POST GRADUATE DEPARTMENT OF ZOOLOGY

DARJEELING GOVERNMENT COLLEGE

(UNIVERSITY OF NORTH BENGAL)

SYLLABUS OF M.Sc. COURSE IN ZOOLOGY

in

SEMESTER SYSTEM

(C.B.C.S.)

2017

DARJEELING GOVERNMENT COLLEGE

19 – LEBONG CART ROAD

DARJEELING - 734101

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

Darjeeling Government College
Post Graduate Department of Zoology
Credit distribution for M.Sc. in Zoology (CBCS)

Semester-wise distribution of course				
Semester	**Courses**	**Marks**	**Lecture Hours**	**Credits**
1st Semester	**1. Core course** **2. Continuation Evaluation**	**400**	**612**	**12** **4.0**
2nd Semester	**1. Core course** **2. Continuation Evaluation**	**400**	**612**	**12** **4.0**
3rd Semester	**1. Core course + Choice-based Elective Course** **2. Continuation Evaluation**	**400**	**612**	**12** **4.0**
4th Semester	**1. Core course + Choice-based Elective Course** **2. Continuation Evaluation**	**400**	**612**	**12** **4.0**
Total		**1600**	**2448**	**64**

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

Orientation of courses in four semesters						
SEMESTER –I						
Paper	**Subject**	**Marks**			**Hours / week**	**Credit**
		End Term Examination	**Continuation Evaluation**	**TOTAL MARKS**		
Theoretical core course						
DZCT 101	Functional Biology of Non-Chordates and Insect Biology	**60**		**60**	**4.5**	**2.5**
DZCT 102	Functional Biology of Chordates and Fish Biology	**60**		**60**	**4.5**	**2.5**
DZCT 103	Genetics and Biochemistry	**60**		**60**	**4.5**	**2.5**
DZCT 104	Ethology and Wildlife Biology	**60**		**60**	**4.5**	**2.5**
Practical Core Course						
DZCP 101	Non-Chordates and Chordates	**30**		**30**	**7.5**	**1**
DZCP 102	Biochemistry and Cytogenetics	**30**		**30**	**7.5**	**1**
Continuation Evaluation						
DZCC 101, 102,103,104	Class Test		**(20 X 4)= 80**	**80**		**(0.75X4)=3.0**
DZCE 101	Choice Based Seminar (**Ability Enhancement Course**)		**20**	**20**	**3.0**	**1.0**
Total Marks and Credits in Semester I		**300**	**100**	**400**	**(36)**	**16**
SEMESTER –II						
Theoretical Core Course						
DZCT 201	Developmental Biology and Endocrinology	**60**		**60**	**4.5**	**2.5**
DZCT 202	Environmental Physiology and Neurobiology	**60**		**60**	**4.5**	**2.5**
DZCT 203	Cell and Molecular Biology	**60**		**60**	**4.5**	**2.5**
DZCT 204	Ecology and Climate Change Biology	**60**		**60**	**4.5**	**2.5**
Practical Core Course						
DZCP 201	Ecology and Developmental Biology	**30**		**30**	**7.5**	**1**
DZCP 202	Histology and Histochemistry	**30**		**30**	**7.5**	**1**
Continuation Evaluation						
DZCC:201, 202 ,203,204	Class Test		**(20 X 4)= 80**	**80**		**(0.75X4)=3.0**
DZCE 201	Review of any Scientific Paper (**Ability Enhancement Course**)		**20**	**20**	**3.0**	**1.0**
Total Marks and Credits in Semester II		**300**	**100**	**400**	**400**	**16**

