UNIVERSITY OF CALCUTTA

CBCS SYLLABUS FOR ZOOLOGY

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THREE-YEAR GENERAL
DEGREE COURSE OF STUDIES

ZOOLOGY

2018

Outline Structure of CBCS Curriculum For Zoology (General), C.U.

PART I; SEM I				
Subject Code	**Name of Paper**	**Theory**	**Practical**	**Internal assessment**
CC1/GE1	**Animal Diversity**	**50**	**30**	**20**
PART I; SEM II				
CC2/GE2	**Comparative Anatomy & Developmental Biology**	**50**	**30**	**20**
PART II; SEM III				
CC 3/GE3	**Physiology and Biochemistry**	**50**	**30**	**20**
SEC-A (1)	**Apiculture**	**80**	**NA**	**20**
PART II; SEM IV				
CC 4/GE4	**Genetics and Evolutionary Biology**	**50**	**30**	**20**
SEC- B(1)	**Aquarium Fish Keeping**	**80**	**NA**	**20**
PART III; SEM V				
DSE A(1)	**Applied Zoology**	**50**	**30**	**20**
DSE B (1)	**Aquatic biology**	**50**	**30**	**20**
SEC-A (1)	**Sericulture**	**80**	**NA**	**20**
PART III; SEM VI				
DSE A (1)	**Biology of Insect**	**50**	**30**	**20**
DSE B (2)	**Ecology & Wild life Biology**	**50**	**30**	**20**
SEC-B (1)	**Medical diagnosis**	**80**	**NA**	**20**

Abbreviations:

CC: Core Course; DSE A/B: Discipline Specific Elective A/B; SEC A/B: Skill Enhancement Course.

SUBJECT/PAPER CODE FORMAT

4. **Subject Code: ZOO**
5. **Honours Code: G**
6. **Course Code: a) Core Course:CC**
   b) Discipline Specific Elective: DSE-A/DSE-B
   c) Skill Enhancement Course: SEC-A/SEC-B
4. **Semester Code: 1/2/3/4/5/6**
5. **Paper No. Code: 1/2/3…../14**
6. **Paper Component Code: a) Theory:TH, b) Practical: P**

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CBCS ZOOLOGY (GENERAL), Papers & Their Codes

PART I: SEMESTER 1. CORE

COURSE 1.Animal Diversity

ZOOG-CC1-1-TH

Full Marks 50	4 Credits	50 Hours
Unit 1: Kingdom Protista		2
General characters and classification up to classes (Levine et. al., 1980); Locomotory Organelles and locomotion in *Amoeba* and *Paramecium*		
Unit 2: Phylum Porifera		2
General characters and classification up to classes (Ruppert and Barnes, 1994, 6th Ed.); Canal System in *Sycon*		
Unit 3: Phylum Cnidaria		2
General characters and classification up to classes (Ruppert and Barnes, 1994, 6th Ed.); Metagenesis in *Obelia*		
Unit 4: Phylum Platyhelminthes		2
General characters and classification up to classes (Ruppert and Barnes, 1994, 6th Ed.); Life history of *Taenia solium*		
Unit 5: Phylum Nemathelminthes		2
General characters and classification up to classes (Ruppert and Barnes, 1994, 6th Ed.); Life history of *Ascaris lumbricoides* and its adaptation		
Unit 6: Phylum Annelida		4
General characters and classification up to classes (Rupert and Barnes, 1994, 6th Ed.); Metamerism in Annelida		
Unit 7: Phylum Arthropoda		4
General characters and classification up to classes (Ruppert and Barnes, 1994, 6th Ed.); Eye in Cockroach, Metamorphosis in Lepidoptera		
Unit 8: Phylum Mollusca		2
General characters and classification up to classes (Ruppert and Barnes, 1994, 6th Ed.); Respiration in *Pila*		
Unit 9: Phylum Echinodermata		4
General characters and classification up to classes (Ruppert and Barnes, 1994, 6th Ed.); Water-vascular system in Asteroidea		
Unit 10: Protochordates		2
General Characters ; Pharynx and feeding mechanism in *Amphioxus*		
Unit 11: Agnatha		2
General features of Agnatha and classification of cyclostomes up to classes (Young, 1981)		

