SYLLABI FOR Ph.D. ENTRANCE TEST IN ZOOLOGY
(Only compulsory papers of M.Sc. Zoology)

Ph.D. ENTRANCE TEST

Paper I : Objective Type Questions

Max. Marks: 50
Time : One hour

The examiner will set 50 questions (cover the entire syllabus), each having four options : (1), (2), (3) and (4). All questions will be compulsory.

Paper II : Subjective Type Questions

Max. Marks: 100
Time : Two hour

i) Seven questions will be set in all. The candidates will attempt four questions. **Question No. 1** will be compulsory and short answer type. It will have 10 sub-parts covering the entire syllabus. This question carries 40 marks with each sub-part of 4 marks.

ii) The remaining six questions will be set section-wise, three questions from section-A and Section-B each. The candidate will be required to attempt any three questions, selecting at least ONE question from each section. These questions carry equal marks.

iii) As far as possible the questions should be divided into sub-parts.

SECTION – A

I. Molecular Cell Biology

1.0 Biomembranes
- 1.1 Molecular composition and arrangement functional consequences.
- 1.2 Transport across cell membrane-Diffusion, active transport and pumps, uniports, symports and antiports.
- 1.3 Membrance potential
- 1.4 Co-transport by symporters or anti porters
- 1.5 Transport across epthelia

2.0 Cytoskeleton
- 2.1 Microfilaments and microtubulus-structure and dynamics
- 2.2 Microtubulus and mistosis
- 2.3 Cell movements-intracellular transport, role and kinesin and dynein, signal, transduction mechanisms.

3.0 Cillia and Flagella

4.0 Cell-Cell signaling
- 4.1 Cell surface receptors
- 4.2 Second messenger system
- 4.3 MOP kinase pathways
- 4.4 Signaling from plasma membrane to nucleus

5.0 Cell-Cell adhesion and communication
- 5.1 Ca++ dependent homophilic cell-cell adhension
- 5.2 Ca++ independent homophilic cell-cell adhension
- 5.3 Gap junction and connexins

6.0 Cell matrix adhesion
- 6.1 Integrins
- 6.2 Collagen
- 6.3 Non-collagen components
- 6.4 Auxin & Cell expansion
- 6.5 Celluslose fibril synthesis and orientation

7.0 Cell cycle
- 7.1 Cyclines and cycline dependent kinases
- 7.2 Regulation of CDK-cycline activity.

8.0 Genome organization
- 8.1 Hierachy in organization
- 8.2 Chromosomal organization of genes and non-coding DNA
- 8.3 Mobile DNA
- 8.4 Morphological and functional elements of eukaryotic chromosomes

9.0 Intracellar protein traffic.
- 9.1 Protein synthesis on free and bound polysomes
- 9.2 Uptake into ER
- 9.3 Membrane proteins, Golgi sorting, post-translational modifications.
- 9.4 Biogenesis of mitochondria, and nuclei
- 9.5 Trafficking mechanisms.

10.0 Biology of cancer

11.0 Biology of aging

12.0 Apoptosis-definition, mechanism and significance

II. Biochemistry, Tools and Techniques

1.0 Glycolysis, citric acid cycles its regulation and role as metabolic hub.

2.0 Hexose monophosphate pathway its regulation and significance.

3.0 Cholesterol biosynthesis, its metabolism steroid genesis, Bile acids and their metabolism derrayed cholesterol level.

4.0 Saturated and unsaturated fatty acid and their metabolism.

5.0 Primary, Second, tertiary and quaternary structure of proteins (Domain, Reverse turn of Ramachandran plot).

6.0 DNA, RNA, structure and functions, DNA choreography.

7.0 Antisense RNA and DNA technology and their application.

8.0 Ribozymes their structure and functions

9.0 Nanotechnology, its application in life sciences.

10.0 Chemical and Biological assays (*in vitro* and *in vivo* assays)

11.0 Principles and uses of analytical instruments : Spectrophotometers, ultra centrifuge, spectrophotometers, NMR spectrophotometer, Microscopes.