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

SEMESTER –III						
Paper	**Subject**	**Marks**			**Hours/ Week**	**Credit**
		Term Examination	**Class Test**	**TOTAL MARKS**		
Theoretical Core Course						
DZCT 301	Taxonomy and Biodiversity	**60**		**60**	**4.5**	**2.5**
DZCT 302	Biotechnology and Biophysical Technique	**60**		**60**	**4.5**	**2.5**
DZCT 303	Population Genetics and Evolution	**60**		**60**	**4.5**	**2.5**
Choice Based Optional Theoretical Course						
DZOT 301/302/303/304/305	Theoretical Paper	**80**		**80**	**4.5**	**3.0**
Practical Core Course						
DZCP 301	Taxonomy and Biophysical Technique	**40**		**40**	**7.5**	**1.5**
Continuation Evaluation						
DZCC 301,302,303	Class Test		**(15 X3)= 45**	**45**		**(0.5X 3)= 1.5**
DZCE 301	Choice Based Seminar (**Ability Enhancement Course**)		**25**	**25**	**3.0**	**1.0**
DZCE 302	Scientific Excursion (**Ability Enhancement Course**)		**30**	**30**	**7.5**	**1.5**
Total Marks and Credits in Semester III		**300**	**100**	**400**	**(36)**	**16**

SEMESTER –IV						
Paper		**Marks**				**Credit**
Theoretical Core Course						
DZCT 401	Biometric Analysis and Conservation Biology	**60**		**60**	**4.5**	**2.5**
DZCT 402	Parasitology and Immunology	**60**		**60**	**4.5**	**2.5**
Choice Based Optional Theoretical Course						
DZOT 401/402/403/404/405	Theoretical Paper	**80**		**80**	**4.5**	**3.0**
Practical Core Course						
DZCP 401	Biometry, Parasitology and Conservation Biology	**40**		**40**	**7.5**	**1.5**
Choice Based Optional Practical Course						
DZOP 401/402/403/404/405	Practical Paper	**60**		**60**	**7.5**	**2.5**
Continuation Evaluation						
DZCC: 401,402	Class Test		**(15X2)= 30**	**30**		**1.0**
DZCE 401	Dissertation/ Review /Project		**50**	**50**	**7.5**	**2.0**
DZCE 402	Comprehensive Viva-voce		**20**	**20**		**1.0**
Total Marks and Credits in Semester IV		**300**	**100**	**400**	**(36)**	**16**
TOTAL MARKS AND CREDITS IN ALL SEMESTERS		**1200**	**400**	**1600**	**(2448)**	**64**

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

Semester-wise and paper-wise distribution of total lecture hours and credits

Semester-I	**L. H.: 612; Credits: 16**
Theoretical core course	**L.H: 306; Credits: 10**
DZCT 101: Functional Biology of Non-Chordates and Insect Biology	L.H: 76.5; Credits: 2.5
DZCT 102: Functional Biology of Chordates and Fish Biology	L.H: 76.5; Credits: 2.5
DZCT 103: Genetics and Biochemistry	L.H: 76.5; Credits: 2.5
DZCT 104: Ethology and Wildlife Biology	L.H: 76.5; Credits: 2.5
Practical Core Course	**L.H: 255; Credits: 2.0**
DZCP 101: Non-Chordates and Chordates	L.H: 127.5; Credits: 1.0
DZCP 102: Biochemistry and Cytogenetics	L.H: 127.5; Credits: 1.0
Continuation Evaluation	**L.H: 51; Credits: 4.0**
DZCC 101,102,103,104: Class Test	L.H: ; Credits: 3.0
DZCE 101: Choice Based Seminar	L.H: 51; Credits: 1.0

Semester-II	**L.H: 612; Credits: 16**
Theoretical core course	**L.H: 306; Credits: 10**
DZCT 201: Developmental Biology and Endocrinology	L.H: 76.5; Credits: 2.5
DZCT 202: Environmental Physiology and Neurobiology	L.H: 76.5; Credits: 2.5
DZCT 203: Cell and Molecular Biology	L.H: 76.5; Credits: 2.5
DZCT 204: Ecology and Climate Change Biology	L.H: 76.5; Credits: 2.5
Practical Core Course	**L.H: 255; Credits: 2.0**
DZCP 201: Ecology and Developmental Biology	L.H: 127.5; Credits: 1.0
DZCP 202: Histology and Histochemistry	L.H: 127.5; Credits: 1.0
Continuation Evaluation	**L.H: 25.5; Credits: 4.0**
DZCC 201,202203,204: Class Test	L.H: ; Credits: 3.0
DZCE 201: Review of any Scientific Paper	L.H: 51; Credits: 1.0

