

Controller of Examinations
SAMBALPUR UNIVERSITY
JYOTI VIHAR, BURLA
Sambalpur (Odisha), PIN- 768 019



PHONE and Fax:0663-2430806
e-mail: coesuniv@gmail.com

Urgent

(Both by post and by e- mail)

No. 7782 / Acd.-I

Dated: 26/10/16

To

The Principals,

(All the Affiliated Colleges under Sambalpur University having
Three Year Degree Courses excluding Autonomous Colleges.)

Sub: Syllabus & Implementation of CBCS pattern Arts/Science/Commerce (Pass and
Hons.) from the Academic Session 2016-17.

Ref :- This office letter No 5314/ Acd.-I dated 21.7.16 and letter No. 5970/Acd.-I
dated 8.8.16.

Sir,

In continuation to the letters and the subject cited above, I am directed to intimate you that the Vice- Chancellor has been pleased to approve the syllabus for Courses / papers related to **Zoology** for CBCS + 3 courses degree B.Sc. (Both Pass & Hons.) examinations under 6 (15) of O.U. Act -1989 giving it effect from the Academic Session, 2016-17. The detail Courses of Studies is enclosed herewith for your reference and necessary action.

This may kindly be noted that it is the final syllabus for Zoology subject/ papers under CBCS pattern. It may be made available to teachers and students concerned. Further you are requested to ensure teaching of the courses in your colleges accordingly.

Any error and omission etc. may kindly be intimated to this office.

. Any queries on the matter may be made through e-mail: coesuniv@gmail.com.
Thanking you,

Yours faithfully,

Encl: *As above*

J.K. Up
26/10/16
Controller of Examinations
Blair

P.T.O.

Memo No. 7783 /Acad.-I(BOS),

dtd. 26/10/16

Copy forwarded with enclosure for information and necessary action to:

1. The Chairman, Post Graduate Council, Sambalpur University.
2. The H.O.D., P.G. Department of *Life Sciences*, Sambalpur University.
3. The Director, College Development Council, Sambalpur University.
4. The Director, Directorate of Distance and Continuing Education, Sambalpur University.
5. The Co-ordinator, Private Examination Cell, Sambalpur University.
6. Asst. Registrar (Examination), Sambalpur University.
7. Programmer, University Computer Unit, Sambalpur University.
8. Asst. Controller of Examinations, Sambalpur University.
9. Section Officer / Assistant –in- Charge, *e – Governance Cell*, Sambalpur University with request to provide all the materials in the official web- site accordingly. (as + 3 cbcs- syllabus – *Zoology –Final*)
10. Section Officers, Computer Unit, E.G.-I, EG-II, E.C-I, EC-II, EC-VI Sections.
11. Five spare Copies for Academic-I Sections with enclosure.

Memo No. 7784 /Acad.-I(BOS),

dtd. 26/10/16

Copy forwarded without enclosure for information and necessary action to:

1. *The Dy. Director, e – Governance Cell*, Sambalpur University with request for needful to provide all the materials in the official web- site accordingly .
2. P.A. to the Vice- Chancellor, Sambalpur University.
3. P.A. to the Registrar, Sambalpur University.
4. P.A. to the Controller of Examinations, Sambalpur University.

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(23)

PASS COURSES AT A GLANCE
SUBJECT: ZOOLOGY

DISCIPLINE SPECIFIC CORE-4 PAPERS

Number	Semester	Title of the Course	Credit	
			Theo ry	Prac/ Tuto
DSC-P-ZOO-1	1 st	Animal Diversity	4	2
DSC-P-ZOO-2	2 nd	Comparative Anatomy and Developmental Biology of Vertebrates	4	2
DSC-P-ZOO-3	3 rd	Physiology and Biochemistry	4	2
DSC-P-ZOO-4	4 th	Genetics and Evolutionary Biology	4	2

DISCIPLINE SPECIFIC ELECTIVE-2 PAPERS

Number	Semester	Title of the Course	Credit	
			Theo ry	Prac/ Tuto
DSE-P-ZOO-1	5 th	Aquatic Biology	4	2
DSE-P-ZOO-2	6 th	Immunology	4	2

SKIL ENHANCEMENT COURSES-LIST-A (Any 1 paper)

Number	Semester	Title of the Course	Credit	
			Theory	
SEC-P-ZOO-1	3 rd /4 th /5 th	Apiculture	2	
SEC-P-ZOO-2	3 rd /4 th /5 th	Sericulture	2	

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**CORE COURSE I
ANIMAL DIVERSITY**

THEORY	(CREDITS 4)
Unit 1: Kingdom Protista General characters and classification up to classes; Locomotory Organelles and locomotion in Protozoa	4
Unit 2: Phylum Porifera General characters and classification up to classes; Canal System in <i>Sycon</i>	3
Unit 3: Phylum Cnidaria General characters and classification up to classes; Polymorphism in Hydrozoa	3
Unit 4: Phylum Platyhelminthes General characters and classification up to classes; Life history of <i>Taenia solium</i>	3
Unit 5: Phylum Nemathelminthes General characters and classification up to classes; Life history of <i>Ascaris lumbricoides</i> and its parasitic adaptations	5
Unit 6: Phylum Annelida General characters and classification up to classes; Metamerism in Annelida	3
Unit 7: Phylum Arthropoda General characters and classification up to classes; Vision in Arthropoda, Metamorphosis in Insects	5
Unit 8: Phylum Mollusca General characters and classification up to classes; Torsion in gastropods	4
Unit 9: Phylum Echinodermata General characters and classification up to classes; Water-vascular system in Asteroidea	4
Unit 10: Protochordates General features and Phylogeny of Protochordata	2
Unit 11: Agnatha General features of Agnatha and classification of cyclostomes up to classes	2
Unit 12: Pisces General features and Classification up to orders; Osmoregulation in Fishes	4
Unit 13: Amphibia General features and Classification up to orders; Parental care	4
Unit 14: Reptiles General features and Classification up to orders; Poisonous and non-poisonous snakes, Biting mechanism in snakes	4
Unit 15: Aves General features and Classification up to orders; Flight adaptations in birds	5
Unit 17: Mammals Classification up to orders; Origin of mammals	5

ANIMAL DIVERSITY

PRACTICAL

(CREDITS 2)