Unit 12: Pisces	4
General features and Classification up to orders (Young, 1981); Osmoregulation in Fishes	
Unit 13: Amphibia	4
General features and Classification up to orders (Young, 1981); Parental care	
Unit 14: Reptiles	4
General features and Classification up to orders (Young, 1981); Poisonous and non-poisonous snakes, Biting mechanism	
Unit 15: Aves	4
General features and Classification up to orders (Young, 1981); Flight adaptations in birds	
Unit 17: Mammals	4
Classification up to orders (Young, 1981); Hair, Horn & Antler, Nail & claw	

Animal Diversity, ZOOG-CC1-1-P

Full Marks: 30	60 Hours	2 Credits

List of Practicals

1. Identification with reasons of the following specimens:

   Amoeba, Euglena, Paramecium, Sycon, Obelia, Aurelia, Metridium, Taenia solium, Ascaris lumbricoides (Male and female), *Aphrodite, Nereis, Hirudinaria, Palaemon, Cancer, Limulus, Apis, Chiton, Dentalium, Unio, Sepia, Octopus, Echinus, Cucumaria* and *Antedon, Balanoglossus, Branchiostoma, Petromyzon, Torpedo, Labeo rohita, Exocoetus, Salamandra, Hyla, Chelone, Hemidactylus, Chamaeleon, Draco, Vipera, Naja*, Bat, *Funambulus*
2. Key for Identification of poisonous and non-poisonous snakes
3. Study of anatomy of digestive system, salivary gland, mouth parts of *Periplaneta*, Study of reproductive system of female cockroach

   An "animal album" containing photographs, cut outs, with appropriate write up about the above mentioned taxa. Different taxa/ topics may be given to different sets of students for this purpose

PART I: SEMESTER 2.

CORE COURSE 2.Comparative Anatomy & Developmental Biology

ZOOG-CC2-2-TH

Full Marks 50	4 Credits	50 Hours
Unit 1: Integumentary System		4
Derivatives of integument with respect to glands in Birds & Mammals		
Unit 2: Digestive System		4
Stomach and Dentition		
Unit 3: Respiratory System		6

Brief account of Gills, lungs, air sacs and swim bladder	
Unit 4: Circulatory System	6
Evolution of heart and aortic arches	
Unit 5: Urino-genital System	6
Succession of kidney, Evolution of urino-genital ducts	
Unit 6: Early Embryonic Development	14
Gametogenesis: Spermatogenesis and oogenesis with respect to mammals. Fertilization: Sea-Urchin; Early development of frog; structure of mature egg and its membranes, patterns of cleavage, fate map, up to formation of gastrula; types of morphogenetic movements; Fate of germ layers	
Unit 7: Late Embryonic Development	10
Placenta types and function; Metamorphic events in frog life cycle and its hormonal regulation	

Comparative Anatomy & Developmental Biology Lab, ZOOG-CC2-2-P

Full marks 30	**60 hours**	**2 Credits**
List of Practical:		
1. Osteology: Limb bones, girdle and vertebra of Pigeon & Guineapig, Mammalian skulls: One herbivorous; Guinea pig and one carnivorous; Dog.		
2. Larval stages: Veliger, Nauplius, Trochophore, Mysis.		
3. Study of the different types of placenta- histological sections through photomicrographs.		
4. Developmental stages of chick embryo: 24 Hrs., 48 Hrs, 72 Hrs., 96 Hrs.		

PART II: SEMESTER 3.

