Phone: 7908040652/7501133806

SWARNAMOYEE JOGENDRANATH MAHAVIDYALAYA

Govt. Aided General Degree College | Estd.: 2014
P.O.: Amdabad, P.S.: Nandigram, Dist.: Purba Medinipur, PIN 721650
www.amdabadcollege.in| Email: sjmahavidyalaya@gmail.com

1.3.1 Cross-cutting issues relevant to professional ethics, gender, human values, environment and sustainability integrated into the curriculum

SUBJECT: ZOOLOGY

Programme	Course type	Course number	Course Title	Cross-cutting Issues			
				Professional ethics	Gender	Human values	Environment and sustainability
BSc Honours	Generic Elective for Honours	GE3	Aquatic Biology				The study of the management of aquatic resources deals with these issues in great depth. Subtopics include the causes of pollution: agricultural, industrial, sewage, thermal and oil spills, Eutrophication, management and conservation (legislations), sewage treatment water quality assessment- BOD and COD.
BSc Honours	General Elective for Honours	GE4	Environment and Public Health				Sources of Environmental hazards, Hazard identification and accounting, Fate of toxic and persistent substances in the environment, Dose response evaluation, Exposure assessment. Climate Change: Greenhouse gases and global warming, Acid rain, Ozone layer destruction, Effect of climate change on public health. Pollution: air, water, noise pollution sources and effects, Pollution control.

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Syllabi with courses and cross-cutting issues identified above marked up (in bright pink)

Vidyasagar University

Curriculum for B.Sc. Honours in Zoology

[Choice Based Credit System]

Semester-I

Sl.No.	Name of the Subject	Nature	Code	Teaching Scheme in hour per week			Credit	Marks
				L	T	P		
C1	**C1T:** Non- Chordates-I	Core Course-1		4	0	0	6	75
	C1P: Non- Chordates-I (Practical)	Core Course1 [Practical]		0	0	4		
C2	**C2T:** Ecology	Core Course-2		4	0	0	6	75
	C2P: Ecology (Practical)	Core Course-2 [Practical]		0	0	4		
GE-1	GE-1	GE					4/5	75
	GE-1	GE					2/1	
AECC	English	AECC					2	50
				Total Credits =20				

L=Lecture, T=Tutorial, P=Practical

AECC- Ability Enhancement Compulsory Course: English /Modern Indian Language.

Interdisciplinary/Generic Elective (GE) from other Department

[**Four papers are to be taken and each paper will be of 6 credits**]:

[Papers are to be taken from any of the following discipline **(GE-1 Preferably Chemistry/Physiology)]:Chemistry/Botany/Physiology/ComputerSc./Microbiology/Bio Technology/ Geology /Nutrition /Aquaculture Management.**

Semester -1

Core Courses-1

CC-1: Non-Chordates I — Credits 06

C1T1 –Non-Chordates I — Credits 04

Non-Chordates I		
	4 Credits	**Class**
Unit 1: Basics of Animal Classification		4
Definitions: Classification, Systematics and Taxonomy; Taxonomic Hierarchy, Taxonomic types Codes of Zoological Nomenclature; Principle of priority; Synonymy and Homonymy; Six kingdom concept of classification (Card woese)		
Unit 2: Protista and Metazoa		15
Protozoa General characteristics and Classification up to phylum (according to Levine et. al., 1981) Locomotion in *Euglena*, *Paramoecium* and *Amoeba*; Conjugation in *Paramoecium*. Life cycle and pathogenicity of *Plasmodium vivax* and *Entamoeba histolytica* **Metazoa** Evolution of symmetry and segmentation of Metazoa		

Unit 3: Porifera	6
General characteristics and Classification up to classes; Canal system and spicules in sponges	
Unit 4: Cnidaria	10
General characteristics and Classification up to classes Metagenesis in *Obelia* & *Aurelia* Metagenesis in *Obelia* Polymorphism in Cnidaria Corals and coral reef diversity, function & conservation	
Unit 5: Ctenophora	2
General characteristics	
Unit 6: Platyhelminthes	6
General characteristics and Classification up to classes Life cycle and pathogenicity and control measures of *Fasciola hepatica* and *Taenia solium*	
Unit 7: Nematoda	7
General characteristics and Classification up to classes Life cycle, and pathogenicity and control measures of *Ascaris lumbricoides* and *Wuchereria bancrofti* Parasitic adaptations in helminthes	
Reference Books	
▸Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition.	

- Invertebrates by Brusca & Brusca. Second edition, 2002.

Classification for metazoans to be followed from: Rupert and Barnes, 1994, 6th Edition.

C1 P1 –Non-Chordates I Lab Credits 02

List of Practical

1. Study of whole mount of *Euglena*, *Amoeba* and *Paramoecium*
2. Identification of *Amoeba, Euglena, Entamoeba, Opalina, Paramecium, Plasmodium vivax* and *Plasmodium falciparum* (from the prepared slides)
3. Identification of *Sycon*, Neptune's Cup, *Obelia*, *Physalia*, *Millepora*, *Aurelia*, *Tubipora*, *Corallium*, *Alcyonium*, *Gorgonia*, *Metridium*, *Pennatula*, *Fungia*, *Meandrina*, *Madrepora*
4. Identification and significance of adult *Fasciola hepatica*, *Taenia solium* and *Ascaris lumbricoides*
5. Staining/mounting of any protozoa/helminth from gut of cockroach

Core -2

CC-2: Ecology Credits 06

C2 T2 –Ecology Credits 04

Ecology		
	4 Credits	**Class**
Unit 1: Introduction to Ecology		4
History of ecology, Autecology and synecology, Levels of organization, Laws of limiting factors,Study of Physical factors, The Biosphere.		
Unit 2: Population		20
Unitary and Modular populations Unique and group attributes of population: Demographic factors, life tables, fecundity tables, survivorship curves, dispersal and dispersion. Geometric, exponential and logistic growth, equation and patterns, r and K strategies Population regulation - density-dependent and independent factors Population Interactions, Gause's Principle with laboratory and field examples, Lotka-Volterra equation for competition.		
Unit 3: Community		11
Community characteristics: species diversity, abundance, , dominance, richness, Vertical stratification, Ecotone and edge effect. Ecological succession with one example		
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 Nutrient and biogeochemical cycle with an example of Nitrogen cycle Human modified ecosystem	
Unit 5: Applied Ecology	5
Wildlife Conservation (in-situ and ex-situ conservation). Management strategies for tiger conservation; Wild life protection act (1972)	

Reference Books

- 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
- Ecology: Theories & Application (2001). 4th Edition by Peter Stilling.