12.0 Microbiological Techniques:
- 12.1 Media preparation and sterilization.
- 12.2 Inoculation and growth monitoring.

13.0 Cell culture techniques:
- 13.1 Design and functioning of tissue culture laboratory.
- 13.2 Cell proliferation measurements.
- 13.3 Cell viability testing.
- 13.4 Culture media preparation and cell harvesting methods.

14.0 Cryotechniques :
- 14.1 Cryopreservation for cells, tissue, organisms.
- 14.2 Cryotechniques for microscopy.

15.0 Separation techniques in biology.
- 15.1 Molecular separations by chromatography, electrophoresis, precipitation etc.
- 15.2 Organelle separation by centrifugation.
- 15.3 Cell separation by flowcytometery, density gradient centrifugation, unit gravity centrifugation, affinity adsorption, anchorage based techniques etc.

16.0 Radioisotope and mass isotope techniques in biology :
- 16.1 Sample preparation for radioactive counting.
- 16.2 Autoradiography.
- 16.3 Metabolic labeling.
- 16.4 Magnetic resonance Imaging

17.0 Immunological techniques based on antigen-antibody reactions.

18.0 Biosensors.

III. Biosystematics and Quantitative Biology

1.1.1.1.1.1.1 Definition and basic concepts of biosystematics and taxonomy.

1.1 Historical resume, Importance and applications of systematics in biology.

2.0 Trends in biosystematics – concepts of different conventional and newer aspects
- 2.1 Chemotaxonomy
- 2.2 Cyotaxonomy
- 2.3 Molecular taxonomy

3.0 Dimensions of speciation and taxonomic characters
- 3.1 Species concepts – species category, different species concepts; sub-species and other intra-specific categories.
- 3.2 Theories of biological classification, hierarchy of categories.
- 3.3 Taxonomic characters – different kinds, Weighing of characters

4.0 Methodology
- 4.1 Taxonomic collections, preservation, curetting process and identification.
- 4.2 Taxonomic keys-different kinds of taxonomic keys, their merits and demerits.
- 4.3 Systematic publications – different kinds of publications.
- 4.4 International code of Zoological Nomenclature (ICZN) – its operative principles and interpretation of the following :
  Stability, Priority, Concept of availability, formation of names, synonymy, homonymy, the type method, kinds of type specimen, type-designation.

5.0 Evaluation of biodiversity indices
- 5.1 Shannon-Weiner index, dominance index
- 5.2 Similarity and dissimilarity index
- 5.3 Association index

6.0 Measures of central value
Arithmetic mean, mode and median Definition, calculation and its properties.

7.0 Measures of Dispersion:
- 7.1 Range, Interquartile range, Quartile deviation.
- 7.2 Mean deviation and standard deviation.

8.0 Correlation:
Methods studying correlation – Scatter diagram method, Graphic method, Karl Pearson coefficient of correlation, Rank correlation.

9.0 Regression analysis (Regression lines and regression equation.)

10.0 Concept of sampling and sampling methods:

Definition and law of sampling, judgment sampling, Random sampling, stratified sampling, systematic sampling, multi-stages sampling and quota sampling.

11.0 Test of significance for large samples and small samples.

12.0 Chi-square analysis

13.0 Analysis of variance

14.0 Probability and law of probability, Theoretical probability distribution: Binomial distribution, Poison distribution, Normal distribution.

15.0 Computer in Biometrics
- 15.1 Components of computers
- 15.2 Use of Microsoft (Word, Excel, Power Point)
- 15.3 Use of Microsoft Excel for statistical calculation and graphical representation of data.
- 15.4 Surfing through Internet.

