1. Dissection		9
2. Preparation of permanent mounting		4
3. Identification		4
4. Morphotaxonomy		5
5. Practical record book		5
6. Viva voce		5
	Total	32

SEMESTER-II

ZooMT- 201: Biochemistry

Marks: 12 (IA) + 48 (End Sem) = 60
42 lecture hours

Unit- 1: Laws of thermodynamics and their application in biochemistry; free energy change in biochemical systems; ATP and other high-energy phosphates as energy carrier; concept of redox systems Basic principles of biological chemistry; water, acid, base, p^H and buffers.

Unit- 2: Structure and classification of carbohydrates, proteins, amino acids and lipids; levels of organization of proteins.

Unit -3: General concept of metabolism- Glycolysis; Krebs cycle; electron transport system (ETS) and ATP synthesis; β-oxidation of fatty acids

Unit- 4: Enzymes- nomenclature, IUB classification, kinetics and mechanism of action; enzyme inhibition; Vitamins (source and functions) and co-enzymes.

Unit -5: Structure and forms of DNA and RNA; DNA as genetic material, DNA replication, genetic code, Transcription

ZooMP- 202: Practical based on ZooMT- 201

Marks: 8 (IA) + 32 (End Sem) = 40
20 lecture hours

1. Preparation of molar, normal and buffer solution.
2. Qualitative test for carbohydrate to identify the common monosaccharides and disaccharides.
3. Essay of enzyme urease/ peroxidase by titrimatric method.
4. Estimation of ascorbic acid in lemon/milk
5. Separation of amino acid using paper chromatography.

SCHEME OF THE PRACTICAL EXAMINATION

Time: 4 hrs.

1. Biochemical test/ solution preparation	8
2. Biochemical estimation/ essay of enzyme	14
3. Practical record book	5

SEMESTER-II

ZooGT- 201: Cell Biology and Biochemistry

Marks: 12 (IA) + 48 (End Sem) = 60
42 lecture hours

Unit- 1: General structure and function of prokaryotic and eukaryotic cells; structure and function of plasma membrane, Golgi bodies, endoplasmic reticulum; membrane transport –osmosis, diffusion and active transport.

Unit- 2: Structure and function of mitochondria, nucleus and chromosomes.

Unit-3: Cell cycle and cell division (amitosis, mitosis & meiosis); basic concept of cancer.

Unit- 4: Basic principles of biochemistry, acid, base, pH and buffer; types of carbohydrates, proteins, fats; structure and function of enzymes; vitamins their sources and functions.

Unit-5: Biological oxidation, glycolysis and Krebs cycle; electron transport system, synthesis of ATP.

ZooGP- 202: Practical based on ZooGT- 201

Marks: 8 (IA) + 32 (End Sem) = 40
20 lecture hours

1. Study of mitosis and meiosis with the help of permanent slides.
2. Preparation of slide for the study of mitosis and meiosis with suitable materials.
3. Preparation of normal and molar solution.
4. Qualitative test of carbohydrate, protein and fat.
5. Qualitative test of salivary amylase.

SCHEME OF THE PRACTICAL EXAMINATION
Time: 4 hrs.

1. Cytological preparation/ experiment	8
2. Biochemical Experiment-I	8
3. Spotting	5
4. Practical record book	5
5. Viva voce	5
Total	**= 32**

SEMESTER-III

ZooGT- 301: Chordate diversity and Developmental Biology

Marks: 12 (IA) + 48 (End Sem) = 60
42 lecture hours

Unit- 1: General characters of chordates; Protochordates: classification up to orders, structural organization of hemichordates, urochordates; Fishes: classification up to orders, respiratory organs and migration.

Unit- 2: Amphibia: Classification up to orders, parental care; Reptilia: classification up to orders, extinct reptiles, poisonous snakes of India; Biting mechanism.

Unit- 3: Aves: classification up to super-orders, beaks and claws, perching and flight mechanism, bird migration; Mammalia: classification up to orders; dentition in mammals.

4. Viva voce 5

Total 32

SEMESTER-III

ZooMT- 301: Chordate diversity and Comparative anatomy

Marks: 12 (IA) + 48 (End Sem) = 60
42 lecture hours

Unit –1: General characters of Chordata and classification upto class; Classification of protochordata up to orders; general characters of hemichordata, urochordata and cephalochordata; larval forms and their significance in chordate phylogeny; affinities of protochordates.