Ecology by Cain, Bowman & Hacker. 3rd edition. Sinauer associates

C2 P2 –Ecology Lab Credits 02

List of Practical

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 quadrate 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 CO_2

4. Report on a visit to National Park/Biodiversity Park/Wild life sanctuary

Note: In field report costal area to be included.

Generic Elective Syllabus

GE-1 [Interdisciplinary for other department]

GE-1 -Animal Cell Biotechnology Credits 06

GE-1 T1 -Animal Cell Biotechnology Credits 04

Animal Cell Biotechnology		
	4 Credits	**Class**
Unit 1: Introduction		2
Concept and Scope of Biotechnology		
Unit 2: Techniques in Gene manipulation		15
Recombinant DNA technology, Isolation of genes, Concept of restriction and modification: Restriction endonucleases, DNA modifying enzymes Cloning Vectors: Plasmids, Phage vectors, Cosmids, Phagemids, BAC, YAC, and HAC. Shuttle and Expression Vectors. Construction of Genomic libraries and cDNA libraries Transformation techniques: microbial, plants and animals: Cloning in mammalian cells, Integration of DNA into mammalian genome- Electroporation and Calcium Phosphate Precipitation method.		
Unit 3: Animal cell Culture		9
Basic techniques in animal cell culture and organ culture, Primary Culture and Cell lines,		

Culture

media- Natural and Synthetic, Stem cells, Cryopreservation of cultures.

Agarose and Polyacrylamide Gel Electrophoresis, Southern, Northern and Western blotting, DNA

sequencing: Sanger method, Polymerase chain reaction, DNA Fingerprinting and DNA microarrays.

Unit 4: Fermentation 8

Different types of Fermentation: Submerged & Solid state; batch, Fed batch & Continuous; Stirred

tank, Air Lift, Fixed Bed and Fluidized.

Downstream Processing: Filtration, centrifugation, extraction, chromatography, spray drying and

lyophilization.

Unit 5: Transgenic Animal Technology 6

Production of transgenic animals: nuclear transplantation, Retroviral method, DNA microinjection

method, Dolly and Polly.

Unit 6: Application in Health 6

Development of recombinant Vaccines, Hybridoma technology, Gene Therapy. Production of

recombinant Proteins: Insulin and growth hormones.

Unit 7: Bio safety Physical and Biological containment 4

Bio safety Physical and Biological containment

Reference Books

- Animal Cells Culture and Media, D.C. Darling and S.J. Morgan, 1994. BIOS Scientific

  Publishers Limited.

- Methods in Cell Biology, Volume 57, Jennie P. Mathur and David Barnes, 1998. Animal

  Cell Culture Methods Academic Press.

- P.K. Gupta: Biotechnology and Genomics, Rastogi publishers (2003).

- B.D. Singh: Biotechnology, Kalyani publishers, 1998 (Reprint 2001).

- T.A. Brown: Gene cloning and DNA analysis: An Introduction, Blackwell Science (2001).

- Bernard R. Click & Jack J. Pasternak: Molecular Biotechnology, ASM Press, Washington

  (1998).

- Methods in Gene Biotechnology, W. Wu, M.J. Welsh, P.B. Kaufman &H.H. Zhang, 1997,

  CRC Press, New York

- 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 & Co., N.Y., USA

GE-1 P1 –Animal Cell Biotechnology Lab Credits 02

List of Practical

1. Packing and sterilization of glass and plastic wares for cell culture.
2. Preparation of culture media.
3. Preparation of genomic DNA from E. coli/animals/ human.
4. Plasmid DNA isolation (p UC 18/19) and DNA quantitation using agarose gel electrophoresis (by using lambda DNA as standard).
5. Restriction digestion of lambda (λ) DNA using EcoR1 and Hind III.
6. Preparation of competent cells and Transformation of E. coli with plasmid DNA using CaCl2, Selection of transformants on X-gal and IPTG (Optional).
7. Techniques: Western Blot, Southern Hybridization, DNA Fingerprinting, PCR, DNA Microarrays

Vidyasagar University

Curriculum for B.Sc. Honours in Zoology [Choice Based Credit System]

Semester-II

Sl.No.	Name of the Subject	Nature	Code	Teaching Scheme in hour per week			Credit	Marks
				L	T	P		
C3	**C3T:** Non- Chordates-II	Core Course-3		4	0	0	6	75
	C3P: Non- Chordates-II (Practical)	Core Course-3 [Practical]		0	0	4		
C4	**C4T:** Cell Biology	Core Course-4		4	0	0	6	75
	C4P: Cell Biology (Practical)	Core Course-4 [Practical]		0	0	4		
GE-2	GE-2	GE					4/5	75
	GE-2	GE					2/1	
AECC -2	Environmental Studies	AECC					4	100
				Total Credits =22				

L=Lecture, T=Tutorial, P=Practical

AECC- Ability Enhancement Compulsory Course: Environmental Studies.