IV. Structure and Functions of Invertebrates

1.0 Classification of Invertebrates up to order level

2.0 Organization of coelom
- 2.1 Pseudocoelomates
- 2.2 Coelomates: Protostomia and Deuterostomia

3.0 Metamerism in Anelida

4.0 Locomotion
- 4.1 Flagella and ciliary movement in Protozoa
- 4.2 Hydrostatic movement in Coelenterata, Annelida and Echniodermata

5.0 Nutrition and Digestion
- 5.1 Patterns of feeding and digestion in lower metazoa
- 5.2 Filter-feeding in Polychaeta, Mollusca and Echinodermata

6.0 Respiration
- 6.1 Organs of respiration : Gills, lungs and trachea
- 6.2 Respiratory pigments
- 6.3 Mechanism of respiration

7.0 Minor Phyla
- 7.1 Concept and significance
- 7.2 Organization and general characters

8.0 Excretion
- 8.1 Organs of excretion: Coelom, coelomoducts, Nephridia and Malphigian tubules.
- 8.2 Mechanism of excretion
- 8.3 Excretion and osmoregulation

9.0 Nervous system
- 9.1 Primitive nervous system: Coelenterata and Echinodermata
- 9.2 Advanced nervous system:Annelida, Arthropoda (Crustacea and Insecta) and Mollusca (Cephalopoda).

9.3 Trends in neural evolution.

10.0 Mouthparts of Insects

11.0 Metamorphosis in insects

12.0 Social life in insects

13.0 Integrated pest management

14.0 Invertebrate larve
- 14.1 Larval forms of free living invertebrates
- 14.2 Larval forms of parasites
- 14.3 Strategies and Evolutionary significance of larval forms

V. Population and Community Ecology

1.0 Basic Concepts : Definition, Scope and Significance of Ecology, Concept of biosphere, atmosphere, litho sphere and hydrosphere.

2.0 Ecological aspects of abiotic, biotic and edaphic factors.

3.0 Ecosystem : Concept, Kinds and components.

4.0 Ecological energetic and energy flow : Food chains, food webs, trophic structure; concept of productivity primary, secondary, gross and net.

5.0 Life history strategies.
- 5.1 Energy apportionment between somatic growth and reproduction
- 5.2 Parental investment and offspring.
- 5.3 Reproductive strategies – ecology and evolution of sex and mating systems, optimal body size ‘ r’ and ‘k’ selection.

6.0 Population characteristics
- 6.1 Population density, methods of population density measurement
- 6.2 Growth rate and growth forms
- 6.3 Natality, mortality, survivorship curves and life tables
- 6.4 Biotic potential – Generation time, net reproductive rate reproductive values
- 6.5 Population and distribution.
- 6.6 Population dispersion

7.0 Population regulation
- 7.1 Extrinsic and intrinsic mechanisms
- 7.2 Concept of density dependent and density independent factors in population regulation.

8.0 Population Interactions
- 8.1 Concept of intra specific and inter specific population interactions
- 8.2 Protocooperation, mutalism and commensalisms

9.0 Competition and niche theory.
- 9.1 Intraspecific and inter specific interactions
- 9.2 History of niche concepts
- 9.3 Theory of limiting similarly

10.0 Predation
- 10.1 Model of prey – predatory dynamics
- 10.2 Role of predation in nature
- 10.3 Parasitism

11.0 Community characteristics
- 11.1 Species diversity
- 11.2 Ecological Succession
- 11.3 Ecological dominance
- 11.4 Ecotones and Edge effect

VI. Comparative Physiology

1.0 Feeding mechanisms and regulation.
- 1.1 Comparative physiology of digestion

2.0 Respiration organs and respiratory pigments through different phylogenie groups

3.0 Patterns of nitrogen excretion among different animal groups

4.0 Osmoregulation in different animal groups

5.0 Thermoregulation
- 5.1 Homeothermic animals
- 5.2 Poikilotherms
- 5.3 Hibernation

6.0 Circulation of body fluids and their regulation

7.0 Receptor physiology – a comparative study
- 7.1 Mechanoreception
- 7.2 Photoreception
- 7.3 Chemoreception
- 7.4 Equilibrium reception

8.0 Contractile elements, cells and tissues among different phylogenie groups
- 8.1 Muscle structure and function-correlation
- 8.2 Specialised organs (eg: electric organs and tissues)

9.0 Heterogamy in eukaryotes

10.0 Biology of sex determination and sex differentiation a comparative account

11.0 Comparative account of differentiation of gonads in vertebrates

12.0 Comparative testicular physiology in animals
- 12.1 Morphology
- 12.2 Differentiation
- 12.3 Function and its regulation

