SEMESTER – III

Core Course (CC- 10): Vertebrate Immunology Full Marks – 70

Time : 3 hrs

Questions to be set in three parts representing all the five units. Part A will consist of 10 objective questions of 2 marks each. Part B will consist of five short questions(Four to be answered) of 5 marks each. Part C will consist of five questions (three to be answered) of 10 marks each.

Unit I: Innate and Acquired Immunology

1. Cell types of innate and adaptive immunity, Lymphocyte trafficking
2. Phagocytosis and inflammation
3. Humoral immunity: β cell activation and differentiation, primary and secondary humoral response
4. Cell mediated immunity: T - cell development and T-cell activation, CTL and NK cell mediated immunity

Unit 2: (A) Nature of Antigens

1. Antigenicity and immunogenicity, and the factors influencing it.
2. Characteristics of β and T cell epitopes and haptens
3. Super antigen and its role in T cell activation
4. Antigen processing and presentation
5. MHC complex

(B) Structure and functions of Antibodies

(a) Gross and fine structure

(b) Classes and sub-classes

(c) Antibody mediated effector functions and monoclonal antibodies

Unit 3: (A) Antigen- antibody interaction and Complement system

1. Antibody affinity and antibody avidity
2. Precipitation reactions
3. Agglutination reactions
4. Complement System - activation pathway, biological function and complement deficiencies
5. ELISA

(B) Cytokines : Classification and function, Cytokines receptors.

Unit 4: Organization and expression of Ig genes

1. Organization of Ig genes
2. Generation of antibody diversity
3. BCR and Generation of T-cell receptor diversity

Unit 5: Immunology and Diseases

1. Hypersensitivity (Type I, II, II, IV).
2. Auto-immunity
3. Immune responses to infectious agents - bacterial, viral and parasitic infection (Protozoa and Helminth parasites).
4. Immunodeficiencies

SEMESTER – III

Core Course (CC- IV): Gamete and Developmental Biology Full Marks – 40

Time : 3 hrs

Questions to be set in three parts representing all the five units. Part A will consist of 10 objective questions of 2 marks each. Part B will consist of five short questions(Four to be answered) of 5 marks each. Part C will consist of five long questions (three to be answered) of 10 marks each.

Unit-I: Gamete Biology

1.1 Cellular basis of spermatogenesis and Biochemistry of semen
1.2 Ovarian follicular growth and differentiation
1.3 Oogenesis and vitellogenesis
1.4 Ovulation and ovum transport
1.5 Molecular events during fertilization

Unit II: (A) Multiple ovulation and Embryo transfer technology in human being

2.1 *In vitro* oocyte maturation
2.2 Super ovulation
2.3 *In vitro*-fertilization

(B) Assisted Reproduction technologies

2.4 Collection and preservation of gametes
2.5 ICST, GIFT & Immuno - contraception

Unit III: Basic concept of development

3.1 Potency, commitment, specification, induction, competence, determination and differentiation
3.2 Morphogenetic gradients, cell fate and cell lineages, genomic equivalence and cytoplasmic determinants

Unit IV: Differentiation, morphogenesis and organogenesis

4.1 Cell differentiation: Role of cytoplasm and nucleus
4.2 Gene amplification and rearrangement during development
4.3 Axes and pattern formation in *Drosophila*.
4.4 Limb development and regeneration in vertebrates

Unit V: Stem cell Biology

5.1 Definition and characteristics of stem cell
5.2 Type of stem cell (embryonic, adult and cancer stem cell)
5.3 Nuclear reprogramming of induced pluripotent stem cell, test for pluripotency
5.4 Potential application of stem cells, therapeutic cloning

SEMESTER – III

Core Course (CC- 12): Vertebrate Endocrinology Full Marks – 70
Time : 3 hrs

Questions to be set in three parts representing all the five units. Part A will consist of 10 objective questions of 2 marks each. Part B will consist of five short questions(Four to be answered) of 5 marks each. Part C will consist of five questions (three to be answered) of 10 marks each.
Time: 3 hrs.