<u>Interdisciplinary/Generic Elective (GE) from other Department</u>
[**Four papers are to be taken and each paper will be of 6 credits**]:
[Papers are to be taken from any of the following discipline **Chemistry/Botany/Physiology/Computer Sc./Microbiology/Bio Technology/ Geology /Nutrition /Aquaculture Management.**

Semester –II

Core Courses
Core-3

CC-3 :Non-Chordates II — Credits 06

C3 T - Non-Chordates II — Credits 04

C3 T - Non-Chordates II

	4 Credits	Class
Unit 1: Introduction		2
Evolution of coelom and metamerism		
Unit 2: Annelida		10
General characteristics and Classification up to classes Excretion in Annelida through nephridia. Metamerism in Annelida.		
Unit 3:Arthropoda		16
General characteristics and Classification up to classes Vision in Insecta only. Respiration in Arthropoda (Gills in prawn and trachea in cockroach) Metamorphosis in Lepidopteran Insects. Social life in termite		
Unit 4: Onychophora		2
General characteristics and Evolutionary significance		
Unit 5: Mollusca		10
General characteristics and Classification up to classes Nervous system and torsion in Gastropoda Feeding and respiration in *Pila* sp		
Unit 6: Echinodermata		8

General characteristics and Classification up to classes

Water-vascular system in Asteroidea

Larval forms in Echinodermata

Affinities with Chordates

Unit 7: Hemichordata **2**

General characteristics of phylum Hemichordata. Relationship with non-chordates and chordates

Reference Books

- Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition
- TheInvertebrates: A New Synthesis, III Edition, Blackwell Science

Note: Classification to be followed from Rupert and Barnes, 1994, 6th Edition.

C3 P – Non-Chordates II Credits 02

List of Practical

1. Study of following specimens:
    a. Annelids - *Aphrodite, Nereis, Heteronereis, Sabella, Serpula, Chaetopterus, Pheretima, Hirudinaria*
    b. Arthropods - *Limulus, Palamnaeus, Palaemon, Daphnia, Balanus, Sacculina, Cancer, Eupagurus, Scolopendra, Julus, Bombyx, Periplaneta*, termites and honey bees *Onychophora - Peripatus*
    c. Molluscs - *Chiton, Dentalium, Pila, Doris, Helix, Unio, Ostrea, Pinctada, Sepia, Octopus, Nautilus*
    d. Echinodermates - *Pentaceros/Asterias, Ophiura, Clypeaster, Echinus, Cucumaria* and
    e. Antedon
2. Study of digestive system, septal nephridia and pharyngeal nephridia of earthworm
3. T.S. through pharynx, gizzard, and typhlosolar intestine of earthworm
4. Mount of mouth parts and dissection of digestive system and nervous system of *Periplaneta**
5. To submit a Project Report on any related topic to larval forms (crustacean, mollusc and echinoderm)

Core-4

CC-4 : Cell Biology — Credits 06

C4 T: Cell Biology — Credits 04

C4 T - Cell Biology

4 Credits — **Class**

Unit 1: Overview of Cells — 2

Basic structure of Prokaryotic and Eukaryotic cells, Viruses, Viroid, Prion and Mycoplasma

Unit 2: Plasma Membrane — 6

Ultra structure and composition of Plasma membrane: Fluid mosaic model

Transport across membrane: Active and Passive transport, Facilitated transport

Cell junctions: Tight junctions, Gap junctions, Desmosomes

Unit 3: Cytoplasmic organelles I — 5

Structure and Functions: Endoplasmic Reticulum, Golgi Apparatus, Lysosomes

Protein sorting and mechanisms of vesicular transport

Unit 4: Cytoplasmic organelles II — 6

Mitochondria: Structure, Semi-autonomous nature, Endosymbiotic hypothesis
Mitochondrial Respiratory Chain, Chemi-osmotic hypothesis
Peroxisomes: Structure and Functions

Centrosome: Structure and Functions

Unit 5: Cytoskeleton — 5

Type, structure and functions of cytoskeleton

Accessory proteins of microfilament & microtubule

A brief idea about molecular motors

Unit 6: Nucleus — 8

Structure of Nucleus: Nuclear envelope, Nuclear pore complex, Nucleolus

Chromatin: Euchromatin and Hetrochromatin and packaging (nucleosome)

Unit 7: Cell Division — 10

Cell cycle and its regulation, Cancer (Concept of oncogenes and tumor suppressor genes with special reference to p53, Retinoblastoma and Ras and APC. Mitosis and Meiosis: Basic process and their significance

Unit 8: Cell Signaling — 8

Cell signalling transduction pathways; Types of signaling molecules and receptors
GPCR and Role of second messenger (cAMP)
Extracellular matrix-Cell interactions
Apoptosis and Necrosis

Reference Books

- Lewin's Cells – 3rd Edition – Cassimeris/Lingappa/Plopper – Johns & Bartlett Publishers
- Biology of Cancer by Robert. A. Weinberg. 2nd edition.
- 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.
- 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.

C4P–Cell Biology (Lab) Credits 02

Cell Biology

List of Practical

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. Preparation of permanent slide to demonstrate:

    a. DNA by Feulgen reaction
    b. Cell viability study by Trypan Blue staining
    c. Mitochondria identification through vital staining

Generic Elective Syllabus

GE-2 [Interdisciplinary for other department]

GE-2 :Animal Diversity — Credits 06

GE2 T:Animal Diversity — Credits 04

GE2 T-Animal Diversity

	4 Credits	Class
Unit 1: Protista		**3**
Protozoa : General characters of Protozoa; Life cycle of *Plasmodium*		
Unit 2: Porifera		3
General characters and canal system in Porifera		
Unit 3: Radiata		3
General characters of Cnidarians and polymorphism		
Unit 4: Aceolomates		2
General characters of Helminthes		
Unit 5: Pseudocoelomates		3
General characters of Nematoda Parasitic adaptations		
Unit 6: Annelida		3
General characters of Annelida Metamerism		
Unit 7: Arthropoda		4
General characters. Social life in insects.		
Unit 8: Mollusca		4
General characters of mollusk. Pearl Formation		
Unit 9: Echynodermata		4
General characters of Echinodermata. Water Vascular system in Starfish.		

Unit 10: Protochordata 2

Salient features

Unit 11: Pisces 3

General Characters.
Osmoregulation, Migration of Fish

Unit 12: Amphibia 4

General characters, Adaptations for terrestrial life, Parental care

Unit 13: Reptilia 4

General Characters.
Amniotes; Origin of reptiles. Terrestrial adaptations in reptiles.