Unit –2: Distinctive characters of Petromyzontia, Chondrichthyes & Dipnoi; Classification of Osteichthyes upto orders with examples; Ammocoete larva and its importance in evolution; structures of gills, accessory/respiratory organs and swim bladders of fish; sense organs, locomotion, migration and parental care in fish.

Unit –3: Distinctive characters and classification of Amphibia upto orders with examples; parental care, metamorphosis and neoteny in amphibia; distinctive characters and classification of Reptilia upto orders with examples; anatomical peculiarities and affinities of *Sphenodon*; poisonous snakes of India; biting mechanisms of poisonous snakes.

Unit –4: General characters and classification of Aves upto super orders with examples; mechanisms of bird flight; perching mechanism; flight adaptation in bird; migration in birds; General characters and classification of Mammalia upto orders with examples; affinities of monotremata and marsupilia; dentition in mammals; echo-location in bats; adaptation of aquatic mammals.

Unit –5: Comparative anatomy of integument- fish, reptile and mammals, pectoral and pelvic girdles of tetrapoda; brain and cranial nerves in amphibia and mammals; Comparative account of alimentary, circulatory and reproductive system in reptiles, birds and mammals.

ZooMP- 302: Practical based on ZooMT- 301

Marks: 8 (IA) + 32 (End Sem) = 40
20 lecture hours

1. Dissection of the following vertebrate system.
   Scoliodon: Efferent branchial vessels, internal ear, 9th and 10th cranial nerves; Weberian ossicles of carp/ catfish.
2. Identification of vertebrate specimens/models with reasons:
   Pyrosoma, Salpa, Doliolum, Oikopleura, Myxine, Sting ray, Hammer headed shark, *Pristis*, Electric ray, Tiger shark, Pipe fish, *Protopterus, Hemiramphus*, Ribbon fish, Sucker fish, *Mugil*, Eel, *Belepthalamus, Ichthyophis, Colisa, Scatophagus, Amphipneus, Glossogobius, Mystus, Harpodon, Tetraodon, Cryptobranchus, Axolotl* larva, *Ambystoma, Necturus, Amphiuma, Typhlops*, Krait, Viper, Pit viper, *Hydrophis, Natrix*, Sea Snake, *Trionix, Chelone*, Leathery Turtle, *Myna*, parrot, crow, monotremes and marsupials, chiroptera, primates.
3. Preparation of permanent slides & mounting of minimum five suitable slides of vertebrate's exoskeleton (scale, feather etc.)

4. Study of vertebral column of mammals; pectoral and pelvic girdle of reptiles, bird and amphibia.
5. Demonstration of digestive, circulatory, respiratory and urinogenital system of reptiles, bird and mammals through electronic media

SCHEME OF THE PRACTICAL EXAMINATION

Time: 4 hrs.

1. Dissection	10
2. Identification of museum specimens and bones	8
3. Preparation of slides	4
4. Practical record book	5
5. Viva voce	5
Total	32

ZooMT- 303: Bioinstrumentation and Biostatistics

Marks: 12 (IA) + 48 (End Sem) = 60
42 lecture hours

Unit-1: Chromatography- details of paper, ion exchange and thin layer chromatography.
Unit-2: Microscopy- basic principle and applications of light, phase contrast and electron microscope.
Unit-3: Photometry- principle and uses of colorimeter and spectrophotometer.
Unit-4: Principles and uses of kymography, microtomy and ultramicrotomy; principles and practices of centrifugation; autoradiography.
Unit-5: Scope and utility of statistics in Bioscience; Sampling, collection and graphical representation of data; Measures of statistical average; mean deviation and standard deviation; Probability tests; Correlation and regression; Significance tests (t, F and X^2 tests)

ZooMP- 304: Practical based on ZooMT- 303

Marks: 8 (IA) + 32 (End Sem) = 40
20 lecture hours

1. Separation of chlorophylls by paper chromatography
2. Demonstration of instruments as prescribed in syllabus
3. Statistical calculation of central tendency, deviations, correlation, regression & t test

SCHEME OF THE PRACTICAL EXAMINATION

Time: 4 hrs.