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

Semester – III	**L.H: 612; Credits: 16**
Theoretical core course	**L.H: 229.5; Credits: 7.5**
DZCT 301: Taxonomy and Biodiversity	L.H:76.5; Credits: 2.5
DZCT 302: Biotechnology and Biophysical Technique	L.H:76.5; Credits: 2.5
DZCT 303: Population Genetics and Evolution	L.H:76.5; Credits: 2.5
Choice Based Optional Theoretical Course	**L.H:76.5; Credits: 3.0**
DZOT 301/302/303/304/305: Theoretical Paper	L.H:76.5; Credits: 3.0
Practical Core Course	**L.H: 127.5; Credits: 1.5**
DZCP 301: Taxonomy and Biophysical Technique	L.H:127.5: Credits: 1.5
Continuation Evaluation	**L.H: 178.5; Credits: 4.0**
DZCC 301,302, 303: Class Test	L.H: ; Credits: 1.5
DZCE 301: Choice Based Seminar	L.H:51; Credits: 1.0
DZCE 302: Scientific Excursion	L.H:127.5; Credits: 1.5

Semester –IV	**L.H.: 612; Credits: 16**
Theoretical Core Course	**L.H: 153; Credits: 06**
DZCT 401: Biometric Analysis and Conservation Biology	L.H: 76.5; Credits: 3.0
DZCT 402: Parasitology and Immunology	L.H: 76.5; Credits: 3.0
Choice Based Optional Theoretical Course	**L.H: 76.5; Credits: 3.0**
DZOT 401/402/403/404/405: Theoretical Paper	L.H: 76.5; Credits: 3.0
Practical Core Course	**L.H: 127.5; Credits: 2.0**
DZCP: 401: Biometry, Parasitology and Conservation Biology	L.H: 127.5; Credits: 2.0
Choice Based Optional Practical Course	**L.H: 127.5; Credits: 2.0**
DZOP 401/402/403/404/405: Practical Paper	L.H: 127.5; Credits: 2.0
Continuation Evaluation	**L.H: 127.5; Credits: 4.0**
DZCC 401,402,: Class Test	L.H: ; Credits: 1.0
DZCE 401: Dissertation/ Review /Project	L.H: 127.5; Credits: 2.0
DZCE 402: Comprehensive Viva-voce	L.H: 0.00; Credits: 1.0

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

DETAILED SYLLABUS:

SEMESTER -I **L. H.: 612; Credits: 16**

Theoretical core course **L.H: 306; Credits: 10**

DZCT 101: Functional Biology of Non-Chordates and Insect Biology
L.H: 76.5; Credits: 2.5

1. Locomotion in protozoa and metazoa.

2. Nutrition and digestion:
   a) Patterns of feeding and digestion in lower metazoan.
   b) Filter-feeding in Polychaeta, Mollusca and Echinodermata.

3. Respiration:
   a) Organs of respiration: Gills, Book-lungs and Trachea.
   b) Respiratory pigments.
   c) Mechanism of respiration.

4. Excretion:
   a) Organs of excretion.
   b) Mechanism of excretion.
   c) Excretion and Osmoregulation.

5. Nervous system:
   a) Trends in neural evolution:
   i) Primitive
   ii) Advanced

6. Invertebrate larvae:
   a) Strategies and evolutionary significance of larval forms.

Insect Biology:

1) Classification of Insects – Major orders with features and examples.
2) Reproductive strategies in insects.
3) Concept of pest status and classification of pesticides.
4) Methods of insect pest control: Integrated Pest Management.
5) Life forms of high altitude insects.

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

SUGGESTED BOOKS:

Invertebrates:

1. Invertebrate Zoology : R. D. Barnes
2. Invertebrate Zoology : Ruppert andBarnes.
3. Biology of Invertebrates : J. A. Pechenik.
4. Invertebrate Zoology : Anderson.
5. Invertebrate structure and functions : Barrington E J W, Thomas Nelson and Sons Ltd., London.
6. Biology of Higher Invertebrates : Russel – Hunter, W.D. The Macmillan Co. Ltd.
7. Biology of Animal Parasites : T. C. Cheng
8. Annelids : R. P. Dales
9. The Invertebrates Vol. I – VI : L. H. Hyman
10. Invertebrate Zoology : P. A. Meglitsch
11. Invertebrate Zoology : Meglitsch and Schram.
12. Textbook of Zoology : Marshall and Williams
13. The Biology of Protozoa : M. Sleigh
14. Insect Physiology : V. B. Wigglesworth
15. Invertebrates- Richard C.Brusca, Garry T.Brusca, Sinauer Associates Inc; Publishers, Massachusetts