Unit 14: Aves 4

General Characters.
The origin of birds; Flight adaptations

Unit 15: Mammalia 4

General Characters.
Early evolution of mammals; Primates; Dentition in mammals.

Reference Books

- Barnes, R.D. (1992). Invertebrate Zoology. Saunders College Pub. USA.
- Ruppert, Fox and Barnes (2006) Invertebrate Zoology. A functional Evolutionary Approach
  7th Edition, Thomson Books/Cole
- Campbell & Reece (2005). Biology, Pearson Education, (Singapore) Pvt. Ltd.

Kardong, K. V. (2002). Vertebrates Comparative Anatomy. Function and Evolution. Tata McGraw Hill Publishing Company. New Delhi.

Raven, P. H. and Johnson, G. B. (2004). Biology, 6th edition, Tata McGraw Hill Publications. New Delhi.

GE2 P –Animal Diversity Lab Credits 02

List of Practical

1. Study of following specimens:

    a. Non Chordates: *Euglena*, *Noctiluca*, *Paramecium*, *Sycon*, , *Physalia*, *Tubipora*, *Metridium*, *Taenia*, *Ascaris*, *Nereis*, *Aphrodite*, Leech, *Peripatus*, *Limulus*, Hermitcrab, *Daphnia*, Millipede, Centipede, Beetle, *Chiton*, *Dentalium*, *Octopus*, *Asterias*, and *Antedon*.

    b. Chordates: *Balanoglossus*, *Amphioxus*, *Petromyzon*, *Pristis*, *Hippocampus*, *Labeo*, *Icthyophis*/*Uraeotyphlus*, Salamander, *Rhacophorus*, *Draco*, *Uromastix*, *Naja*, *Viper*, model of Archaeopteryx, any three common birds-(Crow, duck, Owl), Squirrel and Bat.

2. Study of following Permanent Slides:

    Cross section of *Sycon*, Sea anemone and *Ascaris* (male and female). T. S. of Earthworm passing through pharynx, gizzard, and typhlosolar intestine. Bipinnaria and Pluteus larva.

3. Temporary mounts of:

    a. Septal & pharyngeal nephridia of earthworm.

    b. Unstained mounts of Placoid, cycloid and ctenoid scales.

4. Dissections of:

    a. Digestive and nervous system of Cockroach

    b. Urinogenital system of Rat

Vidyasagar University

Curriculum for B.Sc (Honours) in Zoology
[Choice Based Credit System]

Semester-III

Course	Course Code	Name of the Subjects	Course Type/ Nature	Teaching Scheme in hour per week			Credit	Marks
				L	T	P		
CC-5		**C5T:**Chordates	Core Course - 5	4	0	0	6	75
		C5P: Chordates Lab		0	0	4		
CC-6		**C6T:**Animal Physiology: Controlling & Coordinating Systems	Core Course - 6	4	0	0	6	75
		C6P: Animal Physiology: Controlling & Coordinating Systems Lab		0	0	4		
CC-7		**C7T:**Fundamentals of Biochemistry	Core Course - 7	4	0	0	6	75
		C7P: Fundamentals of Biochemistry Lab		0	0	4		
GE-3	TBD		Generic Elective -3				4/5	75
							2/1	
SEC-1		**SEC-1:**Apiculture Or **SEC-1:**Aquarium Fish Keeping	Skill Enhancement Course-1	1	1	0	2	50
Semester Total							**26**	**350**

L=Lecture, **T=** Tutorial, **P=**Practical, **CC =** Core Course, **GE**= Generic Elective, **SEC** = Skill Enhancement Course, **TBD =** to be decided

Generic Elective (GE) (Interdisciplinary) from other Department [**Four papers are to be taken and each paper will be of 6 credits**]:

Papers are to be taken from any of the following discipline:

Chemistry /Botany/Physiology/Computer Sc./Microbiology /Bio Technology/ Geology /Nutrition /Aquaculture Management.

Modalities of selection of Generic Electives (GE): A student shall have to choose **04** Generic Elective (GE1 to GE4) strictly from **02** subjects / disciplines of choice taking exactly **02** courses from each subjects of disciplines. Such a student shall have to study the curriculum of Generic Elective (GE) of a subject or discipline specified for the relevant semester.

Semester- III
Core Course (CC)

CC-5: Chordates **Credits 06**

C5T: Chordates **Credits 04**

Unit 1: Introduction to Chordates
General characteristics and outline classification of Phylum Chordata

Unit 2: Protochordata
General characteristics and classification of sub-phylum Urochordata and Cephalochordata up to Classes. Retrogressive metamorphosis in *Ascidia*. Chordate Features and Feeding in *Branchiostoma*

Unit 3: Origin of Chordata
Dipleurula concept and the Echinoderm theory of origin of chordates
Advanced features of vertebrates over Protochordata

Unit 4: Agnatha
General characteristics and classification of cyclostomes up to order

Unit 5: Pisces
General characteristics and classification of Chondrichthyes and Osteichthyes up to Subclasses
Accessory respiratory organ, migration and parental care in fishes
Swim bladder in fishes. Classification up to Sub-Classes

Unit 6: Amphibia
General characteristics and classification up to living Orders.
Metamorphosis and parental care in Amphibia

Unit 7: Reptilia
General characteristics and classification up to living Orders.
Poison apparatus and Biting mechanism in Snake

Unit 8: Aves
General characteristics and classification up to Sub-Classes
Exoskeleton and migration in Birds
Principles and aerodynamics of flight

Unit 9: Mammals
General characters and classification up to living orders
Affinities of Prototheria
Exoskeleton derivatives of mammals
Adaptive radiation in mammals with reference to locomotory appendages
Echolocation in Micro chiropterans and Cetaceans

Unit 10: Zoogeography

Zoogeographical realms, Plate tectonic and Continental drift theory, distribution of birds and mammals in different realms