1. Study of the following specimens:

Amoeba, Euglena, Plasmodium, Paramecium, Sycon, Hyalonema, and Euplectella, Obelia, Physalia, Aurelia, Tubipora, Metridium, Taenia solium, Male and female Ascaris lumbricoides, Aphrodite, Nereis, Pheretima, Hirudinaria, Palaemon, Cancer, Limulus, Palamnaeus, Scolopendra, Julus, Periplaneta, Apis, Chiton, Dentalium, Pila, Unio, Loligo, Sepia, Octopus, Pentaceros, Ophiura, Echinus, Cucumaria and Antedon, Balanoglossus, Herdmania, Branchiostoma, Petromyzon, Sphyrna, Pristis, Torpedo, Labeo, Exocoetus, Anguilla, Ichthyophis/Ureotyphlus, Salamandra, Bufo, Hyla, Chelone, Hemidactylus, Chamaeleon, Draco, Vipera, Naja, Crocodylus, Gavialis, Any six common birds from different orders, Sorex, Bat, Funambulus, Loris

2. Study of the following permanent slides:

T.S. and L.S. of *Sycon*, Study of life history stages of *Taenia*, T.S. of Male and female *Ascaris*

3. Key for Identification of poisonous and non-poisonous snakes

SUGGESTED READINGS

- Ruppert and Barnes, R.D. (2006). *Invertebrate Zoology*, VIII Edition. Holt Saunders International Edition.
- Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). *The Invertebrates: A New Synthesis*, III Edition, Blackwell Science
- Young, J. Z. (2004). *The Life of Vertebrates*. III Edition. Oxford university press.
- Pough H. *Vertebrate life*, VIII Edition, Pearson International.
- Hall B.K. and Hallgrimsson B. (2008). *Strickberger's Evolution*. IV Edition. Jones and Bartlett Publishers Inc.
- Parker and Haswell

CORE COURSE II

COMPARATIVE ANATOMY AND DEVELOPMENTAL BIOLOGY OF VERTEBRATES

THEORY	(CREDITS 4)
Unit 1: Integumentary System Derivatives of integument w.r.t. glands and digital tips	4
Unit 2: Skeletal System Evolution of visceral arches	3
Unit 3: Digestive System Brief account of alimentary canal and digestive glands	4
Unit 4: Respiratory System Brief account of Gills, lungs, air sacs and swim bladder	5
Unit 5: Circulatory System Evolution of heart and aortic arches	4
Unit 6: Urinogenital System Succession of kidney, Evolution of urinogenital ducts	4
Unit 7: Nervous System Comparative account of brain	3
Unit 8: Sense Organs Types of receptors	3
Unit 9: Early Embryonic Development of frog Gametogenesis: Spermatogenesis and oogenesis w.r.t. mammals, vitellogenesis in birds; Fertilization: external (amphibians), internal (mammals), blocks to polyspermy; Early development of frog and humans (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; Neurulation in frog embryo.	12
Unit 10: Late Embryonic Development Implantation of embryo in humans, Formation of human placenta and functions, other types of placenta on the basis of histology; Metamorphic events in frog life cycle and its hormonal regulation.	10
Unit 11: Control of Development Fundamental processes in development (brief idea) – Gene activation, determination, induction, Differentiation, morphogenesis, intercellular communication, cell movements and cell death	8

(3)

COMPARATIVE ANATOMY AND DEVELOPMENTAL BIOLOGY OF VERTEBRATES

PRACTICAL

(CREDITS 2)

1. Osteology:

- a) Disarticulated skeleton of fowl and rabbit
- b) Carapace and plastron of turtle /tortoise
- c) Mammalian skulls: One herbivorous and one carnivorous animal.

2. 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.

3. Study of the different types of placenta- histological sections through permanent slides or photomicrographs.

4. Study of placental development in humans by ultrasound scans.

5. Examination of gametes - frog/rat - sperm and ova through permanent slides or photomicrographs.

SUGGESTED READINGS

- Kardong, K.V. (2005) *Vertebrates' Comparative Anatomy, Function and Evolution*. IV Edition. McGraw-Hill Higher Education.
- Kent, G.C. and Carr R.K. (2000). *Comparative Anatomy of the Vertebrates*. IX Edition. The McGraw-Hill Companies.
- Hilderbrand, M and Gaslow G.E. *Analysis of Vertebrate Structure*, John Wiley and Sons.
- Walter, H.E. and Sayles, L.P; *Biology of Vertebrates*, Khosla Publishing House.
- Gilbert, S. F. (2006). *Developmental Biology*, VIII Edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA.
- Balinsky, B.I. (2008). *An introduction to Embryology*, International Thomson Computer Press.
- Carlson, Bruce M (1996). *Patten's Foundations of Embryology*, McGraw Hill, Inc.
- Weichert
- Chordate embryology by P.C.Jain

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CORE COURSE III
PHYSIOLOGY AND BIOCHEMISTRY

THEORY	(CREDITS 4)
Unit 1: Nerve and muscle	8
Structure of a neuron, Resting membrane potential, Graded potential, Origin of Action potential and its propagation in myelinated and non-myelinated nerve fibres, Ultra-structure of skeletal muscle, Molecular basis of muscle contraction	
Unit 2: Digestion	5
Physiology of digestion; Absorption of carbohydrates, proteins, lipids	
Unit 3: Respiration	5
Pulmonary ventilation, Respiratory volumes and capacities, Transport of Oxygen and carbon dioxide in blood	
Unit 4: Excretion	5
Structure of nephron, Mechanism of Urine formation, Counter-current Mechanism	
Unit 5: Cardiovascular system	6
Composition of blood, Hemostasis, Structure of Heart, Origin and conduction of the cardiac impulse, Cardiac cycle	
Unit 6: Reproduction and Endocrine Glands	7
Physiology of male reproduction: hormonal control of spermatogenesis; Physiology of female reproduction: hormonal control of menstrual cycle Structure and function of pituitary, thyroid, Parathyroid, pancreas and adrenal Mechanism of hormone action.	
Unit 7: Carbohydrate Metabolism	8
Glycolysis, Krebs Cycle, Pentose phosphate pathway, Gluconeogenesis, Glycogen metabolism, Review of electron transport chain	
Unit 8: Lipid Metabolism	5
Biosynthesis and β oxidation.	
Unit 9: Protein metabolism	5
Transamination, Deamination and Urea Cycle	
Unit 10: Enzymes	6
Introduction, Mechanism of action, Enzyme Kinetics, Inhibition and Regulation	