13.0 Comparative ovarian physiology and differentiation in vertebrates
- 13.1 Morphology
- 13.2 Endocrinolgy
- 13.3 Oogensis vitellogensis

14.0 Fertilization
- 14.1 Pre-fertilization events
- 14.2 Biochemistry of fertilization
- 14.3 Post fertilization events

15.0 Multiple ovulation and embryo transfer technology (MOFT)
- 15.1 *In vitro* oocyte maturation
- 15.2 Superovulation
- 15.3 *In vitro* fertilization

16.0 Collection and cryopreservation of gametes and embryos

17.0 Assisted reproduction technologies
- 17.1 Embryo sexing and cloning
- 17.2 Screening for genetic disorders
- 17.3 ICSI, GIFT etc.
- 17.4 Cloning of animals by nuclear transfer

VII. Population Genetics and Evolution

1.0 Concepts of evolution and theories of organic evolution with an emphasis on Darwinism.

2.0 Neo Darwinism
- 2.1 Hardy-Weinberg law of genetic equilibrium
- 2.2 A detailed account of destabilizing forces:
  - (i) Natural selection
  - (ii) Mutation
  - (iii) Genetic drift
  - (iv) Migration
  - (v) Meiotic drive

3.0 Quantifying genetic variability
- 3.1 Genetic structure of natural populations
- 3.2 Phenotypic variation
- 3.3 Models explaining changes in genetic structure of populations
- 3.4 Factors affecting human disease frequency

4.0 Molecular population genetics
- 4.1 Patterns of change in nucleotide and amino acid sequences
- 4.2 Ecological significance of molecular variations
- 4.3 Emergence of Non-Darwinism-Neutral Hypothesis

5.0 Genetics of quantitative traits in populations
- 5.1 Analysis of quantitative traits
- 5.2 Estimation or heritability
- 5.3 Genotype-environment interactions
- 5.4 Inbreeding depression and heterosis
- 5.5 Molecular analysis of quantitative traits
- 5.6 Phenotypic plasticity

6.0 Genetics of speciation
- 6.1 Phylogenetic and biological concept of species
- 6.2 Patterns and mechanisms of repropuctive isolation
- 6.3 Models of speciation (Allopatric, sympatric, parapatric)

7.0 Molecular Evolution
- 7.1 Gene Evolution
- 7.2 Evolution of gene families, Molecular drive
- 7.3 Assessment of molecular variation

8.0 Origin of higher categories
- 8.1 Phylogenetic gradualism and punctuated equilibrium
- 8.2 Major trends in 'the origin of higher categories
- 8.3 Micro-and Macro-evolution

9.0 Molecular phylogenetics
- 9.1 How to construct phylogenetic trees?

10.0 Population genetics and ecology
- 10.1 Metapopulations
- 10.2 Monitoring Natural Population
- 10.3 Why small populations become extinct?
- 10.4 Loss of genetic variations
- 10.5 Conservation of genetic resources in diverse texa

SECTION-B

VIII. Structure and Function of Vertebrates

1.0 Origin of Chordata
- 1.1 Concept of Protochordata
- 1.2 Origin and classification of vertebrates

2.0 Vertebrate integument and its derivatives
- 2.1 Development, general structure and functions of skin and its derivatives
- 2.2 Glands, scales, horns, claws, nails, hoofs, feathers and hairs

3.0 Skeletal system
- 3.1 Form, function, body size and skeletal elements of the body
- 3.2 Comparative account of jaw suspensorium, Vertebral column

3.3 Limbs and girdles

4.0 Digestive system: Dentition, Stomach, Digestive Glands

5.0 Respiratory system
- 5.1 Characters of respiratory tissue
- 5.2 Internal and External Respiration
- 5.3 Comparative account of respiratory organs

6.0 General plan of circulation in various groups
- 6.1 Blood
- 6.2 Evolution of heart
- 6.3 Evolution of aortic arches, and Portal systems

