chromatography, and electrophoretic Separation
  - c. Application of immobilized enzymes
2. **Chromatography and Electrophoresis:**
  - a. Types, Principle and Methods of Chromatographic Techniques, (Paper, Thin Layer, Gas, Ion Exchange, Molecular Exclusion, HPLC).
  - c. Principle, Types of Instrument for AGAROSE & PAGE, SDS-PAGE
  - d. Resolution, Separation and Applications of electrophoresis
3. **Spectrophotometer:** Principle, Methodology and applications of Spectrophotometer
  - a. Autoradiography: Principle, Technique & Uses
  - b. Centrifugation: Principle, Simple and Differential Centrifugation
4. **Animal Cell Culture:**
  - a. Culture Technique:
    - i) Disaggregation of cells, Cell Viability, Preparation of Substrate
    - ii) Primary cell culture, Sub Culture
    - iii) Cell Lines: Characteristics of cell Line and their maintenance, Kinetics of Cell growth, Applications of Cell line
  - b. Culture Media: Serum, Serum Free and Chemically Defined Media
5. **Microscopy:** Structure, principle and applications of Optical, Phase Contrast and Electron Microscopes
6. **Spectrometry:**
  - a. Mass Spectrometer: Structure, principle and Applications
  - b. Electron Spin Resonance (ESR): Structure, principle and Applications
  - c. Atomic Absorption Spectroscopy: Structure, principle and Applications
7. **X ray Diffraction Analysis:** Principle, Working and Applications

### Suggested Reading Material:

Name of the Books	Author
1. Practical Biochemistry	K. Wilsn,K. & J. Walker
2. Analysis of Biological Molecules	W.H.P.Geffrey
3. Instrumental Methods of Analysis	Willard
4. Principles of Instrumental Analysis	Skog & West
5. The Electron Microscope in Biology	A.V. Grimstone
6. X -Ray Methods	Clive Whiston
7. Fundamentals of Enzymology	Price & Stevenson
8. Enzyme Technology & Biotechnology	Kennedy J.F.

**PAPER AST 21 - APPLIED ECOLOGY AND WILD LIFE****1. Population ecology:**

- a. The basic concept of population rates, growth and forms.
- b. Density dependent density independent population control.
- c. Population structure, distribution, aggregation, isolation and territoriality.
- d. Energy partitioning and r- and k- selection.

**2. Pollution ecology:**

- a. Air pollution- major pollutants and their effect on human health, control measures.
- b. Soil pollution- major pollutants (insecticides, pesticides, herbicides and chemical fertilizers) their effects on human health control measures.

**3. Sustainable development**

- a. Modern methods for sustainable development - Management of climatic changes, global warming, Green house effect.
- b. Solid waste management.
- c. Application of organic farming and bio indicators.

**4. Wildlife ecology:**

- a. Wildlife depletion - causes, major threatened species of animals.
- b. Wildlife programmes and wildlife acts in India.
- c. Wildlife conservation - National parks and sanctuaries and their brief description.
- d. Wildlife projects- Project tiger, Asian elephant project, white winged wood duck project and conservation of Rhinos.

**Suggested Reading Materials:**

Name of the Books	Author
1. Fundamentals of Ecology	E.P Odum
2. Basic Ecology	E.P Odum
3. Ecology: Principles and applications	J.L Chapman and M.J Reiss
4. Ecology	N.S. Subrahmanyam & A.V.S.S. Sastry
5. Organic farming for business	T. Natarajan
6. Organic farming and biofertilizers	M.K. Gupta
7. Solid waste management in Indian cities	Darshini Mahadevia
8. Handbook of solid waste management	Frank Keith, George T.

## SEMESTER - IV

### PAPER AST 22 – ANIMAL PHYSIOLOGY- II

#### 1. Circulatory Physiology:

- a. Composition and function of blood.
- b. Structure and physiology of human heart, double circulation, physiological types of hearts, cardiac cycle and its regulation.
- c. Transport of O<sub>2</sub> and CO<sub>2</sub> and their regulation in mammals.
- d. Haematopoiesis, blood pressure and blood groups and blood coagulation.