30

PHYSIOLOGY AND BIOCHEMISTRY

PRACTICAL

(CREDITS 2)

1. Preparation of hemin and hemochromogen crystals
2. Study of permanent histological sections of mammalian pituitary, thyroid, pancreas, adrenal gland
3. Study of permanent slides of spinal cord, duodenum, liver, lung, kidney, bone, cartilage
4. Qualitative tests to identify functional groups of carbohydrates in given solutions (Glucose,

Fructose, Sucrose, Lactose)

2. Estimation of total protein in given solutions by Lowry's method.

3. Study of activity of salivary amylase under optimum conditions

SUGGESTED READINGS

- 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.
- Laurell Sheerwood: *Essentials of Physiology*
- Schulte and Moyes: *Animal Physiology*

**CORE COURSE IV
GENETICS AND EVOLUTIONARY BIOLOGY**

THEORY	(CREDITS 4)
Unit 1: Introduction to Genetics	3
Mendel's work on transmission of traits, Genetic Variation, DNA is a genetic material.	
Unit 2: Mendelian Genetics and its Extension	8
Principles of Inheritance, Chromosome theory of inheritance, Incomplete dominance and co-dominance, Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, sex linked inheritance, extra-chromosomal inheritance	
Unit 3: Linkage, Crossing Over and Chromosomal mapping	9
Linkage and crossing over, 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	
Unit 4: Mutations	7
Chromosomal Mutations: Deletion, Duplication, Inversion, Translocation, Aneuploidy and Polyploidy; Gene mutations: Induced versus Spontaneous mutations, Back versus Suppressor mutations,	
Unit 5: Sex Determination	4
Chromosomal mechanisms (Drosophila and Human), dosage compensation	
Unit 6: History of Life	2
Major Events in History of Life	
Unit 7: Introduction to Evolutionary Theories	5
Lamarckism, Darwinism, Neo-Darwinism	
Unit 8: Direct Evidences of Evolution	5
Types of fossils, Incompleteness of fossil record, Dating of fossils, Phylogeny of horse	
Unit 9: Processes of Evolutionary Change	9
Organic variations; Isolating Mechanisms; Natural selection (Example: Industrial melanism); Types of natural selection, Artificial selection	
Unit 10: Species Concept	6
Biological species concept; Modes of speciation (Allopatric, Sympatric)	
Unit 11: Macro-evolution	5
Macro-evolutionary Principles (example: Darwin's Finches)	
Unit 12: Extinction	6
Mass extinction (Causes, Names of five major extinctions, K-T extinction in detail), Role of extinction in evolution	

GENETICS AND EVOLUTIONARY BIOLOGY

PRACTICAL

(CREDITS 2)

1. Study of Mendelian Inheritance and gene interactions (Non Mendelian Inheritance) using suitable examples. Verify the results using Chi-square test.
2. Study of Linkage, recombination, gene mapping using the data.
3. Study of Human Karyotypes (normal and abnormal).
4. Study of fossil evidences from plaster cast models and pictures
5. Study of homology and analogy from suitable specimens/ pictures
6. 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 species
7. Visit to Natural History Museum and submission of report

SUGGESTED READINGS

- Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). *Principles of Genetics*. VIII Edition. Wiley India.
- Snustad, D.P., Simmons, M.J. (2009). *Principles of Genetics*. V Edition. John Wiley and Sons Inc.
- Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). *Concepts of Genetics*. X Edition. Benjamin Cummings.
- Russell, P. J. (2009). *Genetics- A Molecular Approach*. Benjamin Cummings.
- Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. *Introduction to Genetic Analysis*. IX Edition. W. H. Freeman and Co.
- 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 Hallgrimsson, B. (2008). *Evolution*. IV Edition. Jones and Bartlett Publishers
- Campbell, N. A. and Reece J. B. (2011). *Biology*. IX Edition, Pearson, Benjamin, Cummings.
- Douglas, J. Futuyma (1997). *Evolutionary Biology*. Sinauer Associates.

Signature

DISCIPLINE CENTRIC ELECTIVE COURSES

DSE 1

AQUATIC BIOLOGY

THEORY (Credits 4)

UNIT 1: Aquatic Biomes

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: 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

Salinity and density of Sea water, Continental shelf, Adaptations of deep sea organisms, Coral reefs, Sea weeds.

UNIT 4: Management of Aquatic Resources

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

PRACTICAL

(Credits 2)

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 Turbidity/transparency, Dissolved Oxygen, Free Carbon dioxide, Alkalinity (carbonates & bicarbonates) in water collected from a nearby lake/ water body.
4. Instruments used in limnology (Secchi disc, Van Dorn Bottle, Conductivity & Turbidity meter, PONAR grab sampler) and their significance.
5. Project Report on visit to Sewage treatment plant/Marine bio-reserve/Fisheries Institutes.

SUGGESTED READINGS

- **Anathakrishnan** : Bioresources Ecology 3rd Edition
- **Goldman** : Limnology, 2nd Edition
- **Odum and Barrett** : Fundamentals of Ecology, 5th Edition
- **Pawlowski** : Physicochemical Methods for Water and Wastewater Treatment, 1st Edition
- **Wetzel** : Limnology, 3rd edition
- **Trivedi and Goyal** : Chemical and biological methods for water pollution studies
- **Welch** : Limnology Vols. I-II
- **P. Michael**: Ecological Method.

DSE-2
IMMUNOLOGY

THEORY	(CREDITS 4)
Unit 1: Overview of the Immune System	10
Introduction to basic concepts in immunology, components of immune system, principles of innate and adaptive immune system	
Unit 2: Cells and Organs of the Immune System	8
Haematopoeisis, Cells of immune system and organs (primary and secondary lymphoid organs) of the immune system	
Unit 3: Antigens	8
Basic properties of antigens, B and T cell epitopes, haptens and adjuvants	
Unit 4: Antibodies	8
Structure, classes and function of antibodies, monoclonal antibodies, antigen antibody interactions as tools for research and diagnosis	
Unit 5: Working of the immune system	12
Structure and functions of MHC, exogenous and endogenous pathways of antigen presentation and processing, Basic properties and functions of cytokines, Complement system: Components and pathways.	
Unit 6: Immune system in health and disease	10
Gell and Coombs' classification and brief description of various types of hypersensitivities, Autoimmunity and immunodeficiency	
Unit 7: Vaccines	4
Types of vaccines	

IMMUNOLOGY

PRACTICAL	(CREDITS 2)
1. Estimation of WBC & RBC count, haemoglobin and DC.	
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.	
4. ABO blood group determination.	
5. Demonstration of ELISA and Immunoelectrophoresis.	