Insect Biology:

1. Chapman R.F 2000. The Insect: Structure and Function, 4th End. Cambridge Low price End. Cambridge Univ. Press.
2. Chatterjee, P.B :Plant protection Technique, Bharati Bhawan. (P & D).
3. Dey, S. and Raziuddin, M. : The female reproductive system of aak grasshopper : A histomorphological study. Lambert Academic Publishing.
4. Gullan, P.J. and P.S Cranstor, : The Insect: An outline of Entomology, Chapman & Hall.
5. Krebs, C.J., :Ecology, the Experimental analysis of Distribution and Abundance, Harper & Row Publishers.
6. Pedigo, L,P., :Entomology and Pest management, Prentice: Hall of India Pvt. Ltd.
7. Saxena, S.C, : Biology of Insects, Oxford and IBH Publishing Co. Pvt. Ltd.
8. Srivastava, K.P., : A test Book of Applied Entomology Vol. I & II, Kalyani Publishers.
9. Tembhre, D. B.: Modern Entomology.
10. Yazdani, S.S, and M.L Agarwal :Element of Insect Ecology, Narosa Publishing House.

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

DZCT 102: Functional Biology of Chordates and Fish Biology L.H: 76.5; Credits: 2.5

1. Integuments and its derivatives:
   a) General structures of intugement
   b) Functions of integumentary derivatives.

2. Circulation: Evolution of aortic arches and portal system.

3. Respiratory system:
   a) External and internal respiration.
   b) Comparative account of respiratory organs.
   c) Breathing in embryos.

4. Skeletal system:
   a) Jaw suspension: functional and evolutionary significance.
   b) Limbs and girdles structure and function.

5. Evolution of Urinogenital system in vertebrate series.

6. Nervous system and sense organs:
   a) Organs of olfaction and taste.
   b) Lateral-line system.
   c) Electroreception.

Fish Biology:

1. Migratory behaviour of fishes with special emphasis on Hilsa fish.
2. Concepts of monoculture, polyculture and composite fish farming.
3. Parental care in fishes.
4. Osmoregulation in freshwater and marine fishes.
5. Aquaculture – its definition and scope. Pond pisiculture. Mericulture.
6. Prawn culture, Pearl culture, Chunk fisheries.

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

SUGGESTED BOOKS:

Chordate :

1. The Life of Vertebrates : J. Z. Young
2. Analysis of Vertebrate Structure : M. Hilderbrand
3. Biology of Vertebrates : Walter & Sayles
4. Analysis of vertebrate structure : Hilderbrand, M.
5. Anatomy of the Chordates : C. K. Weichert
6. Vertebrate Life Pough, Heiser and Mc Farland
7. Chordate structure and function: Klugg.
8. Outline of comparative anatomy of vertebrates : Kingsley, J.S.
9. Comparative anatomy of the vertebrates : Kent.
10. The Chordates : R. M. N. Alexander.
11. Vertebrate Comparative Anatomy, Functions, Evolution : K. V. Kardong
12. Vertebrate Body : Romer

Fish Biology:

1. Advances in fish biology: H. R. Singh.
2. Air breathing fishes of India: J. S. Dutta Munshi and G. M. Hughes.
3. Aquaculture: T. V. R. Pillai.
4. Biology of fishes: Bone and Moore.
5. Ecology of aquatic system: M. Dobson and C. Frid.
6. Fish and fisheries: S. Kumar and M. Tembhre.
7. Fish and fisheries: S. S. Khanna.
8. Fish and fisheries of India: V. G. Jhingran.
9. Fish and fisheries products: FAO.
10. Fisheries bioeconomics: FAO.
11. Fisheries in India: R. Mitra.