CORE COURSE 3. PHYSIOLOGY AND BIOCHEMISTRY

ZOOG-CC3-3-TH

Full Marks 50	4 Credits	50 Hours
Unit 1: Nerve and muscle		**8**
Structure of a neuron, resting membrane potential, Origin of Action potential and its propagation in myelinated and non-myelinated nerve fibres, Ultra-structure of skeletal muscle, Molecular and chemical basis of muscle contraction		
Unit 2: Digestion		6
Physiology of digestion in the alimentary canal; Absorption of carbohydrates, proteins, lipids		
Unit 3: Respiration		6
Pulmonary ventilation, Transport of Oxygen and carbon		
Unit 4: Cardio-vascular system		6

Composition of blood, Structure of Heart, Origin and conduction of the cardiac impulse, cardiac cycle	
Unit 5: Excretion	6
Structure of nephron, Mechanism of Urine formation; Counter-current Mechanism	
Unit 6:Reproduction and Endocrine Glands	10
Physiology of male reproduction: Histology of testis, hormonal control of spermatogenesis; Physiology of female, reproduction: Histology of ovary, hormonal control of menstrual cycle. Structure and function of pituitary, thyroid, pancreas and adrenal.	
Unit 7: Carbohydrate Metabolism	4
Glycolysis, Kreb's cycle, Glycogenesis, Electron Transport Chain.	
Unit 8: Lipid metabolism	
Beta oxidation of Palmitic acid {saturated (C 16:0)} and Linoleic acid {unsaturated (C 18:2)}	
Unit 9: Protein Metabolism	4
Transamination, Deamination, Urea cycle	
Unit 10. Enzyme	2
Enzyme Classification, factors affecting enzyme action, Inhibition.	

PHYSIOLOGY AND BIOCHEMISTRY Lab; ZOOG-CC3-3-P

Full Marks 30	**60 Hours**	2 Credits
List of Practical		
1. Study of permanent histological sections of mammalian pituitary, thyroid, pancreas, adrenal gland. 2. Study of permanent histological sections of mammalian duodenum, liver, lung, kidney. 3. Qualitative test for carbohydrate samples.		

PART II: SEMESTER 4.

CORE-COURSE 4.Genetics & Evolutionary Biology

ZOOG-CC4-4-TH

Full Marks 50	4 Credits	50 Hours
Unit 1:Mendelian Genetics and its Extension		10
Principles of Inheritance, Chromosome theory of inheritance, Incomplete dominance and co-dominance, Multiple alleles, lethal alleles, sex linked inheritance in *Drosophila* (White eye locus) & Human (Thalassemia).		
Unit 2: Linkage, Crossing Over		8
Linkage and crossing over, Complete & Incomplete Linkage, Recombination frequency as a measure of linkage intensity. Holiday Model		
Unit 3: Mutation		

Chromosomal mutation, Deletion, duplication, inversion, translocation, aneuploidy, gene mutation, induced mutation, types & example	8
Unit 4: Sex determination	8
Genic Balance theory and dosage compensation in *Drosophila*.	
Unit 5: Origin of Life	2
Chemical Origin of life	
Unit 6: Evolutionary Theories	6
Lamarckism, Darwinism, Neo-Darwinism.	
Unit 7: Process of Evolutionary changes	4
Isolating mechanism, Natural Selection.	
Unit 8: Speciation	4
Sympatric, Allopatric, Parapatric	

Genetics and Evolutionary Biology Lab ZOOG-CC4-4-P

Full marks 30	**2 Credits**
List of Practical:	
Verification of Mendelian Ratio using Chi square test. Identification of Human Aneuploidy using photo graph of karyotype. Phylogeny of horse with diagram of limb and skull. Study and identification of Darwin Finches from photographs. Visit to natural history museum and submission of report.	

Discipline specific courses

Elective Course (Any One from DSE-A)

Semester-5

DSE-A

Applied Zoology.ZOOG-DSE-A-5-1-TH

Full Marks 50	Credits 4	50 Hours
Unit I: Host & Parasite Relationship		2
Type of Host, Types of Parasites, Other types of Relations.		
Unit 2: Epidemiology of Diseases		5