SUGGESTED READINGS

- Kindt, T. J., Goldsby, R.A., Osborne, B. A. and Kuby, J (2006). *Immunology*, VI Edition. W.H. Freeman and Company.
- David, M., Jonathan, B., David, R. B. and Ivan R. (2006). *Immunology*, VII Edition, Mosby, Elsevier Publication.
- Abbas, K. Abul and Lechtman H. Andrew (2003.) *Cellular and Molecular Immunology*. V Edition. Saunders Publication.

SKILL ENHANCEMENT COURSES

SEC 1 APICULTURE

(CREDITS 2)

Unit 1: Biology of Bees

(4)

History, Classification and Biology of Honey Bees
Social Organization of Bee Colony

Unit 2: Rearing of Bees

(10)

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

(5)

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

Unit 5: Entrepreneurship in Apiculture

(4)

Bee Keeping Industry – Recent Efforts, Modern Methods in employing artificial
Beehives for cross pollination in horticultural gardens

SUGGESTED READINGS

- Prost, P. J. (1962). *Apiculture*. Oxford and IBH, New Delhi.
- Bisht D.S., *Apiculture*, ICAR Publication.
- Singh S., *Beekeeping in India*, Indian council of Agricultural Research, New Delhi.

SEC-2
SERICULTURE

(CREDITS 2)

Unit 1: Introduction

(3)

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

(3)

Life cycle of *Bombyx mori*
Structure of silk gland and secretion of silk

Unit 3: Rearing of Silkworms

(13)

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, harvesting and storage of cocoons

Unit 4: Pests and Diseases

(4)

Pests of silkworm: Uzi fly, dermestic beetles and vertebrates
Pathogenesis of silkworm diseases: Protozoan, viral, fungal and bacterial
Control and prevention of pests and diseases

Unit 5: Entrepreneurship in Sericulture

(2)

Prospectus of Sericulture in India: Sericulture industry in different states, employment, potential in mulberry and non-mulberry sericulture. Visit to various sericulture centers.

SUGGESTED READINGS

- Handbook of Practical Sericulture: S.R. Ullal and M.N. Narasimhanna CSB, Bangalore
- Appropriate Sericultural Techniques; Ed. M. S. Jolly, Director, CSR & TI, Mysore.
- Handbook of Silkworm Rearing: Agriculture and Technical Manual-1, Fuzi Pub. Co. Ltd., Tokyo, Japan 1972.
- Manual of Silkworm Egg Production; M. N. Narasimhanna, CSB, Bangalore 1988.
- Silkworm Rearing; Wupang—Chun and Chen Da-Chung, Pub. By FAO, Rome 1988.
- A Guide for Bivoltine Sericulture; K. Sengupta, Director, CSR & TI, Mysore 1989.
- Improved Method of Rearing Young age silkworm; S. Krishnaswamy, reprinted CSB, Bangalore, 1986.

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HONOURS COURSES AT A GLANCE

SUBJECT: Zoology

DISCIPLINE SPECIFIC CORE (14 PAPERS)

Number	Semester	Title of the Course	Credit	
			Theory	Prac/Tuto
DSC-H-Z00-1	1 st	Non-chordates I: Protista to Pseudocoelomates	4	2
DSC-H-Z00-2		Perspectives in Ecology	4	2
DSC-H-Z00-3	2 nd	Non-chordates II: Coelomates	4	2
DSC-H-Z00-4		Cell Biology	4	2
DSC-H-Z00-5	3 rd	Diversity of Chordates	4	2
DSC-H-Z00-6		Physiology: Controlling and Coordinating	4	2
DSC-H-Z00-7		Fundamentals of Biochemistry	4	2
DSC-H-Z00-8	4 th	Comparative Anatomy of Vertebrates	4	2
DSC-H-Z00-9		Physiology: Life Sustaining Systems	4	2
DSC-H-Z00-10		Biochemistry of Metabolic Processes	4	2
DSC-H-Z00-11	5 th	Molecular Biology	4	2
DSC-H-Z00-12		Principles of Genetics	4	2
DSC-H-Z00-13	6 th	Developmental Biology	4	2
DSC-H-Z00-14		Evolutionary Biology	4	2

DISCIPLINE SPECIFIC ELECTIVE (4 PAPERS)

Number	Semester	Title of the Course	Credit	
			Theory	Prac/Tuto
DSE-H-Z00-1	5 th	Animal Behaviour and Chronobiology	4	2
DSE-H-Z00-2		Fish and Fishries	4	2
DSE-H-Z00-3	6 th	Immunology	4	2
DSE-H-Z00-4		Wild life conservation and Management	4	2

GENERIC ELECTIVE (4 PAPERS)

Number	Semester	Title of the Course	Credit	
			Theory	Prac/Tuto
GE-H-Z00-1	1 st	Human Physiology	4	2
GE-H-Z00-2	2 nd	Environment and Public Health	4	2
GE-H-Z00-3	3 rd	Aquatic Biology	4	2
GE-H-Z00-4	4 th	Food Nutrition and Health	4	2

SKIL ENHANCEMENT COURSES-LIST-A (Any 1 paper)

Number	Semester	Title of the Course	Credit	
			Theory	
SEC-H-Z00-1	3 rd	Apiculture	2	
SEC-H-Z00-2	3 rd	Sericulture	2	

