

Course Title : Invertebrates

Course Code : BSZY101CCT

Scheme of Instruction

Total Duration : 60Hr
Periods /Week : 4
Credits : 4
Instruction Mode : Lecture

Scheme of Examination

Maximum Score : 100
Internal Evaluation : 30
End Semester : 70
Exam Duration : 3 Hrs

Course Objectives:

Course Outcomes:

Unit	Course Content	Instruction Hours
1	Basis of Classification and Lower Invertebrates <ul style="list-style-type: none">• Basis of animal classification, Zoological nomenclature, concepts of taxonomy & systematics.• Phylum Protozoa: General characters and classification upto classes; Structure, life cycle and clinical significance of human protozoan Parasites and their diseases (<u>Balantidiasis</u>, <u>Amoebiasis</u>, <u>Giardiasis</u>, <u>Leishmaniasis</u>, <u>Malaria</u>, <u>Trichomoniasis</u>, <u>Sleeping sickness</u> and <u>Chagas disease</u>).• Phylum Cnidaria: General characters and classification upto classes: Polymorphism in Coelenterates; Corals and Coral reef formation with their significance.• Phylum Porifera: General characters and classification upto classes: Canal system in Sponges; integumentary system in sponges.	15
2	Phylum Platyhelminthes to Annelida <ul style="list-style-type: none">• Phylum Platyhelminthes: General characters and classification upto classes; life cycle of <i>Fasciola hepatica</i>, and <i>Taenia solium</i>• Phylum Nematelminthes: General characters and classification up to classes; Life history of <i>Ascaris lumbricoides</i> and its parasitic adaptations• Phylum Annelida: General characters and classification up to classes; Metamerism in Annelida; Significance of Hirudin of Leech	15
3	Phylum Onychophora, Arthropoda and Mollusca <ul style="list-style-type: none">• Phylum Onychophora: General characters and classification upto classes: Taxonomic position of <i>Peripatus</i> and its affinities with Annelida and Arthropoda.	15

	<ul style="list-style-type: none"> • Phylum Arthropoda: General characters and classification upto classes: Vision in Arthropoda, Metamorphosis in Insects; Economically and Medically important Arthropods. Gregarious behavior of insects. • Phylum Mollusca: eneral characters and classification up to classes; Torsion in gastropods 	
4	<p>Phylum Echinodermata and Hemichordata</p> <ul style="list-style-type: none"> • Phylum Echinodermata: General characters and classification up to classes; Water-vascular system in Asteroidea; Affinities of Echinoderm with Hemichordates and chordates. • Phylum Hemichordata: General characters and Affinities of <i>Balanoglossus</i> with chordates and non-chordates. 	15
Examination and Evaluation Pattern :		
Text Books and References :		
1	Barnes, R.D. (1982). <i>Invertebrate Zoology</i> , V Edition	
2	Janet Moore (2006). An Introduction to the Invertebrates, Cambridge University Press 2006	
3	Jan Pechenik (2014). <i>Biology of the Invertebrates</i> , McGraw-Hill Science, 2014	
4	Kotpal Volumes Protozoa through Echinodermata, Rastogi Publications	
5	Jordan & Verma (revised editions) <i>Invertebrate Zoology</i> , S. Chand and Co. Ltd., New Delhi.	

Course Title : Invertebrates Lab**Course Code : BSZY150CCP**

Scheme of Instruction

Total Duration : 60Hr
 Periods /Week : 4
 Credits : 2
 Instruction Mode : Lecture /Demonstration

Scheme of Examination

Maximum Score : 50
 Internal Evaluation : 15
 End Semester : 35
 Exam Duration : 3 Hrs

Course Objectives:

Course Outcomes:

	Course Content	Instruction Hours
	1) Theoretical and practical knowledge of simple and compound microscope. 2) Identification, Classification and comments on the slides/specimens of; <ul style="list-style-type: none"> • Protozoa: <i>Amoeba, Euglena, Plasmodium, Paramecium, Trypanosoma, Elphidium, Vorticella,</i> • Porifera: <i>Sycon, Hyalonema, and Euplectella</i> • Cnidaria: <i>Hydra, Obelia, Physalia, Aurelia, Tubipora</i> • Platyhelminthes: <i>Fasciola, Taenia and their larvae,</i> • Aschelminthes: <i>Ascaris, Ancylostoma, Wuchereria,</i> • Annelida: <i>Pheretima, Hirudinaria (Leech), Nereis,</i> • Arthropoda: <i>Palaemon (Prawn), Crab, Palamnaeus (Scorpion)</i> • Mollusca: <i>Pila (Apple snail), Lamellidens (Unio), Sepia, Octopus</i> • Echinodermata: <i>Asterias (Sea Star), Echinus (Sea urchin)</i> • Hemichordata: <i>Balanoglossus</i> 3) Demonstration of earthworm Nerve ring and Ovaries; appendages of arthropods	60Hrs
Examination and Evaluation Pattern :		
Text Books and References :		

Course Title : Chordates**Course Code : BSZY201CCT**

Scheme of Instruction

Total Duration : 60 Hr
 Periods /Week : 4
 Credits : 4
 Instruction Mode: Lecture