Suggested Readings :

1. Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford university press.
2. Pough H. Vertebrate life, VIII Edition, Pearson International.
3. Darlington P.J. The Geographical Distribution of Animals, R.E. Krieger Pub Co.
4. Hall B.K. and Hallgrimsson B. (2008). Strickberger's Evolution. IV Edition. Jones and Bartlett Publishers Inc.
5. Parker, T. J. &Haswell, W. (1972). Text Book of Zoology, Volume II: Marshall and Willam (Eds.) 7th Ed. Macmillan Press, London.
6. Kardong, K. V. (2002). Vertebrates: Comparative anatomy, function evolution. Tata McGraw Hill.
7. Kent, G. C. & Carr, R. K. (2001). Comparative anatomy of the Vertebrates. 9th Ed. McGraw Hill.
8. Nelson, J.S., (2006) : Fishes of the World, 4th Edn., Wiley.
9. Romer, A. S. & Parsons, T. S. (1986). The vertebrate body. 6th Ed. Saunders College Publishing.
10. Jordan, E.L. &Verma, P.S. (2003). Chordate Zoology. S. Chand & Company Ltd. New Delhi.
11. Sinha, K. S., Adhikari, S., Ganguly, B. B. & Bharati Goswami, B. D. (2001). Biology of Animals. Vol. II. New Central Book Agency (p) Ltd.
12. Futuyama, D. (1997). Evolutionary Biology. 3rd Ed. Sinauer Associates, INC.

Note: Classifications for Protochordata, Agnatha, Reptilia, Aves and Mammalia to be followed from Young (1981), for Pisces to be followed from Romer (1959), for Amphibia to be followed from Duellman and Trueb (1986).

CP5: Chordates Lab **Credits 02**

List of Practical

1. Protochordata
   Balanoglossus, Herdmania, Branchiostoma
2. Agnatha
   Petromyzon, Myxine
3. Fishes
   Scoliodon, Sphyrna, Pristis, Torpedo, Chimaera, Mystus, Heteropneustes, Labeo, Exocoetus, Echeneis, Anguilla, Hippocampus, Tetrodon/ Diodon, Anabas, Flat fish
4. Amphibia
   Necturus, Bufo, Hyla, Alytes, Axolotl, Tylototriton
5. Reptilia
   Chelone, Trionyx, Hemidactylus, Varanus, Uromastix, Chamaeleon, Ophiosaurus, Draco, Bungarus, Vipera, Naja, Hydrophis, Zamenis, Crocodylus. Key for Identification of poisonous and non-poisonous snakes
6. Mammalia: Bat (Insectivorous and Frugivorous), *Funambulus*
7. Pecten from Fowl head
8. Dissection of brain and pituitary of Tilapia

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

CC-6: Animal Physiology: Controlling & Coordinating Systems Credits 06

C6T: Animal Physiology: Controlling & Coordinating Systems Credits 04

Unit 1: Tissues
Structure, location, classification and functions of epithelial tissue, connective tissue, muscular tissue and nervous tissue and, fixation and staining of tissues.

Unit 2: Bone and Cartilage
Structure and types of bones and cartilages, Ossification

Unit 3: Nervous System
Structure of neuron, resting membrane potential, Origin of action potential and its propagation across the myelinated and unmyelinated nerve fibers; Types of synapse, Synaptic transmission and Neuromuscular junction; Reflex action and its types

Unit 4: Muscular system
Histology of different types of muscle; Ultra structure of skeletal muscle; Molecular and chemical basis of muscle contraction; Characteristics of muscle fibre

Unit 5: Reproductive System
Histology of testis and ovary
Physiology of Reproduction

Unit 6: Endocrine System
Histology and function of pituitary, thyroid, pancreas and adrenal
Classification of hormones; Mechanism of Hormone action
Signal transduction pathways for Steroidal and Non steroidal hormones
Hypothalamus (neuroendocrine gland) - principal nuclei involved in neuroendocrine control of anterior pituitary and endocrine system
Placental hormones

Suggested Readings :

1. Histology: A Text and Atlas. Sixth Edition. Ross & Pawlina. Lippincott Williams & Wilkins.
2. Eckert Animal Physiology by David Randall and Warren Burggren. 4th edition. W. H. Freeman.

C6P: Animal Physiology: Controlling & Coordinating Systems Lab Credits 02

List of Practical

1. Recording of simple muscle twitch with electrical stimulation (or Virtual)

2. Demonstration of the unconditioned reflex action (Deep tendon reflex such as knee jerk reflex)
3. Preparation of temporary mounts: Squamous epithelium, Striated muscle fibres and nerve cells
4. Study of permanent slides of Mammalian skin, Cartilage, Bone, Spinal cord, Nerve cell, Pituitary, Pancreas, Testis, Ovary, Adrenal, Thyroid and Parathyroid
5. Microtomy: Preparation of permanent slide of any five mammalian (Goat/white rat) tissues

CC-7: Fundamentals of Biochemistry **Credits 06**

C7T: Fundamentals of Biochemistry **Credits 04**

Unit 1: Carbohydrates
Structure and Biological importance: Monosaccharides, Disaccharides, Polysaccharides; Derivatives of Monosachharides

Carbohydrate metabolism: Glycolysis, Citric acid cycle, Pentose phosphate pathway, Gluconeogenesis

Unit 2: Lipids
Structure and Significance: Physiologically important saturated and unsaturated fatty acids, Tri-acylglycerols, Phospholipids, Sphingolipid, Glycolipids, Steroids, Eicosanoids and terpinoids.