7.0 Evolution of Urinogenital system in vertebrate series

8.0 Nervous system
- 8.1 Comparative anatomy of the brain in relation to its functions
- 8.2 Comparative anatomy of spinal cord
- 8.3 Nerves-Cranial, Peripheral and Autonomous nervous systems

9.0 Sense organs
- 9.1 Simple receptors
- 9.2 Organs of Olfaction and taste
- 9.3 Lateral line system
- 9.4 Electroreception

10.0 Adaptations: Levels of morphological adaptation and significance of body size

IX. Molecular Biology

1.0 History and Scope of Molecular Biology

2.0 DNA replication
- 2.1 Prokaryotic and eukaryotic DNA replication
- 2.2 Mechanics of DNA replication
- 2.3 Enzymes and accessory proteins involved in DNA replication

3.0 Transcription
- 3.1 Prokaryotic transcription
- 3.2 Eukaryotic transcription
- 3.3 RNA polymerases
- 3.4 General and specific transcription factors
- 3.5 Regulatory elements and mechanisms of transcription regulation
- 3.6 Transcriptional and post-transcriptional gene silencing.

4.0 Post-transcriptional Modifications in RNA
- 4.1 5'-Cap formation
- 4.2 Transcription termination
- 4.3 3'-end processing and polyadenylation
- 4.4 Splicing, Editing
- 4.5 Nuclear export of mRNA

4.6 mRNA stability

5.0 Translation
- 5.1 Genetic code
- 5.2 Prokaryotic and eukaryotic translation
- 5.3 The translational machinery
- 5.4 Mechanisms of initiation, elongation and termination
- 5.5 Regulation of translation
- 5.6 Co- and post-translational modifications of proteins

6.0 Antisense and Ribozyme technology
- 6.1 Molecular mechanisms of antisense molecules
- 6.2 Inhibition of splicing, polyadenylation and translation
- 6.3 Disruption of RNA structure and capping
- 6.4 Biochemistry of ribozyme; hammerhead, hairpin and other ribozymes
- 6.5 Strategies for designing ribozymes
- 6.6 Application of antisense and ribozyme technologies

7.0 Recombination and repair
- 7.1 Holiday junction, gene targeting, gene disruption
- 7.2 Cre/lox recombination
- 7.3 RecA and other recombinases
- 7.4 DNA repair mechanisms

8.0 Molecular mapping of genome
- 8.1 Genetic and physical maps
- 8.2 Physical mapping and map-based cloning
- 8.3 Southern and fluorescence *in* situ hybridization for genome analysis
- 8.4 Chromosome micro-dissection and micro-cloning
- 8.5 Molecular markers in genome analysis RFLP, RAPD and AFLP analysis.
- 8.6 Molecular markers linked to disease resistance genes
- 8.7 Application of RFLP in forensic, disease prognosis, genetic counseling, pedigree, etc. analysis, Animal trafficking and poaching; germplasm maintenance and taxonomy.

X. Molecular Endocrinology

1.0 Basic concept of endocrinology, its scope and role in molecular biology.

2.0 Chemical nature of hormones;
- 2.1 Amino-acid derived hormones
- 2.2 Peptide hormones
- 2.3 Glyco-protein hormones,
- 2.4 Steroid hormones and
- 2.5 Prostaglandin

3.0 Biosynthesis of peptide hormones, transcriptional and post-transcriptional modifications

4.0 Network of extra-cellular and intracellular signals. Role of cell structure in intracellular communication.

5.0 Prostaglandin structure, type, synthesis and biological activities.

6.0 Mechanism of action of peptide hormones; concept of second messengers, cAMP, cGMP, Ca^{++}, calmoduline, IP_3, DAG, NO, signal transduction mechanism, G-proteins.

7.0 Mechanism of action of steroid hormones; Nuclear receptors, orphan genes and receptors and their role in metabolism and development. Cross talk concept, phosphorylation, Heat shock proteins.

8.0 Hormonal regulation of:
- 8.1 Carbohydrate metabolism
- 8.2 Lipid metabolism
- 8.3 Protein metabolism
- 8.4 Nucleic acid metabolism

9.0 Genetic basis of hormonal disorders.

10.0 Sequence-specific DNA binding proteins, DNA binding receptor proteins and their role in gene transcription, cell differentiation and cell proliferation.