1. Statistical calculation & graphical representation/ correlation	10
2. Separation technique	8
3. Spotting (instruments)	4
4. Practical record book	5

ZooGP- 402: Practical based on ZooGT- 401

Marks: 8 (IA) + 32 (End Sem) = 40
20 lecture hours

1. Preparation of haemin crystals
2. Blood group determination
3. Counting of WBC/RBC (haemocytometer)
4. Display pituitary and gonad of fishes
4. Study of histological slides of endocrine glands

SCHEME OF THE PRACTICAL EXAMINATION
Time: 4 hrs.

1. Physiological Experiment	8
2. Endocrinological Experiment	6
3. Spotting/Identification	4
4. Preparation of slide	4
5. Practical record book	5
6. Viva voce	5
Total	**= 32**

SEMESTER-V

ZooGT- 501: Genetics and Molecular Biology

Marks: 12 (IA) + 48 (End Sem) = 60
40 lecture hours

Unit –1: Principles of heredity: Mendel's laws, linkage and crossing over, non-chromosomal inheritance; sex determination in animals.
Unit –2: Concept of gene, mutation, chromosomal aberrations, mutagens and their application.
Unit-3: Nucleic acids, DNA as genetic material, structure and functions of DNA and RNA.
Unit-4: Concept of central dogma, genetic code, basic steps of transcription and translation.
Unit-5: Genetic engineering; basic steps in gene cloning, cloning vectors, restriction enzymes.

ZooGP- 502: Practical based on ZooGT- 501

Marks: 8 (IA) + 32 (End Sem) = 40
20 lecture hours

1. Mendelian problems on monohybrid and dihybrid cross
2. Construction of nucleotides using Ball and stick model
3. Preparation of slides for study of mitosis and meiosis using suitable material

SCHEME OF THE PRACTICAL EXAMINATION
Time: 4 hrs.

1. Mendelian problems	8
2. Ball and stick model for nucleotides	4
3. Preparation of slides for study of meiosis	10
4. Practical record book	5
5. Viva voce	5
Total	**= 32**

ZooMT- 503: Animal Physiology

Marks: 12 (IA) + 48 (End Sem) = 60
42 lecture hours

Unit-1: Muscle and its contraction- molecular composition of myofilaments; sarcoplasmic reticulum and T- tubules; mechanism of muscle contraction; characteristic of muscle twitch- isometric and isotonic contractions; summation and tetanus.

Unit-2: Digestion- site and sequence of digestion; digestive secretions and their regulation; mechanism of digestion and absorption of carbohydrates, proteins and lipids; role of gastro-intestinal hormones, balanced diet

Unit-3: Excretion- structure and functions of nephron; renal blood supply; mechanism and regulation of urine formation; renal failure and dialysis

Unit-4: Circulation- coronary circulation; origin and conduction of cardiac impulse; cardiac cycle; cardiac output and its regulation; disorders of cardio-vascular system; haemostasis; respiration- structure and functions of haemoglobin; O_2 and CO_2 transport by blood; regulation of respiration; carbon monoxide poisoning; tracheal respiration in insects.

Unit-5: Nervous system- neurons, resting membrane potential and its basis, action potential and its propagation in myelinated and non-myelinated nerve fibre; types of synapses and synaptic transmission; neuro-transmitters- their release and action; neuro-muscular junction; types of reflexes; reflex activity; reflex arc; physiology of vision; addictive drugs-types; drug addiction- causes, physiological effects; social implications.

ZooMP- 504: Practical based on ZooMT- 503

Marks: 8 (IA) + 32 (End Sem) = 40
20 lecture hours

1. Determination of R.Q. of cockroach/Goroi fish.
2. Recording of heart beat of frog by kymograph.
3. Preparation of haemin crystals.
4. Demonstration of knee jerk reflex.
5. Demonstration of osmosis using toad/frog urinary, bladder/alimentary canal.
6. Recording of muscle twitch.
7. Qualitative test of salivary amylase.
8. RBC and WBC counting by haemocytometer.

SCHEME OF THE PRACTICAL EXAMINATION:

Time: 4 hrs.