Lipid metabolism: β-oxidation of fatty acids; Fatty acid biosynthesis

Unit 3: Proteins
Amino acids
Structure, Classification, General and Electro chemical properties of α-amino acids; Physiological importance of essential and non-essential amino acids
Proteins
Bonds stabilizing protein structure; Levels of organization
Protein metabolism: Transamination, Deamination, Urea cycle, Fate of C-skeleton of Glucogenic and Ketogenic amino acids

Unit 4: Nucleic Acids
Structure: Purines and pyrimidines, Nucleosides, Nucleotides, Nucleic acids
Types of DNA and RNA, Complementarity of DNA, Hpyo- Hyperchromaticity of DNA
Basic concept of nucleotide metabolism

Unit 5: Enzymes
Nomenclature and classification; Cofactors; Specificity of enzyme action; Isozymes; Mechanism of enzyme action; Enzyme kinetics; Derivation of Michaelis-Menten equation, Lineweaver-Burk plot;
Factors affecting rate of enzyme-catalyzed reactions; Enzyme inhibition; Allosteric enzymes and their kinetics; Strategy of enzyme action- Catalytic and Regulatory (Basic concept with one example each)

Unit 5: Oxidative Phosphorylation
Redox systems; Review of mitochondrial respiratory chain, Inhibitors and un-couplers of Electron Transport System

C7P: Fundamentals of Biochemistry Lab **Credits 02**

List of Practical

1. Qualitative tests of functional groups in carbohydrates, proteins and lipids.
2. Paper chromatography of amino acids.
3. Quantitative estimation of Lowry Methods.
4. Demonstration of proteins separation by SDS-PAGE.
5. To study the enzymatic activity of Trypsin and Lipase.
6. To perform the Acid and Alkaline phosphatase assay from serum/ tissue.

Suggested Readings:

1. Cox, M.M and Nelson, D.L. (2008). Lehninger's Principles of Biochemistry, V Edition, W.H. Freeman and Co., New York.
2. Berg, J.M., Tymoczko, J.L. and Stryer, L. (2007). Biochemistry, VI Edition, W.H. Freeman and Co., New York.
3. 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.
4. Hames, B.D. and Hooper, N.M. (2000). Instant Notes in Biochemistry, II Edition, BIOS Scientific Publishers Ltd., U.K.
5. 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.

Skill Enhancement Course (SEC)

SEC1: Apiculture **Credits 02**

SEC1T: Apiculture

Unit 1: Biology of Bees
History, Classification and Biology of Honey Bees
Social Organization of Bee Colony

Unit 2: Rearing of Bees
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
Bee Diseases and Enemies
Control and Preventive measures

Unit 4: Bee Economy
Products of Apiculture Industry and its Uses (Honey, Bees Wax, Propolis), Pollen etc

Unit 5: Entrepreneurship in Apiculture
Bee Keeping Industry – Recent Efforts, Modern Methods in employing artificial Beehives for cross pollination in horticultural gardens

Suggested Readings :

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

Or

SEC1: Aquarium Fish Keeping **Credits 02**

SEC1T: Aquarium Fish Keeping

Aquarium Fish Keeping

Unit 1: Introduction to Aquarium Fish Keeping
The potential scope of Aquarium Fish Industry as a Cottage Industry, Exotic and Endemic species of Aquarium Fishes

Unit 2: Biology of Aquarium Fishes
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
Use of live fish feed organisms. Preparation and composition of formulated fish feeds, Aquarium fish as larval predator

Unit 4: Fish Transportation
Live fish transport - Fish handling, packing and forwarding techniques.

Unit 5: Maintenance of Aquarium
General Aquarium maintenance – budget for setting up an Aquarium Fish Farm as a Cottage Industry

Generic Elective
GE-3 [Interdisciplinary for other department]

GE-3: Aquatic Biology **Credits 06**

GE3T: Aquatic Biology **Credits 04**

Unit 1: Aquatic Biomes
Brief introduction to 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

GE3 P: Aquatic Biology Lab **Credits 02**

List of Practical

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, and 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 meter, Turbidity meter, PONAR grab sampler) and their significance.

5. A Project Report on a visit to a Sewage treatment plant/Marine bio- reserve/Fisheries Institute.

Suggested Readings :

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

Vidyasagar University

Curriculum for B.Sc (Honours) in Zoology
[Choice Based Credit System]

Semester-IV

Course	Course Code	Name of the Subjects	Course Type/ Nature	Teaching Scheme in hour per week			Credit	Marks
				L	T	P		
CC-8		**C8T:** Comparative Anatomy of Vertebrates	Core Course - 8	4	0	0	6	75
		C8P: Practical		0	0	4		
CC-9		**C9T:** Animal Physiology: Life Sustaining Systems	Core Course - 9	4	0	0	6	75
		C9P: Practical		0	0	4		
CC-10		**C10T:** Immunology	Core Course - 10	4	0	0	6	75
		C10P: Practical		0	0	4		
GE-4	TBD		Generic Elective -4				4/5	75
							2/1	
SEC-2		**SEC2:** Medical Diagnostic Techniques **Or** Sericulture	Skill Enhancement Course-2	1	1	0	2	50
Semester Total							**26**	**350**

L=Lecture, **T**= Tutorial, **P**=Practical, **CC** = Core Course, **GE**= Generic Elective, **SEC** = Skill Enhancement Course, **TBD** = to be decided

Generic Elective (GE) (Interdisciplinary) from other Department [**Four papers are to be taken and each paper will be of 6 credits**]: **Chemistry/Botany/Physiology/Computer Sc./Microbiology/Bio Technology/ Geology /Nutrition /Aquaculture Management.**

Modalities of selection of Generic Electives (GE): A student shall have to choose **04** Generic Elective (GE1 to GE4) strictly from **02** subjects / disciplines of choice taking exactly **02** courses from each subjects of disciplines. Such a student shall have to study the curriculum of Generic Elective (GE) of a subject or discipline specified for the relevant semester.

Semester-IV

Core Course (CC)

CC-8: Comparative Anatomy of Vertebrates **Credits 06**

C8T: Comparative Anatomy of Vertebrates **Credits 04**

Course Contents:

Unit 1: Integumentary System

Structure, function and derivatives of integument in amphibian, birds and mammals

Unit 2: Skeletal System

Overview of axial and appendicular skeleton; Jaw suspension; Visceral arches.