#### 2. Nervous Physiology:

- a. Structure of a typical neuron
- b. Conduction of nerve impulse, resting and action potential.
- c. Synaptic transmission.
- d. Neurotransmitters.

#### 3. Muscular Physiology:

- a. Properties of muscles, ultra structure and chemical composition of a skeletal muscle.
- b. Mechanisms and chemistry of muscle contraction.
- c. Energy supply and heat production during muscle contraction.
- d. Rigor mortis and Cori-cycle.

#### Suggested Reading Materials:

	Name of the Books	Author
01.	Human Physiology	C.C. Chatterjee (Vol. I & II)
02.	Human Physiology	Hymen
03.	A text book of General Physiology	Davson, H.
04.	Principles of Animal Physiology	Wood, D W
05.	Textbook of Physiology & Biochemistry .	Bell,Davidson & Scarborough

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## SEMESTER -IV

### PAPER AST 23 - FISHERIES AND FISH PATHOLOGY

1. **Fish Harvesting Technology:**
  - a. Fishing methods- Basic methods of fish harvesting in inland aquaculture.
  - b. Different types of craft and gears used in Marine Fisheries.
  - c. Mariculture – Culturable species of finfish & shellfish, Procurement of their seed, culture practices of selected species and constraints of mariculture
  - d. Amphibians (*Rana tigrina*) Culture- natural, induced breeding, Hatching, larval development and culture of frog *R. tigrina*
2. **Fisheries:**
  - a. Cold Water Fisheries – Fisheries of Exotic and Indigenous cold water fishes; Mahseer & Trout Fisheries and their importance.
  - b. Marine Capture Fisheries – Fisheries of important marine fishes - Sardine, Indian mackerel, Bombay duck, Pomfret, mullet shell fishes & small groups of fishes; Coastal- Inshore, Offshore and Deep sea fisheries.
  - c. Lagoons (Chilka and Pulicat) –fish diversity and sustainable development.
3. **Bacterial and Fungal Fish Diseases:**

Bacterial Fish Diseases – a. i. Bacterial gill Disease, ii. BHS, iii. Bacterial Kidney Disease, iv. Columnaris, v. Cold water, vi. Fin and Tail rot, vii. Furunculosis, viii. Ulcer disease: Diagnosis, prophylactic and therapeutic measures.

b. Fungal Fish Diseases - i. Saproligniasis, ii. Dermatologicosis their characteristics, transmission, Diagnosis, Prophylactic and Therapeutic measures and

c. Epizootic ulcerative syndrome (EUS).
4. **Viral Fish Diseases and Phage Therapy:**
  - a. Viral Fish Diseases – i. Infectious Pancreatic Necrosis (IPN), ii. Infectious Haematopoietic Necrosis (IHNV), iii. Viral Haemorrhagic Septicaemia (VHS), iv. Spring Viraemia of carps, viral Catfish diseases: Diagnosis, prophylactic and therapeutic measures.
  - b. Phage therapy – Isolation and characterization, Efficacy and accuracy evaluation, Future prospects of phage therapy in aquaculture.

#### Suggested Reading Materials:

Name of the Book	Author
1. Fish and Fisheries	Jhingran, V.G.
2. Aquaculture	Pillai, T. V. R.
3. Microbial Fish Diseases	English
4. Fish Pathology	Roberts, R.J
5. An introduction to Fishes	Khanna, S.S.

**PAPER AST 24 – ANIMAL PARASITOLOGY****1. Protozoology:**

- Epidemiology, morphology, life cycle, pathogenicity and control of
- Entamoeba histolytica*
  - Trypanosoma gambiense*
  - Giardia lamblia*
  - Plasmodium*.

**2. Nemathelminthes:**

- Epidemiology, morphology, life cycle pathogenicity and control of
- Ascaris lumbricoides*.
  - Ancylostoma duodenale*.
  - Wuchereria bancrofti*.
  - Trichinella spiralis*.

**3. Platyhelminthes:**

- Epidemiology, morphology, life cycle pathogenicity and control of
- Diplozoon paradoxum*.
  - Schistosoma mansoni*.
  - Diphyllobothrium latum*.
  - Taenia solium* and *T. saginata*.