Unit- I

1.1 Aims and scope of endocrinology
1.2 Hormones as messengers
1.3 Chemical nature and gross features of hormones
1.4 Neuro-endocrine system and neurosecretion
1.5 Hypothalemic control of endocrine system

Unit- II

2.1 Hormones involved in reproduction
(a) Seasonal breeders
(b) Continuous breeders
2.2 Hormonal regulation of reproductive cycle
(a) Ovarian cycle
(b) Menstrual cycle
(c) Oestrus cycle

Unit-III

3.1 Biosynthesis of steroid hormones
3.2 Biosyntheses of amino acid derived hormones (T4, Epinephrine)
3.3 Biosynthesis of simple peptide hormones. Pre and Prohormones.

Unit- IV Hormone Receptors:

4.1 β-adrenergic receptor
4.2 Insulin receptor
4.3 Steroid hormone receptor

Unit-V: General principles of hormone actions (signal transduction)

5.1 Second messenger concept [G proteins, Nucleotides (cAMP, cGMP), Calcium, Calmodulin, Phospholipids]
5.2 Lipid soluble hormones and intracellular receptor
5.3 Lipid insoluble hormone and intracellular signalling

SEMESTER – III

Core Course (CC- 13): Animal Behaviour Full Marks – 70

Time : 3 hrs

Questions to be set in three parts representing all the five units. Part A will consist of 10 objective questions of 2 marks each. Part B will consist of five short questions(Four to be answered) of 5 marks each. Part C will consist of five questions (three to be answered) of 10 marks each.

Time: 3 hrs.

Unit-I: **Basics of Animal Behavior**

1.1Ethology- Definition, Branches, Significance

1.2Approaches and methods in the study of Behavior

1.3Patterns of Behavior-

(a) Innate behavior- Kinases/ Taxes, Simple reflex, Comparison of reflex and complex behaviors, Instinct and, Motivation

(b) Learned behavior- Habituation, Imprinting, Conditioned reflex, Trial & error learning, Reasoning and Cognition

Unit II: Social Behavior

2.1Social behavior of insects (Honey bees, Ants and termites)

2.2 Schooling in fish, Flocking in birds,

2.3 Social organization of Primates

2.4 Parental care in fishes

2.5 Altruism: Reciprocal altruism, Inclusive fitness, group selection, and Kin – selection

Unit. III: **Reproductive Behavior**

3.1 Evolution of sex and reproductive strategies

3.2 Mating system

3.3 Courtship & Parental Behaviors: Parental care and parental Investment

Unit IV. Biological Rhythms

4.1 Circadian, Circannual, Lunar, Tidal and Epicycles

4.2 Navigation including orientation

4.3 Migration of fishes and Birds

Unit V: **Control of Behavior**

5.1Neural control of behaviour

5.2Hormones and Behavior

5.3 Ecological aspects of behavior: Habitat selection, Optimal foraging theory, and Aggressive behavior

SEMESTER - III

Core Course(CC- 14) Practical

Time : 6 hrs

Full marks – 70 CIA-30

1.	Any one of the immunological experiments (a) Determination of blood group using ABD antisera (b) Preparation of blood film and identification of blood cells of immunological importance (c) Hormonal assessment of T3/Testesterone/oestrogen by ELISA reader	10	05
2.	Identify and comment upon the given spots (a) Endocrinological slides-03 (b) Embryological slides -02	10	05
3.	Prepare a permanent mount of chick embryo or Identify and comment upon the exposed endocrine glands in a mammal	10	05
4.	Comment upon the behavioural aspects of specimens provided (any two) (a) Parental care (Hippocampus, Cichlids, Alytes, Hyla, Ichthyophis) (b) Caste system (Honey bee/termites/ants) and its significance (c) Dance as means of communication in honey bees	10	05
5.	Identification and comment upon the given embryonic stages (any two)	10	05
6.	Class record	10	05
7.	Viva voce	10	