Unit 3: Digestive System

Comparative anatomy of stomach; dentition in mammals

Unit 4: Respiratory System

Respiratory organs in fish, amphibian, birds and mammals

Unit 5: Circulatory System

General plan of circulation, Comparative account of heart and aortic arches

Unit 6: Urinogenital System

Succession of kidney, Evolution of urinogenital ducts, Types of mammalian uteri

Unit 7: Nervous System

Comparative account of brain, Cranial nerves in mammals

Unit 8: Sense Organs

Classification of receptors, Brief account of olfactory and auditory receptors in vertebrate

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 Saxena, R.K. &Saxena, S.C.(2008) : Comparative Anatomy of Vertebrates, Viva Books Pvt. Ltd.

C8P: Comparative Anatomy of Vertebrates **Credits 02**

List of Practical

1. Study of placoid, cycloid and ctenoid scales through permanent slides/photographs.
2. Study of disarticulated skeleton of Toad, Pigeon and Guineapig.
3. Demonstration of Carapace and plastron of turtle.
4. Identification of mammalian skulls: One herbivorous (Guineapig) and one carnivorous (Dog) animal.
5. Dissection of Tilapia: Circulatory system, Brain, pituitary, urinogenital system.

CC-9: Animal Physiology: Life Sustaining Systems **Credits 06**

C9T: Animal Physiology: Life Sustaining Systems **Credits 04**

Course Contents:

Unit 1: Physiology of Digestion

Structural organisation and functions of Gastrointestinal tract and Associated glands; Mechanical and chemical digestion of food, absorption of Carbohydrates, Lipids, Proteins and Nucleic Acids; Digestive enzymes

Unit 2: Physiology of Respiration

Mechanism of Respiration, Respiratory volumes and capacities, transport of Oxygen and Carbon dioxide in blood, Dissociation curves and the factors influencing it, respiratory pigments; Carbon monoxide poisoning

Unit 3: Physiology of Circulation

Components of Blood and their functions; Structure and functions of haemoglobin Haemostasis; Blood clotting system, Fibrinolytic system Haemopoiesis; Basic steps and its regulation Blood groups; ABO and Rh factor

Unit 4: Physiology of Heart

Structure of mammalian heart, Coronary Circulation, Structure and working of conducting myocardial fibres, Origin and conduction of cardiac impulses Cardiac Cycle and cardiac output Blood pressure and its regulation

Unit 5: Thermoregulation & Osmoregulation

Physiological classification based on thermal biology.

Thermal biology of endotherms

Osmoregulation in aquatic vertebrates

Extrarenal osmoregulatory organs in vertebrates

Unit 6: Renal Physiology

Structure of Kidney and its functional unit, Mechanism of urine formation, Regulation of acid-base balance

Suggested Readings:

- Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Hercourt
- Asia PTE Ltd. W.B. Saunders Company.
- Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI Edition John Wiley & sons,
- Eckert Animal Physiology: Mechanisms and adaptations Randall, Burggren and FrenchVander A, Sherman J. and Luciano D. (2014). Vander's Human Physiology: The Mechanism of Body Function. XIII Edition, McGraw Hills
- 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

C9P: Animal Physiology: Life Sustaining Systems Lab **Credits 02**

List of Practical

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

CC-10: Immunology **Credits 06**

C10T: Immunology **Credits 04**

Course Contents:

Unit 1: Overview of Immune System

Basic concepts of health and diseases, Historical perspective of Immunology, Cells and organs of the Immune system

Unit 2: Innate and Adaptive Immunity

Anatomical barriers, Inflammation, Cell and molecules involved in innate immunity, Adaptive immunity (Cell mediated and humoral).

Unit 3: Antigens

Antigenicity and immunogenicity, Immunogens, Adjuvants and haptens, Factors influencing immunogenicity, B and T-Cell epitopes

Unit 4: Immunoglobulins

Structure and functions of different classes of immunoglobulins, Antigen- antibody interactions,

Immunoassays (ELISA and RIA), Hybridoma technology, Monoclonal antibody production

Unit 5: Major Histocompatibility Complex

Structure and functions of MHC molecules.

Structure of T cell Receptor and its signalling, T cell development & selection

Unit 6: Cytokines

Types, properties and functions of cytokines.

Unit 7: Complement System

Components and pathways of complement activation.

Unit 8: Hypersensitivity

Gell and Coombs' classification and brief description of various types of hypersensitivities.

Unit 9: Immunology of diseases

Malaria, Filariasis, Dengue and Tuberculosis

Unit 10: Vaccines

Various types of vaccines. Active & passive immunization (Artificial and natural).

Suggested Readings:

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

C10P: Immunology Lab **Credits 02**

List of Practical

1. Demonstration of lymphoid organs.
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

Skill Enhancement Courses (SEC)

SEC-2: Medical Diagnostic Techniques **Credits 02**

SEC2T: Medical Diagnostic Techniques

Course Contents:

Unit 1: Introduction to Medical Diagnostics and its Importance

Unit 2: Diagnostics Methods Used for Analysis of Blood

Blood composition, Preparation of blood smear and Differential Leucocyte Count (D.L.C) using Leishman's stain, Platelet count using haemocytometer, Erythrocyte Sedimentary Rate (E.S.R), Packed Cell Volume (P.C.V.)

Unit 3: Diagnostic Methods Used for Urine Analysis

Urine Analysis: Physical characteristics; Abnormal constituents

Unit 4: Non-infectious Diseases

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 5: Infectious Diseases

Causes, types, symptoms, diagnosis and prevention of Tuberculosis and Hepatitis, Malarial parasite (Microscope based and ELISA based)

Unit 6: Clinical Biochemistry

LFT, Lipid profiling

Unit 7: Clinical Microbiology

Antibiotic Sensitivity Test

Unit 8: Tumours

Types (Benign/Malignant), Detection and metastasis; Medical imaging: X-Ray of Bone fracture, PET, MRI and CT Scan (using photographs).