Transmission, Prevention and Control of Tuberculosis and Typhoid.	
Unit 3: Parasitic Protozoa	7
Life History and pathogenicity of *Entamoeba histolytica*, *Plasmodium vivax* and *Trypanosoma gambiense.*	
Unit 4: Parasitic Helminthes	8
Life History and pathogenicity of *Alcylostoma duodenale*, *Wuchereria bancrofti*.	
Unit 5: Insect of Economic Importance	8
Biology, Control and Damage caused by *Heliocoverpa armigera*, *Pyrilla perpusilla*, *Sytophilus oryzae* and *Tribolium casteneum*.	
Unit 6: Insect of Medical Importance	2
Medical Importance and control of *Anopheles*	
Unit 8: Animal Husbandry	6
Preservation and artificial insemination in cattle; Induction of early puberty and synchronization of estrus in cattle	
Unit 9: Poultry Farming	6
Principles of poultry breeding, Management of breeding stock and broilers, Processing and preservation of eggs	
Unit 10: Fish Technology	6
Genetic improvements in aquaculture industry; Induced breeding and transportation of fish seed	

Applied Zoology. ZOOG-DSE-A-5-1-P

Full marks 30	**60 Hours**	2 Credits
List of Practical:		

1. Study of *Plasmodium vivax*, *Entamoeba histolytica*, *Trypanosoma gambiense*, *Ancylostoma duodenale* and *Wuchereria bancrofti* and their life stages through permanent slides/photomicrographs or specimens.
2. Study of arthropod vectors associated with human diseases: *Pediculus*, *Culex*, *Anopheles*, *Aedes*
3. Study of insect damage to different plant parts/stored grains through damaged products/photographs.
4. Identifying feature and economic importance of *Helicoperva; Heliothis armigera*,*Papilio demoleus*, *Pyrilla perpusilla*, *Callosobruchus chinensis*, *Sitophilus oryzae* and *Tribolium castaneum*
5. Visit to poultry farm or animal breeding centre. Submission of visit report
6. Maintenance of freshwater aquarium(demonstration only)

Discipline specific courses

Elective Course (Any One from DSE-A)

Semester-5

DSE-A

AQUATIC-BIOLOGY. ZOOG-DSE-A-5-2-TH

Full Marks 50	**Credits 4**	**Class 60**
Unit 1: Aquatic Bionics		15
Brief introduction of the aquatic biomes: Freshwater ecosystem; lakes, wetlands, streams and rivers, estuaries, intertidal zones, oceanic pelagic zone, marine benthic zone and coral reefs.		
Unit 2: Freshwater Biology lakes		15
Origin and classification, Lake as an Ecosystem, Lake morphometry, Physico-chemical Characteristics: Light, Temperature, Thermal stratification, Dissolved Solids, Carbonate, Bicarbonates, Phosphates and Nitrates, Turbidity; dissolved gases; Oxygen, Carbon dioxide. Nutrient Cycles in Lakes-Nitrogen, Sulphur and Phosphorous. **Streams:** Different stages of stream development, Physico-chemical environment, Adaptation of hill-stream fishes.		
Unit 3: Marine Biology		15
Salinity and density of Sea water, Continental shelf, Adaptations of deep sea organisms, Coral reefs, Sea weeds.		
Unit 4: Management of Aquatic Resources		15
Causes of pollution: Agricultural, Industrial, Sewage, Thermal and Oil spills, Eutrophication, Management and conservation ;legislations, Sewage treatment Water quality assessment - BOD and COD		

AQUATIC BIOLOGY. ZOOG-DSE-A-5-2-P

Full Marks 30	60 Hours	2 Credits

1. Determine the area of a lake using graphimetric and gravimetric method.
2. Identify the important macrophytes, phytoplanktons and zooplanktons present in a lake ecosystem.
3. Determine the amount of dissolved Oxygen, and free Carbon dioxide, in water collected from a nearby lake / water body.
4. Visit to any aquatic Ecosystem and preparation and submission of report.