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

DZCT 103: Genetics and Biochemistry **L.H: 76.5; Credits: 2.5**

Genetics:

1. Sex chromosomes, sex determination and dosage compensation in *C. elegans*, *Drosophila* and humans.
2. Gene concept: concept of cistron; Benzer's Experiment and modern view.
3. Human karyotype – banding – nomenclature.
4. Chromosomal aberrations.
5. Extra chromosomal inheritance: mitochondrial DNA, maternal inheritance.
6. Molecular disorders; Sickle celled anaemia, Prion disease, Cystic Fibrosis, Xeroderma Pigmentosum.

Biochemistry:

1. Biomolecules and Bio molecular interaction:
    a) Water as ideal biological solvent.
    b) Basic concept of pH, normality, morality, molality, osmolality.
    c) Characteristic features of van-der Waal's interaction, Hydrogen Bond, Co-valent bond, Non-covalent bond.
2. Protein folding and protein stability, Ramachandran Plot, Amino acid sequencing.
3. Enzymology:
    a) Kinetic analysis of enzyme-catalyzed reaction
    b) Regulation of enzyme activity
    c) Mechanism of enzyme catalysis, isozymes, co-enzymes.
4. Bioenergetics: Thermodynamic principles and steady-state conditions of living organism;
5. Biotransformation: Cytochrome p450 and other haemoproteins.

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

SUGGESTED BOOKS:

Genetics:

1. Old and Primrose – Principle of Gene Manipulation.
2. From gene To Clones –Winnacker
3. Alberts *et al*
4. Lodish *et al*
5. Watson *et al* Pearson education
6. Genetic Engineering -Watson *et al*
7. Brooker – Genetics
8. Strickberger – Genetics
9. Suzuki *et al* Genetics
10. Lewin – Genes Series: Pearson education
11. Allison
12. Becker, The world of the cell, Pearson education
13. Gardner et al, Principle of Genetics, John Wiley and Sons
14. Snustad and Simmons, Principle of Genetics, John Wiley and Sons
15. Klug and Cummings, Concepts of Genetics, Pearson education
16. Sambrook and Russell, Molecular Cloning: A laboratory manual, Vol. I, II, III, Cold Spring Harbour Laboratory Press, New York.
17. Pierce B.A., Genetics: A conceptual approach, W. H. Freeman And Company, New York.
18. Hartwell *et al* – Genetics from genes to genomes.

Biochemistry:

1. Biochemistry and Molecular Biology, Elliot, W. H. and D. C. Elliot, Oxford University Press
2. Text Book of Biochemistry with clinical correlation, Devlin T. M., Wiley-Liss, New.
3. Lehninger's Principles of Biochemistry, Nelson D.L. and M. M. Cox, Worth Publishers, New York.
4. Biochemistry, Stryer L., W. H. Freeman and Company, New York.
5. Biochemistry, Voet and Voet, John Wiley and Sons Inc.
6. Biochemistry : Berg, J.M.; Tymoczko, J.L.; Stryer, L.; W. H. Freeman, New York.

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

DZCT 104: Ethology and Wildlife Biology

Ethology **L.H: 76.5; Credits: 2.5**

1. Innate and learnt behaviour.
   a) Neural and hormonal control of behaviour.
   b) Genetic and environmental components in development of behaviour.

2. Ecological aspects of behaviour:
   a) Habitat selection, food selection, optimal foraging theory, anti – predator defence.
   b) Aggression, homing, territoriality, dispersal.
   c) Communication: Chemical, Visual, Light, Audio, Species specificity of songs.

3. Group selection: kin selection, altruism, reciprocal altruism, inclusive fitness.

4. Cooperation and conflict:
   a) Male-male competition and sexual selection
   b) Elaborate ornaments: Fisher's hypothesis and Handicap hypothesis
   c) Parent-offspring conflict
   d) Range of cooperative behaviours and Prisoner's dilemma

5. Reproductive behaviour:
   a) Evolution of sex and reproductive strategies.
   b) Mating systems.
   c) Courtship.
   d) Parental care.