CORE COURSE I
NON-CHORDATES I: PROTISTS TO PSEUDOCOELOMATES

THEORY	(Credits 4)
Unit 1: Protista, Parazoa and Metazoa	19
General characteristics and Classification up to classes of protozoa.	
Life cycle and pathogenicity of <i>Plasmodium vivax</i> and <i>Entamoeba histolytica</i>	
Reproduction in Protista	
Unit 2: Porifera	7
General characteristics and Classification up to classes	
Canal system and spicules in sponges	1
Unit 3: Cnidaria	2
General characteristics and Classification up to classes	
Polymorphism in Cnidaria	
Coral reefs	
Unit 4: Ctenophora	4
General characteristics and Evolutionary significance	1
Unit 5: Platyhelminthes	0
General characteristics and Classification up to classes	
Life cycle and pathogenicity of <i>Fasciola hepatica</i> and <i>Taenia solium</i>	
Unit 6: Nematelminthes	8
General characteristics and Classification up to classes	
Life cycle, and pathogenicity of <i>Ascaris lumbricoides</i> and <i>Wuchereria bancrofti</i>	
Parasitic adaptations in helminthes	

NON-CHORDATES I: PROTISTS TO PSEUDOCOELOMATES

PRACTICALS	(Credits 2)
1. Study of whole mount of <i>Euglena</i> , <i>Amoeba</i> and <i>Paramecium</i> , Binary fission and Conjugation in <i>Paramecium</i>	
2. Examination of pond water collected from different places for diversity in protista	
3. Study of <i>Sycon</i> (T.S. and L.S.), <i>Hyalonema</i> , <i>Euplectella</i> , <i>Spongilla</i>	
4. Study of <i>Obelia</i> , <i>Physalia</i> , <i>Millepora</i> , <i>Aurelia</i> , <i>Tubipora</i> , <i>Corallium</i> , <i>Alcyonium</i> , <i>Gorgonia</i> , <i>Metridium</i> , <i>Pennatula</i> , <i>Fungia</i> , <i>Meandrina</i> , <i>Madrepora</i>	
5. One specimen/slide of any ctenophore	
6. Study of adult <i>Fasciola hepatica</i> , <i>Taenia solium</i> and their life cycles (Slides/micro-photographs)	
7. Study of adult <i>Ascaris lumbricoides</i> and its life stages (Slides/micro-photographs)	
8. To submit a Project Report on any related topic on life cycles/coral/ coral reefs.	

SUGGESTED READINGS

- Ruppert and Barnes, R.D. (2006). *Invertebrate Zoology*, VIII Edition. Holt Saunders International Edition.
- Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). *The Invertebrates: A New Synthesis*, III Edition, Blackwell Science
- Barrington, E.J.W. (1979). *Invertebrate Structure and Functions*. II Edition, E.L.B.S. and Nelson.
- Hyman series. Invertebrates
- Parker and Haswel. Text Book of Zoology (Vol.I).

**CORE COURSE II
PRINCIPLES OF ECOLOGY**

THEORY	(Credits 4)
Unit 1: Introduction to Ecology	6
History of ecology, Autecology and synecology, Levels of organization, Laws of limiting factors, Study of physical factors (Light and Temperature)	
Unit 2: Population	24
Unitary and Modular populations	
Unique and group attributes of population: Density, natality, mortality, life tables, fecundity tables, survivorship curves, age ratio, sex ratio, dispersal and dispersion Exponential and logistic growth, equation and patterns, r and K strategies, Population interactions, Gause's Principle with laboratory and field examples, Competition and Predation, symbiosis, parasitism, mutualism	
Unit 3: Community	12
Community characteristics: species richness, dominance, diversity, abundance, vertical stratification, Ecotone and edge effect; Ecological succession with one example	
Unit 4: Ecosystem	14
Types of ecosystems with one 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, Nutrient and biogeochemical cycle with example of Nitrogen & Carbon cycle.	
Unit 5: Applied Ecology	4
Ecology in Wildlife Conservation and Management	

PRINCIPLES OF ECOLOGY

PRACTICALS **(Credits 2)**

1. Study of life tables and plotting of survivorship curves of different types from the hypothetical/real data provided
2. Determination of population density in a natural/hypothetical community by quadrat method and calculation of Shannon-Weiner diversity index for the same community
3. Study of an aquatic ecosystem: Phytoplankton and zooplankton, Measurement of area, temperature, turbidity/penetration of light, determination of pH, and Dissolved Oxygen content (Winkler's method), Chemical Oxygen Demand and free CO₂
4. Report on a visit to National Park/Biodiversity Park/Wild life sanctuary

SUGGESTED READINGS

- Colinvaux, P. A. (1993). Ecology. II Edition. Wiley, John and Sons, Inc.
- Krebs, C. J. (2001). Ecology. VI Edition. Benjamin Cummings.
- Odum, E.P., (2008). Fundamentals of Ecology. Indian Edition. Brooks/Cole
- Robert Leo Smith Ecology and field biology Harper and Row publisher
- Ricklefs, R.E., (2000). Ecology. V Edition. Chiron Pres

**CORE COURSE III
NON-CHORDATES II: COELOMATES**

THEORY	(Credits 4)
Unit 1: Introduction to Coelomates	2
Evolution of coelom and metamerism	
Unit 2: Annelida	10
General characteristics and Classification up to classes	
Excretion in Annelida	
Unit 3: Arthropoda	17
General characteristics and Classification up to classes	
Respiration in Arthropoda	
Metamorphosis in Insects	
Social life in bees and termites	
Unit 4: Onychophora	4
General characteristics and Evolutionary significance	
Unit 5: Mollusca	
General characteristics and Classification up to classes	
Respiration in Mollusca	
Torsion and detorsion in Gastropoda	
Pearl formation in bivalves	
Evolutionary significance of trochophore larva	
Unit 6: Echinodermata	12
General characteristics and Classification up to classes	
Water-vascular system in Asteroidea	
Larval forms in Echinodermata	
Affinities with Chordates	

NON-CHORDATES II: COELOMATES

PRACTICAL	(Credits 2)
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1. Study of following specimens:
Annelids - *Aphrodite*, *Nereis*, *Heteronereis*, *Sabella*, *Serpula*, *Chaetopterus*, *Pheretima*, *Hirudinaria*
Arthropods - *Limulus*, *Palamnaeus*, *Palaemon*, *Daphnia*, *Balanus*, *Sacculina*, *Cancer*, *Eupagurus*, *Scolopendra*, *Julus*, *Bombyx*, *Periplaneta*, termites and honey bees
Onychophora - *Peripatus*
Molluscs - *Chiton*, *Dentalium*, *Pila*, *Doris*, *Helix*, *Unio*, *Ostrea*, *Pinctada*, *Sepia*, *Octopus*, *Nautilus*
Echinodermates - *Pentaceros/Asterias*, *Ophiura*, *Clypeaster*, *Echinus*, *Cucumaria* and *Antedon*
2. T.S. through pharynx, gizzard, and typhlosolar intestine of earthworm
3. Demonstration of excretory organs of Annelids through computer model/ photographs.
4. To submit a Project Report on any related topic to larval forms (crustacean, molluscs and echinoderm)