Discipline specific courses Elective

Course (Any One from DSE-B)

Semester-6

DSE-B

Biology of Insect. ZOOG-DSE-B-6-1-TH

Full Marks 50	Credits 4	50 Hours
Unit I: Introduction to Insects		6
General Features of Insects, Morphological features, Head, Eyes, Types of antennae, Mouth parts with respect to feeding habits		
Unit II: Concept of Vectors		6
Brief introduction of Carrier and Vectors; mechanical and biological vector, Reservoirs, Host-vector relationship, Adaptations as vectors, Host Specificity		
Unit III: Insects as Vectors		8
Classification of insects up to orders, detailed features of orders with insects as vectors - Diptera, Siphonaptera, Siphunculata, Hemiptera		
Unit IV: Dipteran as Disease Vectors		14
Dipterans, as important insect vectors - Mosquitoes, Sand fly, Houseflies; Study of mosquito-borne diseases - Dengue, Viral encephalitis, Filariasis; Control of mosquitoes.		
Unit V: Siphonaptera as Disease Vectors		6
Fleas as important insect vectors; Host-specificity, Study of Flea-borne diseases - Plague, Typhus fever; Control of fleas		
Unit VI: Siphunculata as Disease Vectors		4
Human louse; Head, Body and Pubic louse as important insect vectors; Study of louse-borne diseases -Typhus fever, Relapsing fever, Trench fever; Control of human louse		
Unit VII: Hempitera as Disease Vectors		6
Bugs as insect vectors; Blood-sucking bugs; Chagas disease, Bed bugs as mechanical vectors,Control and prevention measures		

Biology of Insect. ZOOG-DSE-B-6-1-P

Full marks 25	**60 Hours**	2 Credits
List of Practical		

1. Study of different kinds of mouth parts of insects
2. Study of following insect vectors through permanent slides/photographs: *Aedes, Culex, Anopheles, Pediculus humanuscapitis, Pediculus humanuscorporis, Phlebotomus argentipes, Musca domestica,*
3. Submission of a project report on any one of the insect vectors and disease transmitted by the insect.

Ecology& Wild life Biology;ZOOG-DSE-B-6-2-TH

Full Marks 50	Credits 4	Class 60
Unit 1: Introduction to Ecology		4
Ecosystem, Autecology and synecology, Levels of organization, Laws of limiting factors, Study of Physical factors, The Biosphere.		
Unit 2: Population		20
Attributes of population: Life tables, fecundity tables, survivorship curves, dispersal and dispersion. Geometric, exponential and logistic growth, equation and patterns, Population regulation: density-dependent and independent factors,		
Unit 3: Community		11
Community characteristics: species diversity, abundance, dominance, richness, Vertical stratification, Ecotone and edge effect.		
Unit 4: Ecosystem		10
Types of ecosystem with an example in detail, Food chain: Detritus and grazing food chains, Linear and Y-shaped food chains, Food web, Energy flow through the ecosystem, Ecological pyramids and Ecological efficiencies		
Unit 5: Wild Life		5
Wildlife Conservation (in-situ and ex-situ conservation)**:** Necessity for wildlife conservation; National parks & sanctuaries, Tiger conservation - Tiger reserves in India; Management challenges in Tiger reserve		

Ecology& Wild life Biology;ZOOG-DSE-B-6-2-P

Full marks 30	**60 Hours**	2 Credits
List of Practical		
1. Identification of flora, mammalian fauna, avian fauna 2. Demonstration of basic equipment needed in wildlife studies use, care and maintenance (Compass, Binoculars, Spotting scope, Range Finders, Global Positioning System, Various types of Cameras and lenses) 3. Familiarization and study of animal evidences in the field; Identification of animals through pug marks, hoof marks, scats, pellet groups, nest, antlers, etc. 4. Study of an aquatic ecosystem: Phytoplankton and zooplankton, Measurement of area, temperature, salinity, determination of pH, and Dissolved Oxygen content (Winkler's method), Chemical Oxygen Demand and free CO_2		

Skill Enhancement Elective Courses (SEC)

SEMESTER –3

SEC-A

APICULTURE; ZOOG-SEC-A-3-1-TH

Full Marks 80	Credits 2	30 Hours
Unit 1: Biology of Bees		2
Classification and Biology of Honey Bees Social Organization of Bee Colony		
Unit 2: Rearing of Bees		14
Artificial Bee rearing; Apiary, Beehives - Newton and Langstroth, Bee Pasturage; Selection of Bee Species for Apiculture; Bee Keeping Equipment; Methods of Extraction of Honey; Indigenous and Modern		
Unit 3: Diseases and Enemies		6
Bee Diseases and Enemies Control and Preventive measures		
Unit 4: Bee Economy		2
Products of Apiculture Industry and its Uses ;Honey, Bees Wax, Propolis, Pollen etc		
Unit 5: Entrepreneurship in Apiculture		6
Bee Keeping Industry - Recent Efforts, Modern Methods in employing artificial Beehives for cross		