Unit 9: Visit to Pathological Laboratory and Submission of Project

Suggested Readings:

- Park, K. (2007), *Preventive and Social Medicine*, B.B. Publishers
- Godkar P.B. and Godkar D.P. *Textbook of Medical Laboratory Technology*, II Edition, Bhalani Publishing House
- Cheesbrough M., *A Laboratory Manual for Rural Tropical Hospitals, A Basis for Training Courses*
- Guyton A.C. and Hall J.E. T*extbook of Medical Physiology*, Saunders Robbins and Cortan, *Pathologic Basis of Disease*, VIII Edition, Saunders
- Prakash, G. (2012), *Lab Manual on Blood Analysis and Medical Diagnostics*, S. Chand and Co. Ltd.

Or

SEC-2: Sericulture **Credits 02**

SEC2T: Sericulture

Course Contents:

Unit 1: Introduction

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

Life cycle of *Bombyx mori*

Structure of silk gland and secretion of silk

Unit 3: Rearing of Silkworms

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

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

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

Suggested Readings:

- Non-conventional energy sources - G.D Rai - Khanna Publishers, New Delhi
- Solar energy - M P Agarwal - S Chand and Co. Ltd.

- Solar energy - Suhas P Sukhative Tata McGraw - Hill Publishing Company Ltd Godfrey Boyle, “Renewable Energy, Power for a sustainable future”, 2004,
- Oxford University Press, in association with The Open University.
- Dr. P Jayakumar, Solar Energy: Resource Assesment Handbook, 2009
- J. Balfour, M. Shaw and S. Jarosek, Photovoltaics, Lawrence J Goodrich (USA). http://en.wikipedia.org/wiki/Renewable_energy

Generic Elective Syllabus
GE-4 [Interdisciplinary for other department]

GE-4: Insect Vectors and Diseases **Credits 06**

GE4T: Insect Vectors and Diseases **Credits 04**

Course Contents:

Unit 1: Introduction to Insects

General Features of Insects, Morphological features, Head – Eyes, Types of antennae, Mouth Parts

Unit 2: Concept of Vectors

Brief introduction to Vectors (mechanical and biological vectors),Reservoirs, Host-vector relationship, Adaptations as vectors, Host specificity

Unit 3: Insects as Vectors

Detailed features of orders with insects as vectors – Diptera, Siphonaptera, Siphunculata, Hemiptera

Unit 4: Dipteran as Disease Vectors

Dipterans as important insect vectors – Mosquitoes, Sand fly, Houseflies

Study of mosquito-borne diseases – Malaria, Dengue, Chikungunya, Viral encephalitis, Filariasis Control of mosquitoes

Study of sand fly-borne diseases –Leishmaniasis,; Control of Sand fly

Study of house fly as important mechanical vector, Myiasis, Control of house fly

Unit 5: Siphonaptera as Disease Vectors

Fleas as important insect vectors; Host-specificity, Study of Flea-borne diseases – Plague, Typhus fever; Control of fleas

Unit 6: Siphunculata as Disease Vectors

Human louse (Head, Body and Pubic louse) as important insect vectors; Control of human louse

Unit 7: Hempitera as Disease Vectors

Bugs as insect vectors; Blood-sucking bugs; Chagas disease, Bed bugs as mechanical vectors, Control and prevention measures

Suggested Readings:

- Imms, A.D. (1977). A General Text Book of Entomology. Chapman & Hall, UK
- Chapman, R.F. (1998). The Insects: Structure and Function. IV Edition, Cambridge University Press, UK
- Pedigo L.P. (2002). Entomology and Pest Management. Prentice Hall Publication
- Mathews, G. (2011). Integrated Vector Management: Controlling Vectors of Malaria and Other Insect Vector Borne Diseases. Wiley-Blackwell
- Mosquito (2000) Chandra G, Sribhumi Publication Co. Kolkata
- Medical Entomology, Hati A. K Allied Book Agency, Kolkata

GE4P: Insect Vectors and Diseases Lab **Credits 02**

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 humanus capitis*, *Pediculus humanus corporis*, *Phithirus pubis*, *Xenopsylla cheopis*, *Cimex lectularius*, *Phlebotomus argentipes*, *Musca domestica* through permanent slides/ photographs
3. Study of different diseases transmitted by above insect vectors

Submission of a project report on any one of the insect vectors and disease transmitted

Or

GE-4: Environment and Public Health **Credits 06**

GE4T: Environment and Public Health **Credits 04**

Course Contents:

Unit 1: Introduction

Sources of Environmental hazards, Hazard identification and accounting, Fate of toxic and persistent substances in the environment, Dose response evaluation, Exposure assessment.

Unit 2: Climate Change

Greenhouse gases and global warming, Acid rain, Ozone layer destruction, Effect of climate change on public health

Unit 3: Pollution

Air, water, noise pollution sources and effects, Pollution control.

Unit 4: Waste Management Technologies

Sources of waste, types and characteristics, Sewage disposal and its management, Solid waste disposal, Biomedical waste handling and disposal, Nuclear waste handling and disposal, Waste from thermal power plants.

Unit 5: Diseases

Causes, symptoms and control of tuberculosis, Asthma, Cholera, Minamata disease, typhoid, filariasis

Suggested Readings:

- Cutter, S.L., Environmental Risk and Hazards, Prentice-Hall of India Pvt. Ltd., New Delhi, 1999.
- Kolluru Rao, Bartell Steven, Pitblado R and Stricoff "Risk Assessment and Management Handbook", McGraw Hill Inc., New York, 1996.
- Kofi Asante Duah "Risk Assessment in Environmental management", John Wiley and sons, Singapore, 1998.
- Kasperson, J.X. and Kasperson, R.E. and Kasperson, R.E., Global Environmental Risks, V. N. University Press, New York, 2003.
- Joseph F Louvar and B Diane Louver Health and Environmental Risk Analysis
- fundamentals with applications, Prentice Hall, New Jersey 1997.

GE4P: Environment and Public Health Lab **Credits 02**

List of Practical

To determine pH, Cl, SO_4, NO_3 in soil and water samples from different locations.