Wildlife biology

1. Definition of wildlife, importance of wildlife and rationale for their conservation; Classification of wildlife according to severity of threats

2. Wildlife in India
   a) Wildlife wealth of India & threatened wildlife
   b) Reasons for wildlife depletion in India
   c) Wildlife conservation approaches and limitations

3. Wild life Habitat
   a) Characteristic, Fauna and Adaptation with special reference to Tropical forest
   b) Protected Area concept: National Parks, Sanctuaries and Biosphere Reserves, cores and Buffers, Nodes and corridors.
   c) Community Reserve and conservation Reserves

4. Wildlife management in India, principles and strategies of conservation.
   a) Special Management Programme of Wild Animals in India: Project tiger, Operation rhino, Project Elephant, crocodile.
   b) Distribution, status. Habitat utilization pattern, threats to survival of Slender Loris, Musk deer, Great Indian Bustard, Olive Ridley turtle.

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

SUGGESTED BOOKS:

Ethology (Animal Behaviour)

1. Animal Behaviour: Manning & Dawkins
2. Animal behaviour: Drickamer *et al*
3. Animal Behaviour:An Evolutionary Approach: Alcock
4. Principles of Animal Behaviour:
5. Perspectives of Animal Behaviour: Goodenough *et al*
6. Animal Behaviour: Ridley
7. Behavioural Ecology : An Evolutionary Approach: Krebs & Davies
8. An Introduction to Behavioural ecology: Krebs and Davies
9. Cooperation and conflicts in animal Societies: Gadagkar
10. Threats to Indian mammals : G.K.Saha & S. Majumder
11. Fundamentals of Ecology by Odum
12. Ecology by Krebs
13. Ecology by Riclefs and Miller
14. Fundamentals of Ecology by Dash
15. Envirnmental Science by Wright
16. Ecology by Begon Harper.

Wildlife biology

1. Wildlife ecology. Aaron, N.M. (1973): W.H. Freeman Co. San Francisco, USA.
2. Faunal diversity in India, ZSI , J.R.S. Alfred, A.K. Das and A. K Sanyal. Calcutta.
3. The book of Indian Reptiles and Amphibians, , J.C .Daneil Oxford publ..
4. Biodiversity and its conservation in India. S.S. Negi, Indus Publishing Co.,New Delhi.
5. The Book of Indian Animals. S.H. Prater, BNHS/Oxford
6. Indian wildlife resources: Ecology and development. B.D. Sharma, Daya publishing House, Delhi.

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

Practical Core Course **L.H: 255; Credits: 2.0**

DZCP 101: Non-Chordates and Chordates **L.H: 127.5; Credits: 1.0**

1. Major Dissection (As specimen available at the market or from laboratory specimens):
   a) Nervous system of Earthworm.
   b) Sting apparatus of Honey bee.

2. Mounting / Minor dissection (As specimen available at the market or from laboratory specimens) :
   a) Nephridium and spermatheca in Earthworm.
   b) Setae of Earthworm, Mouth parts of honey bee or mosquito or house fly.

3. Identification with reason upto subclasses / order:
   a) Protozoa: *Opalina, Balantidium, Nyctotherus*.
   b) Porifera: Neptune's cup, *Scypha* sp.
   c) Coelenterata: *Physalia, Aurelia, Pennatula*.
   d) Helminths: Microfilaria of *W. bancrofti, Echinococcus, Anchylostoma*.
   e) Annelida: *Aphrodite, Sabella*.
   f) Arthropoda: *Sacculina, Mantis*, Stick insect.
   g) Mollusca: *Loligo, Sepia, Doris*, Pearl oyster.
   h) Echinodermata: Sea star, Brittle star.

4. Major Dissection (As specimen available at the market):
   a) V th. and VII th. cranial nerves in *Gallus* sp.
   b) Location and extraction of pituitary gland of carp.

5. Mounting / Minor dissection (As specimen available at the market):
   a) Weberian ossicles and swim bladder in carp.
   b) Cycloid / Ctenoid / Placoid scales of fish.

6. Identification with reason upto subclasses / order:
   Balanoglossus, Doliolum, Salpa, Sucker fish, Flying fish, Sea horse, *Labeo rohita, Labeo bata, Catla catla, Siren, Tylototriton verrucosa, Mabuya, Chelone, Scinctilla sikkimensis, Javalura verrucosa*, Pangolin, Megachiropteran bat, Microchiropteran bat.