Scheme of Examination

Maximum Score : 100
 Internal Evaluation: 30
 End Semester : 70
 Exam Duration : 3 Hrs

Course Objectives:

Course Outcomes:

Unit	Course Content	Instruction Hours
1	Chordates: Introduction and origin; Protochordates - General features and Phylogeny of Hemichordates, Urochordates and Cephalochordates. Retrogressive metamorphosis; Agnatha - General features of Agnatha and classification of cyclostomes up to classes; Pisces - General features and Classification up to orders; Osmoregulation in Fishes; Migration and Parental care in fishes	15
2	Amphibian Classification upto orders, Parental care; Reptiles - Classification upto orders. Poisonous and non- poisonous snakes in India, Biting mechanism in snakes; Aves - Classification upto orders, flight adaptations, Mechanism of flight and Migration. Mammals - Classification upto orders. Origin of Mammals.	15
3	Integumentary System - Derivatives of integument w.r.t. glands and digital tips; Skeletal System, Evolution of visceral arches; Digestive System -Brief account of alimentary canal and digestive glands; Respiratory System -Brief account of Gills, lungs, air sacs and swim bladder	15
4	Circulatory System - Evolution of heart and aortic arches; Urino-genital system- Succession of kidney, Evolution of Urino-genital ducts; Nervous System -Comparative account of brain; Sensory organs -Types of receptors	15

Examination and Evaluation Pattern :

Text Books and References :

1	Kardong, K.V. (2005) <i>Vertebrates' Comparative Anatomy, Function and Evolution</i> . IV Edition. McGraw-Hill Higher Education.
2	Kent, G.C. and Carr R.K. (2000). <i>Comparative Anatomy of the Vertebrates</i> . IX Edition. The McGraw-Hill Companies.
3	Hilderbrand, M and Gaslow G.E. <i>Analysis of Vertebrate Structure</i> , John Wiley and Sons.
4	Walter, H.E. and Sayles, L.P; <i>Biology of Vertebrates</i> , Khosla Publishing House.
5	Cleveland P. Hickman et.al. (2008). <i>Animal Diversity</i> , McGraw-Hill Higher Education
6	Kotpal (2015). <i>Modern Textbook Of Zoology Vertebrates</i> , Rastogi publishers, New Delhi
7	Saxena, R.K. and Saxena, S. (2015). <i>Comparative Anatomy of Vertebrates</i> , Viva Books, Delhi
8	Jordan E.L. and Verma P.S. (2010). <i>Chordate Zoology</i> , S. Chand & Co, New Delhi.

Course Title : Chordates Lab**Course Code : BSZY250CCP**

Scheme of Instruction

Total Duration : 60 Hr

Periods /Week : 4

Credits : 2

Instruction Mode: Lecture/Demonstration

Scheme of Examination

Maximum Score : 50

Internal Evaluation : 15

End Semester : 35

Exam Duration : 3 Hrs

Course Objectives:

Course Outcomes:

Unit	Course Content	Instruction Hours
	<p>Identification, Classification and comments on the specimens of:</p> <p>Protochordates:</p> <ul style="list-style-type: none"> • <i>Herdmania; Amphioxus</i> <p>Pices:</p> <ul style="list-style-type: none"> • <i>Branchiostoma, Petromyzon, Sphyrna, Pristis, Torpedo, Labeo, Exocoetus, Anguilla,</i> • Estimation of age of fishes through Scales <p>Amphibia</p> <ul style="list-style-type: none"> • <i>Ichthyophis/Ureotyphlus, Salamandra, Bufo, Hyla</i> <p>Reptiles:</p> <ul style="list-style-type: none"> • Cobra; Viper • <i>Calotis; Varanus; Chamilon; Rock Python, Draco, Crocodiles, Gharial, turtle, tortoise</i> • Distinction between Poisonous and Non-poisonous snake <p>Aves;</p> <ul style="list-style-type: none"> • Sparrow; Parrot; Columba; Myna • Owl; Duck; Woodpecker, penguin • Collection of different types of feathers from birds <p>Mammals:</p> <ul style="list-style-type: none"> • Mole; Playtypus • Guinepig; Bat, Whale <p>Comparative anatomy:</p> <ol style="list-style-type: none"> a) Types of scales in fishes; Feathers in birds; Integumentary organs in mammals b) skeleton of fowl and rabbit c) Carapace and plastron of turtle/tortoise d) Mammalian skulls: One herbivorous and one carnivorous animal. <p>Dentition in mammals</p>	60Hrs

Examination and Evaluation Pattern :

Text Books and References :

Course Title: PHYSIOLOGY AND BIOCHEMISTRY (Semester III)**Course Code: BSZY301CCT**

Scheme of Instruction

Total Duration : 60 Hr

Periods /Week : 4

Credits : 4

Instruction Mode: Lecture

Scheme of Examination

Maximum Score : 100

Internal Evaluation : 30

End Semester : 70

Exam Duration : 3 Hrs

Course Objectives:

Course Outcomes:

Unit	Course Content	Instruction Hours
1	<p>Digestion- Digestion definition and extra and intracellular digestion, Digestion of Carbohydrates, Proteins, Lipids and Cellulose, Absorption and Assimilation of digested food; role of Gastrointestinal hormones indigestion</p> <p>Respiration- Definition of Respiration and Respiratory mechanisms – External, Internal and cellular; Respiratory Pigments; Transport of oxygen, Oxygen dissociation curves. Bohr's effect, Transport of CO₂ – Chloride shift; Regulation of respiration – nervous and chemical</p> <p>Circulation -Types of circulation - Open and Closed circulation; Structure of Mammalian Heart, Types of hearts – Neurogenic and Myogenic; Heart function –Conduction and regulation of heart beat, Regulation of Heart rate – Tachycardia and Bradycardia; Blood Clotting mechanism</p>	15
2	<p>Excretion - Classification of Animals on the basis of excretory products- Ammonotelic, Uricotelic, Ureotelic, Structure and function of Nephron; Urine formation, Counter current mechanism. Osmoregulation - Water and ionic regulation by freshwater, brackish water and marine animals</p> <p>Types of Muscles, , Muscle Contraction, Ultra structure of skeletal muscle fibre, Sliding Filament theory, muscle contraction mechanism and energetics, Nerve Impulse, Structure of Neuron, Nerve impulse - Resting potential and Action potential and Conduction of Nerve impulse, Synapse, types of synapses and Synaptic transmission</p>	15
3	<p>Reproduction and Endocrine System- Endocrine glands - Structure, secretions and functions of Pituitary, Thyroid, Parathyroid, Adrenal glands and Pancreas, Hormone action and concept of Secondary messengers, Male and Female Hormones, Hormonal control of Menstrual cycle in humans.</p> <p>Homeostasis and Enzymes, Concept of Homeostasis, Mechanism of</p>	15

	Homeostasis, Enzymes: Definition, Classification, Inhibition and Regulation	
4	<p>Biomolecules and Metabolism, Carbohydrates: Classification and function of Carbohydrates, Carbohydrate metabolism - Glycolysis, Krebs cycle, , Electron transport and oxidative, phosphorylation.</p> <p>Proteins: Classification of proteins based on functions and Chemical nature, Protein Metabolism - Transamination, Deamination and Urea Cycle</p> <p>Lipids: Classification of Lipids, Lipid Metabolism - Fatty acid synthesis and Fatty acid oxidation.</p>	15
Examination and Evaluation Pattern :		
<p>Text Books and References :</p> <ul style="list-style-type: none"> • Tortora, G.J. and Derrickson, B.H. (2009). Principles of Anatomy and Physiology, XII Edition, John Wiley & Sons, Inc. • Widmaier, E.P., Raff, H. and Strang, K.T. (2008) Vander's Human Physiology, XI Edition., McGraw Hill • Guyton, A.C. and Hall, J.E. (2011). Textbook of Medical Physiology, XII Edition, Harcourt Asia Pvt. Ltd/ W.B. Saunders Company • Berg, J. M., Tymoczko, J. L. and Stryer, L. (2006). Biochemistry. VI Edition. W.H Freeman and Co. • Nelson, D. L., Cox, M. M. and Lehninger, A.L. (2009). Principles of Biochemistry. IV Edition. W.H. Freeman and Co. • Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. (2009). Harper's Illustrated Biochemistry. XXVIII Edition. Lange Medical Books/Mc Graw3Hill. • Singh. H.R, & Neeraj Kumar (2017) Animal Physiology and Biochemistry, Vishal Publishing Co • Nagabhushanam, (2008) , Textbook Of Animal Physiology, Oxford & IBH • Rastogi, S.C. (2007). Essentials of Animal Physiology, New Age International Publishers 		

Course Title: LAB- PHYSIOLOGY AND BIOCHEMISTRY (SEMESTER III)**Course Code : BSZY350CCP**

Scheme of Instruction

Total Duration : 60 Hr

Periods /Week : 4

Credits : 2

Instruction Mode: Lecture

Scheme of Examination

Maximum Score : 50

Internal Evaluation : 15

End Semester : 35

Exam Duration : 3 Hrs

Course Objectives:

Course Outcomes:

Unit	Course Content	Instruction Hours
	<ol style="list-style-type: none">1. Preparation of hemin and hemochromogen crystals2. Study of permanent histological sections of mammalian pituitary, thyroid, pancreas, adrenal gland3. Study of permanent slides of spinal cord, duodenum, liver, lung, kidney, bone, cartilage4. Qualitative tests to identify functional groups of carbohydrates in given solutions (Glucose, Fructose, Sucrose, Lactose)5. Estimation of total protein in given solutions by Lowry's method.6. Study of activity of salivary amylase under optimum conditions	60Hrs
Examination and Evaluation Pattern :		
Text Books and References :		

Course Title: Genetics and Evolutionary Biology (Semester IV)**Course Code: BSZY401CCT**

Scheme of Instruction

Total Duration : 60 Hr

Periods /Week : 4

Credits : 4

Instruction Mode: Lecture

Scheme of Examination

Maximum Score : 100

Internal Evaluation : 30

End Semester : 70

Exam Duration : 3 Hrs

Course Objectives:

Course Outcomes:

Unit	Course Content	Instruction Hours
1	<p>Introduction to Genetics: Inheritance and variation, Brief explanation on Mendel's work on transmission of traits (selection of experimental material and traits, hybridization, pure line, reciprocal crosses, maintenance of statistical records etc.), Molecular basis of Genetic Information (DNA and chromosome structure, replication, concept of gene); Importance of model organisms in the study of genetics;</p> <p>Mendelian Principles of Inheritance and its extensions: Law of segregation, Law of Independent Assortment, test cross (3:1; 9:3:3:1; 1:1), chromosome theory of inheritance (mitosis and meiosis) Incomplete dominance and co dominance (1:2:1), Multiple alleles (ABO blood groups), Lethal alleles (2:1), Epistasis (12:3: 1; 9:7; 15:1), Pleiotropy (sickle cell anaemia);</p> <p>Inheritance patterns: Autosomal inheritance Vs Sex linked Inheritance (pedigree construction of various mode of inheritance, dominant eg., achandropasia, recessive-eg., albinism, X-linked-eg., haemophilia and Y Linked eg., hypertrichosis), extra chromosomal inheritance (mitochondrial inheritance in human).</p>	15
2	<p>Linkage Crossing over and gene mapping: Linkage and crossing over, Bateson and Punnett's experiment, Recombination frequency as a measure of linkage intensity, two factor and three factor crosses, Interference and coincidence, Somatic cell genetics - an alternative approach to gene mapping;</p> <p>Sex determination: Chromosomal mechanisms of Sex Determination (grasshopper, birds, human), dosage compensation (Lyonization and Barr body);</p> <p>Mutations: Chromosome Structural Mutations: standard Karyotype, Deletion, Duplication, Inversion, Translocation, chromosome numerical mutations: Non-disjunction, Aneuploidy (eg, trisomy 13,18 and 21; monosomy for X chromosome) and Polyploidy; Induced versus Spontaneous gene mutations (mutagen, somatic and germline mutations, substitution and frameshift mutations), Back versus Suppressor mutations.</p>	15
3	History of Life, Major Events in History of Life, Introduction to Evolutionary theories, Lamarckism, Darwinism, Neo-Darwinism	

	Direct Evidences of Evolution, Types of fossils, Incompleteness of fossil record, Dating of fossils, Phylogeny of horse, Processes of Evolutionary Change, Organic variations; Isolating Mechanisms; Natural selection (Example: Industrial melanism); Types of natural selection (Directional, Stabilizing, Disruptive), Artificial selection	15
4	Species Concept- Biological species concept (Advantages and Limitations); Modes of speciation (Allopatric, Sympatric), Macro-evolution, Macro-evolutionary Principles (example: Darwin's Finches), Extinction- Mass extinction (Causes, Names of five major extinctions, K-T extinction in detail), Role of extinction in evolution	15

Examination and Evaluation Pattern :

Text Books and References

- Bhaskaran, K.K. & Biju Kumar, A.: Cell Biology, Genetics & Molecular Biology.
- Brooks, R. J.: Genetics: Analysis and Principles. 1999, Addison Wesley
- Gardner, E. J. et al.: Principles of Genetics. 8e, 200 J W & S.
- Robert H. Tamarin, Principles of Genetics.
- Sharma, A., Chromosomes. 1992, Oxford & IBH
- Vijayakumaran Nair, K. & Jayaprakash, M.: Cell Biology, Genetics, Molecular Biology. Academica, TVM.
- Ridley, M. (2004). *Evolution*. III Edition. Blackwell Publishing
- Barton, N. H., Briggs, D. E. G., Eisen, J. A., Goldstein, D. B. and Patel, N. H. (2007).
- *Evolution*. Cold Spring, Harbour Laboratory Press.
- Hall, B. K. and Hallgrímsson, B. (2008). *Evolution*. IV Edition. Jones and Bartlett Publishers
- Verma & Agarwal (2006) Cell Biology, Genetics, Molecular Biology, Evolution & Ecology, S. Chand publishers
- Carl T. Bergstrom & Lee Alan Dugatkin (2012). *Evolution*, W. W. Norton & Company; International student edition
- Brian K. Hall & Benedikt Hallgrímsson (2013) Strickberger's Evolution Paperback, Jones & Bartlett Learning.

Course Title: Lab -Genetics and Evolutionary Biology (Semester IV)**Course Code: BSZY450CCP**

Scheme of Instruction

Total Duration : 60 Hr

Periods /Week : 4

Credits : 2

Instruction Mode: Lecture / Demonstration

Scheme of Examination

Maximum Score : 50

Internal Evaluation : 15

End Semester : 35

Exam Duration : 3 Hrs

Course Objectives:

Course Outcomes:

Unit	Course Content	Instruction Hours
	<ol style="list-style-type: none">1. Study of Mendelian Inheritance and gene interactions (Non Mendelian Inheritance) using suitable examples. Verify the results using Chi-square test.3. Study of Linkage, recombination, gene mapping using the data.4. Study of Human Karyotypes (normal and abnormal).5. Demonstration of inactive x-chromosome in buccal epithelial cells of human female6. Study of fossil evidences from plaster cast models and pictures7. Study of homology and analogy from suitable specimens/ pictures8. Charts: a) Phylogeny of horse with diagrams/ cut outs of limbs and teeth of horse ancestors b) Darwin's Finches with diagrams/ cut outs of beaks of different species9. Visit to Natural History Museum and submission of report	60Hrs
Examination and Evaluation Pattern :		