Skill Enhancement Elective Courses (SEC)

SEMESTER – 4

AQUARIUM FISH KEEPING; ZOOG-SEC-B-4-2-TH

Full Marks 80	Credits 2	30 Hours
Unit l: Introduction to Aquarium Fish Keeping		2
The potential scope of Aquarium Fish Industry as a Cottage Industry, Exotic and Endemic species of Aquarium Fishes		
Unit 2: Biology of Aquarium Fishes		10
Common characters and sexual dimorphism of Fresh water and Marine Aquarium fishes such as Guppy, Molly, Sword tail, Gold fish, Angel fish, Blue morph, Anemone fish and Butterfly fish		
Unit 3: Food and feeding of Aquarium fishes		8
Use of live fish feed organisms. Preparation and composition of formulated fish feeds		
Unit 4: Fish Transportation		5
Live fish transport - Fish handling, packing and forwarding techniques.		
Unit 5: Maintenance of Aquarium		5
General Aquarium maintenance - budget for setting up an Aquarium Fish Farm as a Cottage		

Skill Enhancement Elective Courses (SEC)

SEMESTER –5

SEC-A

Sericulture; ZOOG-SEC-A-5-3-TH

Full Marks 80	Credits 2	30 Hours
Unit 1: Introduction		6
Sericulture: Definition, history and present status; Silk route; Types of silkworms, Distribution and Races Exotic and indigenous races Mulberry and non-mulberry Sericulture		
Unit 2: Biology of Silkworm		4
Life cycle of *Bombyx mori;* Structure of silk gland and secretion of silk		
Unit 3: Rearing of Silkworms		10
Selection of mulberry variety and establishment of mulberry garden Rearing house and rearing appliances Disinfectants: Formalin, bleaching powder, RKO Silkworm rearing technology: Early age and Late age rearing Types of mountages; Spinning and harvesting and storage of cocoons.		
Unit 4: Pests and Diseases		7
Pests of silkworm: Uzi fly, dermestid beetles and vertebrates Pathogenesis of silkworm diseases: Protozoan, viral, fungal and bacterial Control and prevention of pests and diseases		
Unit 5: Entrepreneurship in Sericulture		3
Prospectus of Sericulture in India: Sericulture industry in different states, employment, potential in mulberry and non-mulberry sericulture. Visit to various sericulture centres.		

Skill Enhancement Elective Courses (SEC)

SEMESTER –6

SEC-B

Medical diagnosis; ZOOG-SEC-B-6-4-TH

Full Marks 80	Credits 2	Class 30
Unit 1: Diagnostics Methods Used for Analysis of Blood		8
Blood composition, Preparation of blood smear and Differential Leucocyte Count (D.L.C) using Leishman's stain, Platelet count using haemocytometer, Erythrocyte Sedimentation Rate (E.S.R)		
Unit 2: Diagnostic Methods Used for Urine Analysis		4
Urine Analysis: Physical characteristics; Abnormal constituents, Urine culture		
Unit 3: Non-infectious Diseases		6
Causes, types, symptoms, complications, diagnosis and prevention of Diabetes (Type I and Type II), Hypertension (Primary and secondary), Testing of blood glucose using Glucometer/Kit		
Unit 4: Infectious Diseases		3
Causes, types, symptoms, diagnosis and prevention of Tuberculosis and Hepatitis, Malarial parasite		

(Microscope based and ELISA based)	
Unit 5: Clinical Biochemistry	1
Lipid profiling, Liver function test. PSA test	
Unit 6: Clinical Microbiology	1
Antibiotic Sensitivity Test	
Unit 8: Tumours	2
Types (Benign/Malignant), Detection and metastasis; Medical imaging: X-Ray of Bone fracture,	
Unit 9: Visit to Pathological Laboratory and Submission of Project	5