SUGGESTED READINGS

- Ruppert and Barnes, R.D. (2006). *Invertebrate Zoology*, VIII Edition. Holt Saunders International Edition
- Barnes, R.S.K., Calow, P., Olive, P. J. W., Golding, D.W. and Spicer, J.I. (2002). *The Invertebrates: A New Synthesis*, III Edition, Blackwell Science
- Barrington, E.J.W. (1979). *Invertebrate Structure and Functions*. II Edition, E.L.B.S. and Nelson

**CORE COURSE IV
CELL BIOLOGY**

THEORY	(Credits 4)
Unit 1: Overview of Cells	3
Typical animal cell, Cell theory, Differences between Prokaryotic and Eukaryotic cells, General structure of virus, Origin of Eukaryotic cell.	
Unit 2: Plasma Membrane	7
Various models of plasma membrane structure	
Transport across membranes: Active and Passive transport, Facilitated transport	
Cell junctions: Tight junctions, Desmosomes, Gap junctions	
Unit 3: Endomembrane System	10
Structure and Functions: Endoplasmic Reticulum, Golgi Apparatus, Lysosomes	
Unit 4: Mitochondria and Peroxisomes	8
Mitochondria: Structure and function, Semi-autonomous nature, TCA cycle, Mitochondrial Respiratory Chain, Chemi-osmotic hypothesis	
Unit 5: Cytoskeleton	8
Structure and Functions: Microtubules, Microfilaments and Intermediate filaments	
Unit 6: Nucleus	12
Structure of Nucleus: Nuclear envelope, Nuclear pore complex, Nucleolus	
Chromatin: Euchromatin and Hetrochromatin and packaging (nucleosome)	
Unit 7: Cell Division	8
Mitosis, Meiosis, Cell cycle and its regulation	
Unit 8: Cell Signaling	4
GPCR and Role of second messenger (cAMP)	

**CORE COURSE IV
CELL BIOLOGY**

PRACTICAL	(Credits 2)
<ol style="list-style-type: none"> 1. Preparation of temporary stained squash of onion root tip to study various stages of mitosis 2. Study of various stages of meiosis. 3. Preparation of permanent slide to show the presence of Barr body in human female blood cells/cheek cells. 4. Demonstration of permanent slide and/or models: <ol style="list-style-type: none"> i DNA ii RNA iii Proteins, carbohydrate and lipids 	

SUGGESTED READINGS

- Karp, G. (2010). *Cell and Molecular Biology: Concepts and Experiments*. VI Edition. John Wiley and Sons. Inc.
- De Robertis, E.D.P. and De Robertis, E.M.F. (2006). *Cell and Molecular Biology*. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
- Cooper, G.M. and Hausman, R.E. (2009). *The Cell: A Molecular Approach*. V Edition. ASM Press and Sunderland, Washington, D.C.; Sinauer Associates, MA.
- Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009). *The World of the Cell*. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.
- Bruce Albert, Bray Dennis, Levis Julian, Raff Martin, Roberts Keith and Watson James (2008). *Molecular Biology of the Cell*, V Edition, Garland publishing Inc., New York and London.
- Cytology by Cohn.

**CORE COURSE V
DIVERSITY OF CHORDATA**

THEORY	(Credits 4)
Unit 1: Introduction to Chordates	2
General characteristics and outline classification	
Unit 2: Protochordata	8
General characteristics of Hemichordata, Urochordata and Cephalochordata; Study of larval forms in protochordates; Retrogressive metamorphosis in Urochordata	
Unit 3: Origin of Chordata	3
Dipleurula concept and the Echinoderm theory of origin of chordates Advanced features of vertebrates over Protochordata	
Unit 4: Agnatha	2
General characteristics and classification of cyclostomes up to class	
Unit 5: Pisces	8
General characteristics of Chondrichthyes and Osteichthyes, classification up to order Migration, Osmoregulation and Parental care in fishes	
Unit 6: Amphibia	6
Origin of <i>Tetrapoda</i> (Evolution of terrestrial ectotherms); General characteristics and classification up to order; Parental care in Amphibians	
Unit 7: Reptilia	7
General characteristics and classification up to order. Poison apparatus and Biting mechanism in snakes	
Unit 8: Aves	8
General characteristics and classification up to order <i>Archaeopteryx</i> -- a connecting link; Flight adaptations, Migration in birds	
Unit 9: Mammals	8
General characters and classification up to order; Affinities of Prototheria and Metatheria, Adaptive radiation	
Unit 10: Zoogeography	8
Zoogeographical realms, Theories pertaining to distribution of animals, Plate tectonic and Continental drift theory, distribution of vertebrates in different realms	

DIVERSITY OF CHORDATA

PRACTICAL	(Credits 2)
1. Protochordata	
<i>Balanoglossus</i> , <i>Herdmania</i> , <i>Branchiostoma</i> , Colonial Urochordata Sections of <i>Balanoglossus</i> through proboscis and branchiogenital regions, Sections of <i>Amphioxus</i> through pharyngeal, intestinal and caudal regions. Permanent slide of <i>Herdmania</i> spicules	
2. Agnatha	
<i>Petromyzon</i> , <i>Myxine</i>	
3. Fishes	
<i>Scoliodon</i> , <i>Sphyrna</i> , <i>Pristis</i> , <i>Torpedo</i> , <i>Chimaera</i> , <i>Mystus</i> , <i>Heteropneustes</i> , <i>Labeo</i> , <i>Exocoetus</i> , <i>Echeneis</i> , <i>Anguilla</i> , <i>Hippocampus</i> , <i>Tetrodon/ Diodon</i> , <i>Anabas</i> , Flat fish	

4. Amphibia

Ichthyophis/Ureotyphlus, Necturus, Bufo, Hyla, Alytes, Salamandra

5. Reptilia

Chelone, Trionyx, Hemidactylus, Varanus, Uromastix, Chamaeleon, Ophiosaurus, Draco, Bungarus, Vipera, Naja, Hydrophis, Zamenis, Crocodylus, Identification of poisonous and non-poisonous snakes

6. Aves

Study of six common birds from different orders. Types of beaks and claws

7. Mammalia

Sorex, Bat (Insectivorous and Frugivorous), *Funambulus, Loris, Herpestes, Erinaceous*.