1. Physiological experiment I	12
2. Physiological experiment II (blood)	10
3. Practical record book	5
4. Viva voce	5
Total	**32**

ZooMT- 505: Environmental Biology and Wildlife

Marks: 12 (IA) + 48 (End Sem) = 60
42 lecture hours

Unit-1: Concepts pertaining to ecosystem, species, community, biome and ecotone; biotic and abiotic environmental factors and their effect on animals; trophic relations and energy flow.

Unit-2: Shelfords law of tolerance; Liebig's law of minimum; concept of productivity; population structure and dynamics; exponential and logistic growth; r and k strategies and multidimensional niche concept; Lotka-Volterra model; natality and mortality; predator & prey relationship.

Unit-3: Biogeochemical cycles (carbon, nitrogen, phosphorus and hydrological cycles); Renewable and non-renewable resources of N.E. India and strategy for their sustainable utilization; basic concept of remote sensing and EIA.

Unit-4: Environmental pollution (water, air and soil); bioindicators in pollution studies; ecological succession; ecological backlash; greenhouse effect; ozone layer depletion and its impact.

Unit-5: IUCN status of species category; important endangered species of N.E. India - rhinoceros, tiger, golden langur, dancing deer, river dolphin, pigmy hog, white winged wood duck and golden mahseer (*Tor* spp.); threats to biodiversity; man-wildlife conflict; *ex-situ* and *insitu* conservation strategies; major national parks of NE India; concept of biosphere reserve and biodiversity hot spot; Indian Wildlife Protection Act, 1972.

ZooMP- 506: Practical based on ZooMT- 505

Marks: 8 (IA) + 32 (End Sem) = 40
20 lecture hours

1. Estimation of the size of the population by capture-recapture method (any vertebrate/invertebrate).
2. Find out the abundance and density of insect pests in some essential food commodities.
3. Determination of dissolved Oxygen/CO_2 /Alkalinity in the water samples.
4. Find out the abundance and densities of terrestrial invertebrates/macrophyte associated fauna by Quadrate method.
5. Study of structural components of an aquatic/ grassland ecosystem.
6. Field study: To visit a National park/ Wildlife Sanctuary to study the habitat/ forest types and prepare a full note on it.

SCHEME OF THE PRACTICAL EXAMINATION:
Time: 4 hrs.

1. Ecological experiment	8
2. Estimation	7
3. Field study	7
4. Practical record book	5
5. Viva voce	5

ZooMT- 507: Endocrinology Total 32

Marks: 12 (IA) + 48 (End Sem) = 60
42 lecture hours

Unit-1: Comparative anatomy of pituitary, thyroid, adrenal and pancreas in fish, amphibia, birds and mammals.

Unit-2: Hormones secreted by endocrine glands (pituitary, thyroid, adrenal and pancreas) and their functions in mammals.

Unit-3: General characters of hormones; mechanism of action of hormones; regulation of hormone secretion; hypothalamo-hypophysial system; disorders associated with hypo and hyper secretion of hormones.

Unit-4: Roles of hormones in reproductive cycle, pregnancy, parturition and lactation; methods of contraception; amniocentesis and IVF.

Unit-5: Neuroendocrine system in insects; role of hormones in growth and development of insects.

ZooMP- 508: Practical based on ZooMT- 507

Marks: 8 (IA) + 32 (End Sem) = 40
20 lecture hours

1. Histological preparation of thyroid, adrenal, pancreas and gonads.
2. Dissect and display the following endocrine gland in fish/birds: pituitary, thyroid, adrenal
3. Study of permanent slides of endocrine glands.
4. Submission of chart/models related to endocrinology

SCHEME OF THE PRACTICAL EXAMINATION
Time: 4 hrs.

1. Dissection and display of endocrine gland	8
2. Stained slide preparation	5
3. Spotting	6
4. Submission of slides	3
5. Practical record book	5
6. Viva voce	5
Total	**32**

SEMESTER-VI

ZooMT- 601: Parasitology and Ethology

Marks: 12 (IA) + 48 (End Sem) = 60
42 lecture hours

Unit-1: Parasitism; types of parasites, hosts and vectors; pasasitic adaptations and effects on hosts; life history and mode of infection and pathogenicity of *Entamoeba histolytica*, *Trypanosoma* spp., *Leishmania donovanii*, *Giardia intestinalis*, *Trichomonas vaginalis* & *Plasmodium* spp.