Course Title : Applied Zoology and Developmental Biology (DSE- Semester V)**Course Code : BSZY501CCT**

Scheme of Instruction

Total Duration : 60 Hr

Periods /Week : 4

Credits : 4

Instruction Mode : Lecture

Scheme of Examination

Maximum Score : 100

Internal Evaluation : 30

End Semester : 70

Exam Duration : 3 Hrs

Course Objectives:

Course Outcomes:

Unit	Course Content	Instruction Hours
1	Introduction to Host-parasite Relationship Host, Definitive host, Intermediate host, Parasitism, Reservoir, Zoonosis, Symbiosis, Commensalism. Examples of bacterial diseases, protozoan and helminth diseases Insects of Economic importance - Pests : Biology, Control and damage caused by <i>Helicoverpa armigera</i> , <i>Pyrilla perpusilla</i> and <i>Papilio demoleus</i> , <i>Callosobruchus chinensis</i> , <i>Sitophilus oryzae</i> and <i>Tribolium castaneum</i> ; <i>Pediculus humanus corporis</i> , <i>Anopheles</i> , <i>Culex</i> , <i>Aedes</i> , <i>Xenopsylla cheopis</i> Useful Insects - Honey bee : social organization, importance of apiculture, bee products. Silk worm and lac insect: Economic importance.	15
2	Animal Husbandry- Preservation and artificial insemination in cattle; Induction of early puberty and synchronization of estrus in cattle Poultry Farming- Principles of poultry breeding, Management of breeding stock and broilers, Processing and preservation of eggs Introduction to Pisciculture, Genetic improvements in aquaculture industry; Induced breeding and transportation of fish seed	15
3	Introduction - Historical Perspective, Theories of Preformation, Epigenesis, Recapitulation and Germplasm, Determinate and Indeterminate types of development, Germ layers and Derivatives. Types of eggs - Classification of eggs based on: the amount, distribution of yolk and presence or absence of shell; the development (determinate & indeterminate); egg membranes; Cleavage and cell lineage - Types of cleavage with examples: based on planes ; based on amount of yolk ; based on development ; based on Pattern (Radial & Spiral); Cell lineage studies in Planocera; Different types of blastulae. Development of Frog - Fertilization, Cleavage, Blastulation & fate map, Gastrulation, (Morphogenetic movements) and formation of germ layers, neurulation & notochord formation, mesoderm and coelom formation; organogeny of brain and eye; hormonal control	15

	of amphibian metamorphosis.	
4	<p>Development of Chick - Fertilization, Structure of egg; cleavage, blastulation, gastrulation and formation of germ layers; Salient features of chick embryo at primitive streak stage, 24 & 33, 48 hours stage; Development and functions of extraembryonic membranes.</p> <p>Development of Man - Cleavage and formation of morula, development of blastocyst, implantation, gastrulation up to the formation of germ layers. Cell Differentiation and Gene action during development, Cell differentiation, totipotency, pluripotency, Dedifferentiation and Redifferentiation; controlled gene expression during development, Homeotic genes, Mention Hox genes; Stem cells, their significance and applications .</p> <p>Experimental Embryology - Construction of fate map, Vital staining, Marking with carbon particles & radio active tracing.</p>	15
Examination and Evaluation Pattern :		
Text Books and References :		
<ul style="list-style-type: none"> - Gilbert, S. F. (2006). Developmental Biology, VIII Edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA. - Balinsky, B.I. (2012). An introduction to Embryology, Cengage Learning India - Carlson, Bruce M (1996). Patten's Foundations of Embryology, McGraw Hill, Inc. - Park, K. (2007). Preventive and Social Medicine. XVI Edition. B.B Publishers. - Arora, D. R and Arora, B. (2001). Medical Parasitology. II Edition. CBS Publications and Distributors. - Kumar and Corton. Pathological Basis of Diseases. - Atwal, A.S. (1986). Agricultural Pests of India and South East Asia, Kalyani Publishers. - Hafez, E. S. E. (1962). Reproduction in Farm Animals. Lea & Fabiger Publisher - Dunham R.A. (2004). Aquaculture and Fisheries Biotechnology Genetic Approaches. CABI publications, U.K. - Pedigo, L.P. (2002). <i>Entomology and Pest Management</i>, Prentice Hall. - Verma & Agarwal (2010). Chordate Embryology, S. Chand Publishers - Shukla, G.S. & Upadhyay, V.B. (2014). Applied And Economic Zoology, Rastogi Publications 		

Course Title : Lab-Applied Zoology and Developmental Biology (DSE-Semester V)**Course Code : BSZY550CCP**

Scheme of Instruction

Total Duration : 60Hr

Periods /Week : 4

Credits : 2

Instruction Mode: Lecture /Demonstration

Scheme of Examination

Maximum Score : 50

Internal Evaluation : 15

End Semester : 35

Exam Duration : 3 Hrs

Course Objectives:

Course Outcomes:

Unit	Course Content	Instruction Hours
	<ul style="list-style-type: none">- Study of arthropod vectors associated with human diseases: <i>Pediculus, Culex, Anopheles, Aedes</i> and <i>Xenopsylla</i>.- Study of insect damage to different plant parts/stored grains through damaged products/ photographs.-Identifying feature and economic importance of Helicoverpa (<i>Heliothis</i>) armigera, <i>Papilio demoleus</i>, <i>Pyrilla perpusilla</i>, <i>Callosobruchus chinensis</i>, <i>Sitophilus oryzae</i> and <i>Tribolium castaneum</i>-Visit to poultry farm or animal breeding centre. Submission of visit report-Maintenance of freshwater aquarium-Frog - Study of developmental stages - whole mounts and sections through permanent slides – cleavage stages, blastula, gastrula, neurula, tail bud stage, tadpole external and internal gill stages.-Study of the different types of placenta- histological sections through permanent slides or photomicrographs.-Study of placental development in humans by ultrasound scans.-Examination of gametes - frog/rat - sperm and ova through permanent slides or photomicrographs.	60Hrs
Examination and Evaluation Pattern :		
Text Books and References :		

Course Title: Animal Behaviour & Chronobiology (DSE- Semester V)**Course Code:** BSZY502DST

Scheme of Instruction

Scheme of Examination

Total Duration : 60 Hr

Maximum Score : 100

Periods /Week : 4

Internal Evaluation : 30

Credits : 4

End Semester : 70

Instruction Mode : Lecture

Exam Duration : 3 Hrs

Course Objectives:

Course Outcomes:

Unit	Course Content	Instruction Hours
1	<p>Introduction to Animal Behaviour Origin and history of Ethology; Brief profiles of Karl Von Frish, Ivan Pavlov, Konrad Lorenz, Niko Tinbergen, Proximate and ultimate causes of behaviour , categories of behaviour pattern, Behaviour patterns; A-Group behaviour; i-Stereotyped-characteristics, patterns and types (Spatial orientation, Reflexes, Instincts, Motivation); ii-Acquired behaviour: Types of Learning-Non-associative learning (Habituation; sensitization); Associative learning (Classical conditioning and Operant conditioning); Latent learning; Insight learning (Reasoning; Intelligence; Cognitive thinking); and Phase-specific learning (Imprinting; Avian song and language). Instinct vs learnt behaviour . Methods and recording of behaviour in brief.</p>	15
2	<p>Social Behaviour and Communications Social Behaviour: Concept of society; Structure and benefits of social organisation-Aggregation, group selection, kin selection, Altruism/selfishness, Reciprocal Altruism; Social organization in invertebrates and vertebrates (Examples); Advantages and disadvantages of social behaviour Presociality and Eusociality (eg. castes in termites).</p> <p>Communication in Animals: Purposes and types of communication (Signals-Visual, Chemical/Olfactory, Auditory, Mechanical/ Tactile, and language with examples); Foraging: The Dance language of Honey bees (Foraging, Waggle dance and its advantages); Pheromones- types and their functions in Insects/ vertebrates and economic uses.</p>	15
3	<p>Sexual Behaviour and Reproductive patterns Sexual behaviour: Courtship behaviour and Sexual conflicts (purposes and sex differences with examples)); Sexual selection vs Natural selection; Sexual selection acts (examples in animals)- its advantages and disadvantages; Intra-sexual selection (male rivalry), Inter-sexual selection (female choice), Asymmetry of sex, Sexual dimorphism, Mate choice by male and female,</p> <p>Parental care in animals: Role of male and female in Parental care, Parental investments (fish only), effect, cost and benefit of parental</p>	15

	investment; Sexual conflict in parental care. Parent-offspring conflict.	
4	<p>Introduction to Chronobiology</p> <p>Historical developments in chronobiology; Basic cycles of chronobiology (Circadian, ultradian and Infradian) Biological Rhythm:Types and characteristics of biological rhythms-Circadian/Short- and Circannual/Long- term rhythms; Diurnal (Entrainment & related phenomena); Biological clocks: Circadian, Circatidal and Circalunar Clocks (Lunar, semilunar and Tidal); Concept of synchronization and masking; Photic and non-photic zeitgebers; Photoperiod and regulation, seasonal reproduction of vertebrates. Structure and functional significance of biological clocks (Insect and vertebrate); Biological oscillation: the concept of Average, amplitude, phase and period ; Role of melatonin; Chronopharmacology, Chronomedicine and Chronotherapy.</p>	15
Examination and Evaluation Pattern :		
<p>Text Books and References :</p> <ol style="list-style-type: none"> 1.David McFarland, Animal Behaviour, Pitman Publishing Limited, London, UK. 2. Manning, A. and Dawkins, M. S, An Introduction to Animal Behaviour, Cambridge, University Press, UK. 3.John Alcock, Animal Behaviour, Sinauer Associate Inc., USA. 4.Chronobiology Biological Timekeeping: Jay. C. Dunlap, Jennifer. J.Loros, Patricia J. DeCoursey (ed). 2004, Sinauer Associates, USA. 5. Vinod Kumar (2002) Biological Rhythms: Narosa Publishing House, Delhi/ Springer-Verlag, Germany 6.Agarwal V.K., Animal Behaviour (2013). S. Chand Publishing, New Delhi 		