1.0 Nutrient-induced insulin secretion, pH and DNA synthesis.

12.0 Interaction between pathways i.e. cAMP, Ca^{++} pathway, parallel pathway.

13.0 Genomic and non-genomic action of hormones (peptides and steroid).

XI. Parasitology

1.0 Parasites, Types of parasites: Ecto and endoparasites, facultative, obligatory semiparasites and permanent parasite and hyper parasitism.

2 Hosts; host types, regular, irregular hosts, Intermediate hosts; Carriers; Vectors, series Hosts main; subsidiaries; Primary Secondary, Reservoir hosts.

3.0 Parasitic Adaptations; Structural adaptation Trivial to extreme morphological adaptations.

4.0 Physiological adaptations in Protozoa, Helminths, Nematodes, Arthropods.

5.0 Protozoon diseases in Humans.

6.0 Host Cell Reaction, Blood Cells, Host, Tissues reaction, some physiological and biochemical responses, hormones stress and parasitism.

7.0 Distribution and Zoogeography; Microdistribution site selection, Host migration, Distribution of arthropods by Commercial Vehicles; parasites as clues to host affinities and evaluation.

8.0 Host parasite specificity; Isolation of Parasite populations, Kinds of specificity, infection and Growth Vectors, flies mosquitoes, fleas, Ticks, mites lice, etc.

9.0 Evolution of Parasitism : Fahrenholz Rule; Szidat Rule, Eichler rule; Parasite-Host co-evolution Adaptation of pre adaptations; Physiological races. Origin of parasitism; Progressive and retrogressive evolution; Origin of groups, Protozoa, Trematodes, Cestodes, Nematodes, and Arthropods

10.0 Zoonosis.
- 10.1 Viral : Rabies, Japanese encephalitis.
- 10.2 Bacterial : Brucellosis, Plague
- 10.3 Richeltsial : Ricketisial Zoonosis, Q fever, Scrub typhus
- 10.4 Parasitic : Hydatid disease

1.0 Helminth, Nematode and Artlisopod diseases in man.

XII. Developmental Biology

1.0 Introduction to animal development
- 1.1 Problems of developmental biology
- 1.2 Developmental patterns in metazoans
- 1.3 Development in unicellular eukaryotes

2.0 Creating multicellularity
- 2.1 Cleavage types
- 2.2 Comparative account of gastrulation

3.0 Early vertebrate development
- 3.1 Neurulation and ectoderm
- 3.2 Mesoderm and endoderm

4.0 Cytoplasmic determinants and autonomous cell specification
- 4.1 Cell commitment and differentiation
- 4.2 Cell specification in nematodes
- 4.3 Germ cell determinants
- 4.4 Germ cell migration
- 4.5 Progressive cell - Cell interaction and cell specification fate

5.0 Body Axes
- 5.1 Establishment of Body axes in mammals and birds
- 5.2 Proximate tissue interactions
- 5.3 Genetics of axis specification in *Drosophila*

6.0 Homeobox concept in different phylogenetic groups

7.0 Tetrapod limb development

8.0 Hormones as mediators of development
- 8.1 Amphibian metamorphosis
- 8.2 Insect metamorphosis
- 8.3 Ovarian luteinization and mammary gland differentiation.

9.0 Environmental evolution and animal development
- 9.1 Environmental cues and effects
- 9.2 Malformations and disruptions
- 9.3 Changing evolution through development modularity
- 9.4 Developmental constraints
- 9.5 Creating new cell types - basic evolutionary mystery

10.0 Biology of sex determination
- 10.1 Chromosomal sex determination - mammals and drosophila
- 10.2 Testis determining genes
- 10.3 Ovarian development
- 10.4 Secondary sex 'determination in mammals
- 10.5 Environmental sex determination.