**4. Human intestinal parasitic worms:**

- Varieties
- Symptoms and signs
- Prevention
- Elimination.

**Suggested Reading Materials:**

	Name of the Books	Author
1.	General Parasitology	V.A. Dogiel
2.	Introduction to Animal Parasitology	J. D. Smith
3.	General Parasitology	I.C. Cheng
4.	Introduction to Parasitology	Sharma & Ratnu
5.	Understanding Parasitology	Sarkar, Amita
6.	Text Book of Parasitology	Ashok Kumar

## DEPARTMENT OF ANIMAL SCIENCE

Semester wise Course Programme

For M. Sc. Animal Science/Zoology

M. Sc. Animal Science/Zoology is being implemented from 2012 – 2013 session as a four semesters programme. The following modifications have been made in theory and practical papers and the modified course programme shall be implemented from the Academic Session 2015-2016:

### SEMESTER - I

		Marks		
		Sessional	End sem.	Total
Paper AST 01 -	Genetics -I	30	70	100
Paper AST 02 -	Biochemistry -I	30	70	100
Paper AST 03 -	Microbiology	30	70	100
Paper AST 04 -	General Entomology	30	70	100
Paper AST 05 -	Cell Biology	30	70	100
Paper AST 06 -	Developmental Biology -I	30	70	100
Lab Course ASL 01 -	Genetics -I and Biochemistry -I	30	70	100
Lab Course ASL 02 -	Microbiology and General Entomology	30	70	100
Lab Course ASL 03 -	Cell Biology > Development Biology	30	70	100
				<b>Total 900</b>

### SEMESTER - II

		Sessional	End sem.	Total
Paper AST 07 -	Genetics -II	30	70	100
Paper AST 08 -	Biochemistry -II	30	70	100
Paper AST 09 -	Immunology	30	70	100
Paper AST 10 -	Applied Entomology	30	70	100
Paper AST 11 -	Molecular Biology	30	70	100
Paper AST 12 -	Development Biology - II	30	70	100
Lab Course ASL 04 -	Genetics - II	30	70	100
	Biochemistry- II and			
Lab Course ASL 05 -	Immunology	30	70	100
	Appl. Entomol.			
Lab Course ASL 06 -	Molecular Biology &	30	70	100
	Development Biology -II			
				<b>Total 900</b>

### SEMESTER - III

	Marks	Sessional	End sem.	Total
Paper AST 13 - Mammalian Endocrinology - I	30	70	100	
Paper AST 14 - Biotechnology -I	30	70	100	
Paper AST 15 - Environmental Biology	30	70	100	
Paper AST 16 - Animal Physiology - I	30	70	100	
Paper AST 17 - Aquaculture	30	70	100	
Paper AST 18 - General Parasitology & Pathology	30	70	100	
Lab Course ASL 07 - Mammalian Endocrinology - I and Biotechnology -I	130	70	100	
Lab Course ASL 08 - Environmental Biology and Animal Physiology- I	30	70	100	
Lab Course ASL 09 - Aquaculture and General Parasitology and Pathology	30	70	100	
				<b>Total 900</b>

#### SEMESTER - IV

	Marks	Sessional	End sem.	Total
Paper AST 19 - Mammalian Endocrinology - II	30	70	100	
Paper AST 20 - Biotechnology -II	30	70	100	
Paper AST 21 - Applied Ecology & Wild Life	30	70	100	
Paper AST 22 - Animal Physiology - II	30	70	100	
Paper AST 23 - Fisheries & Fish Pathology	30	70	100	
Paper AST 24 - Animal Parasitology	30	70	100	
Lab Course ASL 10 - Mammalian Endocrinology II and Biotechnology	130	70	100	
Lab Course ASL 11 - Applied Ecology & WildLife Animal Physiology- II	30	70	100	
Lab Course ASL 12 - Fisheries & Fish Pathology and Animal Parasitology				<b>Total 900</b>

**Grand Total of 04 semesters = 3600**