Study of scales of fishes and feathers of birds.

Power point presentation on study of any two animals from two different classes by students (may be included if dissections not given permission)

Classification from Young, J. Z. (2004) & Parker and Haswel to be followed.

SUGGESTED READINGS

- Young, J. Z. (2004). *The Life of Vertebrates*. III Edition. Oxford university press.
- Pough H. *Vertebrate life*, VIII Edition, Pearson International.
- Darlington P.J. *The Geographical Distribution of Animals*, R.E. Krieger Pub Co.
- Hall B.K. and Hallgrimsson B. (2008). *Strickberger's Evolution*. IV Edition. Jones and Bartlett Publishers Inc.

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CORE COURSE VI

ANIMAL PHYSIOLOGY: CONTROLLING AND COORDINATING SYSTEMS

THEORY (Credits 4)

Unit 1: Tissues 6

Structure, location, classification and functions of epithelial tissue, connective tissue, muscular tissue and nervous tissue

Unit 2: Bone and Cartilage 4

Structure and types of bones and cartilages, Ossification, bone growth and resorption

Unit 3: Nervous System 10

Structure and function of vertebrate neuron, resting membrane potential, Origin of action potential and its propagation across the nerve fibers;

Types of synapse, Synaptic transmission, Reflex action and its types

Unit 4: Muscle 12

Ultra structure and function of skeletal muscle; Molecular and chemical basis of muscle contraction; Characteristics of muscle twitch; Motor unit, summation and tetanus

Unit 5: Reproductive System 10

Histology of testis and ovary; Physiology of female reproduction; Ovarian cycle.

Unit 6: Endocrine System 18

Endocrine glands - pituitary, thyroid, pancreas and adrenal hormones; Placental hormones. Mechanism of hormone action.

ANIMAL PHYSIOLOGY: CONTROLLING AND COORDINATING SYSTEMS

PRACTICALS (Credits 2)

1. Demonstration of the unconditioned reflex action (Deep tendon reflex such as knee jerk reflex)
2. Study of permanent slides/photographs/computer models of Squamous epithelium, Striated muscle fibres and nerve cells
3. Study of permanent slides of Mammalian skin, Cartilage, Bone, Spinal cord, Nerve cell, Pituitary, Pancreas, Testis, Ovary, Adrenal, Thyroid and Parathyroid
4. Microtomy: Preparation of permanent slide.

SUGGESTED BOOKS

- Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Hecourt Asia PTE Ltd. /W.B. Saunders Company.
- Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI Edition John Wiley & sons
- Victor P. Eroschenko. (2008). diFiore's Atlas of Histology with Functional correlations. XII Edition. Lippincott W. & Wilkins.

**CORE COURSE VII
FUNDAMENTALS OF BIOCHEMISTRY**

THEORY	(CREDITS 4)
Unit 1: Carbohydrates	8
Structure and Biological importance: Monosaccharides, Disaccharides, Polysaccharides and Glycoconjugates	
Unit 2: Lipids	8
Structure and Significance of saturated and unsaturated fatty acids, Tri-acylglycerols, Phospholipids, Glycolipids.	
Unit 3: Proteins	14
Amino acids: Structure, Classification and General properties, Physiological importance of essential and non-essential amino acids	
Proteins: Structure of proteins, Bonds stabilizing protein structure;	
Immunoglobulins: Basic Structure, Classes and Function, Antigenic Determinants	
Unit 4: Nucleic Acids	12
Structure: Purines and pyrimidines, Nucleosides, Nucleotides, Nucleic acids Cot Curves, Types of DNA and RNA	
Unit 5: Enzymes	18
Nomenclature and classification; Cofactors; Specificity of enzyme action; Isozymes; Mechanism of enzyme action; Enzyme kinetics; Factors affecting rate of enzyme-catalyzed reactions; Derivation of Michaelis-Menten equation, Concept of Km and Vmax, Lineweaver-Burk plot; Enzyme inhibition; Allosteric enzyme; Regulation of enzyme action	

FUNDAMENTALS OF BIOCHEMISTRY

PRACTICAL	(CREDITS 2)
1. Qualitative tests of functional groups in carbohydrates, proteins and lipids.	
2. Paper chromatography of amino acids.	
3. Action of salivary amylase under optimum conditions.	
4. Effect of pH, temperature and inhibitors on the action of salivary amylase.	
5. Demonstration of proteins separation by SDS-PAGE.	

SUGGESTED READING

- Cox, M.M and Nelson, D.L. (2008). *Lehninger's Principles of Biochemistry*, V Edition, W.H. Freeman and Co., New York.
- Berg, J.M., Tymoczko, J.L. and Stryer, L. (2007). *Biochemistry*, VI Edition, W.H. Freeman and Co., New York.
- Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. and Well, P.A. (2009). *Harper's Illustrated Biochemistry*, XXVIII Edition, International Edition, The McGraw- Hill Companies Inc.
- Hames, B.D. and Hooper, N.M. (2000). *Instant Notes in Biochemistry*, II Edition, BIOS Scientific Publishers Ltd., U.K.
- Watson, J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M. and Losick, R. (2008). *Molecular Biology of the Gene*, VI Edition, Cold Spring Harbor Lab. Press, Pearson Pub.

**CORE COURSE VIII
COMPARATIVE ANATOMY OF VERTEBRATES**

THEORY	(CREDITS 4)
Unit 1: Integumentary System	8
Structure, functions and derivatives of integument	
Unit 2: Skeletal System	8
Overview of axial and appendicular skeleton, Jaw suspensorium, Visceral arches	
Unit 3: Digestive System	8
Alimentary canal and associated glands	
Unit 4: Respiratory System	8
Skin, gills, lungs and air sacs; Accessory respiratory organs	
Unit 5: Circulatory System	8
Evolution of heart and aortic arches	
Unit 6: Urinogenital System	6
Succession of kidney, Evolution of urinogenital ducts, Types of mammalian uteri	
Unit 7: Nervous System	8
Comparative account of brain Autonomic nervous system, Spinal cord, Cranial nerves in vertebrates	
Unit 8: Sense Organs	6
Classification of receptors, conic and phasic receptors, receptor potential.	