Unit-2: General organizations and pathogenosity of bacteria & viruses (*Rickettsia*, *Borrelia*,*Treponema* & *Leptospira*); life history, parasitic adaptation and pathogenicity of *Taenia solium*, *Fasciola hepatica*, *Ancylostoma duodenale* and *Wuchereria bancrofti*.

Unit-3: Vectors of human diseases- Malaria, Yellow fever, dengue, haemorrhagic fever, filariasis, Japanese B-encephalitis & dengue; measures of control of the vectors.

Unit- 4: Introduction to animal behaviour; brief history of ethology; patterns of behaviour; sense organs and behaviour; genetical and ecological aspects of behaviour.

Unit-5: Different types of orientation and communication in animals; comparative aspects of learning, offensive and defensive behaviour; social behaviour in insects.

ZooMP- 602: Practical based on ZooMT- 601

Marks: 8 (IA) + 32 (End Sem) = 40
20 lecture hours

1. Identification of mosquito species causing malaria, encephalitis and dengue fever.
2. Study of protozoan parasites (permanent slides).
3. Study of geotactic, phototactic, chemotactic and sociotactic behaviour of earthworm, cockroach, *Paramecium* and fish.
4. Study of habituation in mosquito larvae.

SCHEME OF THE PRACTICAL EXAMINATION:
Time: 4 hrs.

1. Parasitology		12
2. Ethology		10
3. Practical record book		5
4. Viva voce		5
	Total	**32**

ZooMT- 603: Molecular Biology and Immunology

Marks: 12 (IA) + 48 (End Sem) = 60
42 lecture hours

Unit-1: Genome organization in prokaryotes and eukaryotes. DNA as genetic material, structure and functions of DNA & RNA; Watson & Crick Model of DNA; other forms of DNA (A & Z).

Unit-2: Replication and transcriptions; genetic code; Wobble hypothesis; protein biosynthesis in prokaryotes.

Unit-3: Recombination in prokaryotes; transformation, conjugation and transduction; concept of transposons and plasmids; regulation of gene expression in prokaryotes, operon concept (Lac operon).

SCHEME OF THE PRACTICAL EXAMINATION:
Time: 6 hrs.

		Marks = 52 + 15 (project work) = 67
1.	Molecular biology	15
2.	Immunology	10
3.	Biotechnology and Bioinformatics	7
4.	Practical record book	10
5.	Viva voce	10
6.	Project work	15
	Total =	**67**

ZooMT- 606: Economic Zoology

Marks: 12 (IA) + 48 (End Sem) = 60
42 lecture hours

Unit-1: Major insect pests of paddy, tea and stored grains and their biology; Pest management- chemical, cultural and biological; integrated pest management.

Unit-2: Life histories of silkworm (eri, muga and mulberry); culture technique of silkworms; diseases of silkworms and its prevention

Unit-3: Life history of honey bee (*Apis india*); rearing techniques of honeybee; Biology and culture of lac insect.

Unit-4: Principles and practices in aquaculture; fish and prawn culture; preparation and management of different types of ponds for fish culture; induced breeding and hybridization technique in fishes; fish preservation methods; fish by-products.

Unit-5: Piggery: management and practices of pig rearing; poultry: selection of breed (chicken and duck) and their scientific rearing methods; poultry diseases and its prevention/control.

ZooMP- 607: Practical based on ZooMT- 606

Marks: 8 (IA) + 32 (End Sem) = 40
20 lecture hours

1. Identification of silkworms (eri, muga & mulberry), immature and adult stages.
2. Submission of life cycles of eri/ muga/ mulberry silkworms.
3. Study of important pests of paddy, tea plants and stored grains and their submission.
4. Identification of economically important fish and prawn available locally.
5. Identification of common aquatic weeds, plankton and insects.
6. Demonstration of induced breeding in fish.
7. Apiculture- culture of honey bee and extraction of honey.
8. Analysis of nutrients (Carbohydrate, Protein and Lipid) of Honey.

SCHEME OF THE PRACTICAL EXAMINATION:
Time: 4 hrs.

1.	Identification	10
2.	Collection and submission	6
3.	Qualitative analysis	6
4.	Practical record book	5
5.	Viva voce	5
	Total =	**32**