11.0 Cell diversification in early animal embryo
- 11.1 Xenopus blastomeres
- 11.2 Morphogen gradients
- 11.3 Totipotency & Pleuripotency
- 11.4 Embryonic stem cells
- 11.5 Renewal by stem cells - epidermis
- 11.6 Skeletal muscle regeneration
- 11.7 Connective tissue cell family

12.0 Hemopoietic stem cells
- 12.1 Stem cell disorders
- 12.2 Blood cells formation
- 12.3 Bone marrow transplants
- 12.4 Gene therapy

XIII. Vertebrate Immunology

1.0 Innate and Acquired Immunity

2.0 Phylogeny and Ontogeny of immune system
- 2.1 Organization and structure of lymphoid organs
- 2.2 Cells of the immune system and their differentiation
- 2.3 Lymphocyte traffic

3.0 Nature of immune response

4.0 Nature of antigens and superantigens
- 4.1 Antigenicity and immunogenicity
- 4.2 Factors influencing immunogenicity
- 4.3 Epitopes and haptens

5.0 Structure and Functions of Antibodies
- 5.1 Classes and subclasses
- 5.2 Gross and Fine structure
- 5.3 Antibody mediated effector functions

6.0 Antigen-Ab interactions *in vitro* and *in vivo.*

7.0 Complement System

8.0 Major Histocompatibility Complex in mouse and HLA system in human
- 8.1 MHC haplotypes
- 8.2 Class I and class II molecules
- 8.3 Cellular distribution
- 8.4 Peptide binding
- 8.5 Expression and diversity
- 8.6 Disease susceptibility and MHC/HLA

9.0 Organization and expression of Ig genes
- 9.1 Models for Ig gene structure
- 9.2 Multigene brganization of Ig genes
- 9.3 DNA rearrangements and mechanisms
- 9.4 Generation of antibody diversity
- 9.5 Differential expression of Ig genes.

10.0 T-cell receptors
- 10.1 Isolation, molecular components and structure
- 10.2 T-cell maturation and thymus
- 10.3 T H-cell activation mechanism 10.4 T-cell differentiation
- 10.5 Cell death and T-cell population

11.0 B-cell generation, activation and differentiation
- 11.1 B-cell receptors
- 11.2 Selection of immature self-reactive B-cells
- 11.3 B-cell activation and proliferation
- 11.4 T H-B-Cell interactions
- 11.5 Humoral immune response-kinetics

12.0 Cytokines
- 12.1 Structures and functions
- 12.2 Cytokine receptors
- 12.3 Cytokines and Immune response

13.0 Cell-mediated effector functions
- 13.1 Cell adhesion molecules
- 13.2 Effector cells and molecules
- 13.3 CTL and NK cells-mechanisms of action
- 13.4 Delayed type hypersensitivity

14.0 Immunological tolerance and Anti-immunity

15.0 Hypersensitivity and immune responses to infection agents especially intracellular parasites.

XIV. Environmental Toxicology

1.0 Environmental Policy: Economic environmental policy, social environmental policy, legal environmental policy at global and national level.

2.0 Environment Impact Assessment: Definition, Introduction, Different phases, significance.

3.0 Environmental pollution: Definition, types of pollution; air, water land, noise, plastic and marine; Principal pollutants; Significance, consequences and possible management strategies. Green House effect: Definition, global warming, consequences and significance. Ozone layer: Ozone as a friends and a foe; phenomenon, reasons and possible effects on plants, animal and man; Measures to check deflection of ozone layer.

4.0 Food production trends on national and global basis and its ecological and social consequences.

5.0 Concepts of sustainable development: Utility and significance.

6.0 Introduction to Toxicology: Definition, classification of toxicants.

7.0 Xenebiotics: Definition, types and significance.

8.0 Toxic agents & mode of action: Pesticides, metals, solvents Radiation, carcinogens, poisons. Bio-toxins, petrochemicals.

9.0 Solid waste management: Primary waste products-Solid waste, toxic biological and hospital landfills, incineration, source reduction and recycling.

10.0 Environmental Toxicology: Food additives, air, water and soil pollutants.

11.0 Principles and significance of systematic toxicology: Definition, introduction and discussion of Genotoxicology, applications of toxicology anthropogenic activities and environment, Human toxicology and medicinal ethics.