COMPARATIVE ANATOMY OF VERTEBRATES

PRACTICAL	(CREDITS 2)
1. Study of placoid, cycloid and ctenoid scales through permanent slides/photographs	
2. Disarticulated skeleton of Frog, <i>Varanus</i> , Fowl, Rabbit	
3. Carapace and plastron of turtle /tortoise	
4. Mammalian skulls: One herbivorous and one carnivorous animal	
5. Study of structure of any two organs (heart, lung, kidney, eye and ear) from video recording (may be included if dissection not permitted)	
6. Project on skeletal modifications in vertebrates (may be included if dissection not permitted)	

SUGGESTED READINGS

- Kardong, K.V. (2005) *Vertebrates' Comparative Anatomy, Function and Evolution*. IV Edition. McGraw-Hill Higher Education
- Kent, G.C. and Carr R.K. (2000). *Comparative Anatomy of the Vertebrates*. IX Edition. The McGraw-Hill Companies
- Hilderbrand, M and Gaslow G.E. *Analysis of Vertebrate Structure*, John Wiley and Sons
- Walter, H.E. and Sayles, L.P; *Biology of Vertebrates*, Khosla Publishing House

**CORE COURSE IX
ANIMAL PHYSIOLOGY: LIFE SUSTAINING SYSTEMS**

THEORY	(Credits 4)
Unit 1: Physiology of Digestion	14
Structural organization and functions of gastrointestinal tract and associated glands; Mechanical and chemical digestion of food; Absorptions of carbohydrates, lipids, proteins, Hormonal control of secretion of enzymes in Gastrointestinal tract. (Mammal)	
Unit 2: Physiology of Respiration	12
Mechanism of respiration, Pulmonary ventilation; Respiratory volumes and capacities; Transport of oxygen and carbon dioxide in blood; Respiratory pigments, Dissociation curves and the factors influencing it; Carbon monoxide poisoning; Control of respiration. (Mammal)	
Unit 3: Renal Physiology	8
Structure of kidney and its functional unit; Mechanism of urine formation; Regulation of water balance; Regulation of acid-base balance. (Mammal)	
Unit 4: Blood	14
Components of blood and their functions; Structure and functions of haemoglobin Haemostasis: Blood clotting system, Kallikrein-Kininogen system, Complement system & Fibrinolytic system, Haemopoiesis Blood groups: Rh factor, ABO and MN. (Mammal)	
Unit 5: Physiology of Heart	12
Structure of mammalian heart; Coronary circulation; Structure and working of conducting myocardial fibers. Origin and conduction of cardiac impulses Cardiac cycle; Cardiac output and its regulation, Frank-Starling Law of the heart, nervous and chemical regulation of heart rate. Electrocardiogram, Blood pressure and its regulation. (Mammal)	

ANIMAL PHYSIOLOGY: LIFE SUSTAINING SYSTEMS

PRACTICALS **(CREDITS 2)**

1. Determination of ABO Blood group
2. Enumeration of red blood cells and white blood cells using haemocytometer
3. Estimation of haemoglobin using Sahli's haemoglobinometer
4. Preparation of haemin and haemochromogen crystals
5. Recording of blood pressure using a sphygmomanometer
6. Examination of sections of mammalian oesophagus, stomach, duodenum, ileum, rectum liver, trachea, lung, kidney

SUGGESTED READINGS

- Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Hecourt Asia PTE Ltd. W.B. Saunders Company.
- Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI Edition John Wiley & sons,
- Victor P. Eroschenko. (2008). diFiore's Atlas of Histology with Functional correlations. XII Edition. Lippincott W. & Wilkins.
- Vander A, Sherman J. and Luciano D. (2014). Vander's Human Physiology: The Mechanism of Body Function. XIII Edition, McGraw Hills

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**CORE COURSE X
BIOCHEMISTRY OF METABOLIC PROCESSES**

THEORY	(CREDITS 4)
Unit 1: Overview of Metabolism	10
Catabolism vs Anabolism, Stages of catabolism, Compartmentalization of metabolic pathways, Shuttle systems and membrane transporters; ATP as "Energy Currency of cell"; coupled reactions; Use of reducing equivalents and cofactors; Intermediary metabolism and regulatory mechanisms	
Unit 2: Carbohydrate Metabolism	16
Sequence of reactions and regulation of glycolysis, Citric acid cycle, Phosphate pentose pathway.	
Unit 3: Lipid Metabolism	14
β -oxidation and omega -oxidation of saturated fatty acids with even and odd number of carbon atoms.	
Unit 4: Protein Metabolism	10
Catabolism of amino acids: Transamination, Deamination, Urea cycle.	
Unit 5: Oxidative Phosphorylation	10
Redox systems; Review of mitochondrial respiratory chain, Inhibitors and un-couplers of Electron Transport System	

BIOCHEMISTRY OF METABOLIC PROCESS

PRACTICALS	(CREDITS 2)
1. Estimation of total protein in given solutions by Lowry's method.	
2. Detection of SGOT and SGPT or GST and GSH in serum/ tissue	
3. To study the enzymatic activity of Trypsin and Lipase.	
4. Study of biological oxidation (SDH).	
5. Qualitative and quantitative estimation of carbohydrate.	
6. Dry Lab: To trace the labelled C atoms of Acetyl-CoA till they evolve as CO ₂ in the TCA cycle	

SUGGESTED READINGS

- Cox, M.M and Nelson, D.L. (2008). *Lehninger Principles of Biochemistry*, V Edition, W.H. Freeman and Co., New York.
- Berg, J.M., Tymoczko, J.L. and Stryer, L. (2007). *Biochemistry*, VI Edition, W.H. Freeman and Co., New York.
- Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. and Well, P.A. (2009). *Harper's Illustrated Biochemistry*, XXVIII Edition, International Edition, The McGraw-Hill Companies Inc.
- Hames, B.D. and Hooper, N.M. (2000). *Instant Notes in Biochemistry*, II Edition, BIOS Scientific Publishers Ltd., U.K.