Course Title : Lab- ANIMAL BEHAVIOUR AND CHRONOBIOLOGY (DSE- Semester V)

Course Code : BSZY551DSP

Scheme of Instruction

Total Duration : 60 Hr

Periods /Week : 4

Credits : 2

Instruction Mode : Lecture /Demonstration

Scheme of Examination

Maximum Score : 50

Internal Evaluation : 15

End Semester : 35

Exam Duration : 3 Hrs

Course Objectives :

Course Outcomes :

Unit	Course Content	Instruction Hours
	<ol style="list-style-type: none">1. To study nests and nesting habits of the birds and social insects.2. To study the behavioural responses of wood lice to dry and humid conditions.3. To study geotaxis behaviour in earthworm.4. To study the phototaxis behaviour in insect larvae.5. Visit to Forest/ Wild life Sanctuary/Biodiversity Park/Zoological Park to study behavioural activities of animals and prepare a short report.6. Study of circadian functions in humans (daily eating, sleep and temperature patterns).	60Hrs
Examination and Evaluation Pattern :		
Text Books and References :		

Course Title: Animal Biotechnology (DSE-Semester VI)**Course Code: BSZY601DST**

Scheme of Instruction

Total Duration : 60Hr
Periods /Week : 4
Credits : 4
Instruction Mode : Lecture

Scheme of Examination

Maximum Score : 100
Internal Evaluation : 30
End Semester : 70
Exam Duration : 3 Hrs

Course Objectives:

Course Outcomes:

Unit	Course Content	Instruction Hours
1	Animal Cell and Tissue Culture Concept and scope of Biotechnology; Culture media- Natural and Synthetic, Preparation and sterilization . Basic techniques in animal cell culture and organ culture. Primary cell culture, Cell lines, stem cells, Cryopreservation of cultures.	15
2	Molecular Techniques in Gene manipulation Cloning vectors: Plasmids, Cosmids, Phagemids, Lambda Bacteriophage, M13, BAC, YAC, MAC and Expression vectors (characteristics) Restriction enzymes: Nomenclature, detailed study of Type II. Transformation techniques: Calcium chloride method and electroporation. Construction of genomic and cDNA libraries and screening by colony and plaque hybridization Southern, Northern and Western blotting; DNA sequencing: Sanger method, Polymerase Chain Reaction, DNA Finger Printing and DNA micro array	15
3	Genetically Modified Animals Production of cloned and transgenic animals: Nuclear Transplantation, Retroviral Method, DNA microinjection Applications of transgenic animals: Production of pharmaceuticals, production of donor organs, knockout mice. Production of transgenic plants: Agrobacterium mediated transformation. Applications of transgenic plants: insect and herbicide resistant plants.	15
4	Applications in Human Health Molecular diagnosis of genetic diseases (Cystic fibrosis, Sickle cell anaemia); Expressing cloned genes in mammalian cells, Recombinant DNA in medicines: Recombinant insulin and human growth Hormone, An over view on Gene therapy, stem cell therapy, Bio safety and ethical issues.	15

Examination and Evaluation Pattern :

Text Books and References :

1. Brown, T.A. (1998). Molecular Biology Labfax II: Gene Cloning and DNA Analysis. II Edition, Academic Press, California, USA.
2. Glick, B.R. and Pasternak, J.J. (2009). Molecular Biotechnology - Principles and applications of Recombinant DNA. IV Edition, ASM press, Washington, USA.
3. Griffiths, A.J.F., J.H. Miller, Suzuki, D.T., Lewontin, R.C. and Gelbart, W.M. (2009). An Introduction to Genetic Analysis. IX Edition. Freeman and Co., N.Y., USA.
4. Snustad, D.P. and Simmons, M.J. (2009). Principles of Genetics. V Edition, John Wiley and Sons Inc.
5. Watson, J.D., Myers, R.M., Caudy, A. and Witkowski, J.K. (2007). Recombinant DNAGenes and Genomes- A Short Course. III Edition, Freeman and Co., N.Y., USA.
6. Beauchamp, T.I. and Childress, J.F. (2008). Principles of Biomedical Ethics. VI Edition, Oxford University Press.
7. Kumaresan, V (2014). Animal Biotechnology. Saras Publications
8. Singh, B. & Gautam, S.K. (2013). Textbook of Animal Biotechnology Paperback. The Energy and Resources Institute, TERI

Course Title: Lab- Animal Biotechnology (DSE-Semester VI)

Course Code: BSZY650DSP

Scheme of Instruction

Total Duration : 60 Hr

Periods /Week : 4

Credits : 2

Instruction Mode : Lecture /Demonstration

Scheme of Examination

Maximum Score : 50

Internal Evaluation : 15

End Semester : 35

Exam Duration : 3 Hrs

Course Objectives:

Course Outcomes:

Unit	Course Content	Instruction Hours
	<ol style="list-style-type: none">1. Genomic DNA isolation from E. coli2. Restriction digestion of plasmid DNA/genomic DNA.3. PCR for cloning a DNA segment4. Construction of circular and linear restriction map from the data provided.5. Calculation of transformation efficiency from the data provided.6. To study following techniques through photographs<ol style="list-style-type: none">a. Southern Blottingb. Northern Blottingc. Western Blottingd. DNA Sequencinge. Sanger's Method), f. DNA fingerprinting	60Hrs
Examination and Evaluation Pattern :		

Course Title : IMMUNOLOGY (DSE-Semester VI)

Course Code : BSZY602CCT

Scheme of Instruction

Total Duration : 60 Hr

Periods /Week : 4

Credits : 4

Instruction Mode : Lecture

Scheme of Examination

Maximum Score : 100

Internal Evaluation : 30

End Semester : 70

Exam Duration : 3 Hrs

Course Objectives:

Course Outcomes:

Unit	Course Content	Instruction Hours
1	Introduction: Historical background, general concepts of the immune system. Innate Immunity (Concept of anatomical, physiological, phagocytic and inflammatory barriers); Adaptive immunity; Characteristics and cooperation between lymphocytes and antigen-presenting cells (T and B lymphocytes, antigen-presenting cells), Basic mechanism of Humoral and cell mediated immunity (Cell types-CTLs, NK cells, macrophages and TDTH cells); Humoral immune response, primary and secondary immune response (T & B cell response), generation of plasma and memory B cells. T & B cells maturation in thymus and bone marrow. Active vs Passive immunity; Passive immunization vs. vaccination. Inflammation - general properties.	15
2	Structure, properties and functions of the immune cells, tissues & organs: Hematopoiesis, Immune system cells- Lymphoid cells:T-lymphocytes and B-lymphocytes, Natural killer cells (NK cells); Monocytes and Macrophages; Neutrophils, Eosinophils, and Basophils, Mast cells and Dendritic cells. Primary and Secondary lymphoid organs Structure and functions (Bone-marrow, Spleen,Thymus and Lymph nodes, MALT, GALT and CALT). Functions of the immune system. Immune dysfunction and its consequences e.g. Allergy, Asthma, Graft rejection, Autoimmune diseases with examples, Organ specific immune diseases with examples. Immunodeficiency. Hypersensitivity: Elementary concept of immediate and delayed-type hypersensitivity.	15
3	Concept of Immunogenicity/Antigenicity. Characteristics and types of antigens (Foreignness, molecular size, heterogeneity) T-dependent and T- independent antigens; Antigenic determinants (epitopes- B and T cell); Adjuvants & Haptens. Immunoglobulins: Molecular structure, classification and functions of antibodies; Isotypes of antibodies (IgG, IgM, IgE, IgA). Antigen-antibody reactions - Precipitation reaction, Agglutination reaction, Polyclonal vs monoclonal antibodies and production of monoclonal	15

	antibodies by hybridoma technology and applications of monoclonal antibodies.	
4	Cytokines- properties and functions of Th1 and Th2. Complement system: Basic concepts of complement cascades, classical, alternative and MBL pathways, implications of complement system in immune defences. Biological consequence of complement activation. Structure and functions of Major Histocompatibility Complex (MHC) proteins (class I, class- II), exogenous and endogenous pathways of antigen presentation and processing Antigen presenting cells, antigen processing and presentation pathway.	15
Examination and Evaluation Pattern :		
Text Books and References :		
<ol style="list-style-type: none"> 1. Khan, F.H. (2009). The elements of Immunology. Pearson Education India 2. Abbas, A.K., Andrew H. H. Lichtman, and Shiv Pillai (2017). Cellular and Molecular immunology. Elsevier 3. Peter J. Delves, Seamus J. Marti, Dennis R. Burton, Ivan M. Roitt. (2017). Roitt' s Essential Immunology. Wiley-Blackwell 4. Thomas J. Kindt, Barbara A. Osborne, and Richard Goldsby (2006). Kuby Immunology. W. H. Freeman 5. Ramesh (2016). Immunology. McGraw Hill Education India Private Limited 		

Course Title : Lab- IMMUNOLOGY (DSE-Semester VI)

Course Code : BSZY651CCP

Scheme of Instruction

Total Duration : 60 Hr

Periods /Week : 4

Credits : 2

Instruction Mode : Lecture/Demonstration

Scheme of Examination

Maximum Score : 50

Internal Evaluation : 15

End Semester : 35

Exam Duration : 3 Hrs

Course Objectives :

Course Outcomes :

Unit	Course Content	Instruction Hours
	<ol style="list-style-type: none">1. Demonstration of lymphoid organs in farm bred animals.2. Histological study of spleen, thymus and lymph nodes through slides/ photographs.3. Preparation of stained blood film to study various types of blood cells. To perform differential leukocyte count of the blood sample.4. To separate serum from the blood sample.5. To perform immunodiffusion by Ouchterlony method.6. Agglutination test to show antigen-antibodyreaction.7. Cell counting and viability test from splenocytes of farm bred animals/cell lines. To perform8. Demonstration of a) ELISA b) Immunoelectrophoresis .	60Hrs
Examination and Evaluation Pattern :		
Text Books and References :		