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

DZCP 102: Biochemistry and Cytogenetics **L.H: 127.5; Credits: 1.0**

Biochemistry:

1. Colorimetric / Spectrophotometric estimation of Glucose, RNA, DNA and Proteins.
2. Determining the effect of substrate concentration and temperature on enzyme activity.
3. Estimation of sugars by Somogyi-Nelson Method,

Cytogenetics:

1. Estimation of gene and genotype frequencies in the light of Hardy – Weinberg principles.
2. ABO blood grouping (From own blood).
3. Collection and preparation of pedigrees and their analysis.
4. Preparation of sex chromatin.
5. Identification of mutant verities of *Drosophila* sp.

Continuation Evaluation **L.H: 51; Credits: 4.0**

DZCC 101,102,103,104 : Class Test **L.H: ; Credits: 3.0**

DZCE 101: Choice Based Seminar **L.H: 51; Credits: 1.0**

This is to evaluate the knowledge, presentation technique, presence of mind, and over all smartness of a student. Students need to produce at least three seminar topics as per their choice. From those topics any one will be selected as per their preference for presentation. 15 minutes will be allotted for presentation and 10 minutes for interaction with audience.

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

SEMESTER -II **L.H: 612; Credits: 16**

Theoretical core course **L.H: 306; Credits: 10**

DZCT 201: Developmental Biology and Endocrinology **L.H: 76.5; Credits: 2.5**

Developmental Biology:

1. Foundation of gamete biology:
    a) Heterogamy in eukaryotes.
    b) Comparative account of differentiation of gonads in mammals.
    c) Leydig cells: Morphology, differentiation, functions and its regulation.
    d) Spermatogenesis: Morphological basis and gamete specific gene expression.
    e) Biochemistry of semen: Composition and formation, assessment of sperm function and Y – specific probes.
    f) Ovarian follicular growth and differentiation: Morphology, endocrinology, molecular biology, oogenesis and vitellogenesis, ovulation and ovum transport in mammals.

2. Fertilization:
    a) Pre-fertilization events.
    b) Biochemistry of fertilization.
    c) Post-fertilization events.

3. Events of cleavage, gastrulation and organogenesis as found in chick embryo.

4. Multiple ovulation and embryo transfer technology (MOET):
    a) *In vitro* oocyte maturation.
    b) Super ovulation.
    c) *In vitro* fertilization.

Endocrinology:

1. Aims and scope of Endocrinology:
    a) Hormone as messengers.
    b) Hormone and eukaryotic metabolic regulation.
    c) Classification and chemical nature of hormone.

2. Purification and characterisation of hormones.

3. Nature of hormone action: Hormone receptors, membrane receptors, G proteins, nuclear receptors.

4. Neuroendocrine regulation.

5. Ultra structure and functions of:
    a) Pituitary gland.
    b) Thyroid gland.
    c) Pancreas.

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

d) Adrenal gland.
e) Testis and Ovary.

SUGGESTED BOOKS:

Developmental Biology:

1. Introduction to Embryology: Balinsky
2. Developmental Biology: Berril
3. Biology of Developmental System: Grant
4. Reproduction in Animals: Austin and Short
5. Molecular Biology of Fertilization: Schatten and Schatten
6. Human Reproduction : R. G. Edwards
7. Embryology : S. F. Gilbert
8. Molecular Cell Biology : Harvey, Baltimore, Arnold, Zipursky, Matsudaria and Darnell
9. Biological Development : Kalthoff
10. Developmental Biology : Wolpart
11. Developmental Biology: S. Chattopadhyay. Books and Allied.
12. Fertilization: Longo, F. T.

Endocrinology:

1. General and Comparative Endocrinology: E. J. W. Barrington
2. Endocrine Physiology: C. R. Martin - Oxford
3. Comparative Endocrinology: A. Gorbman
4. General Endocrinology: Turner and Bagnara
5. Essential Endocrinology: Brook and William
6. Comparative Endocrinology: Norris
7. Experimental Endocrinology: M. X. Zarrow
8. Endocrinology: MacHadley
9. Endocrinology: Greenspan

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

DZCT 202 : Environmental Physiology and Neurobiology.

L.H: 76.5; Credits: 2.5

Environmental Physiology:

1. Introduction:
   a) Basic concepts of Environmental stress and strain
   b) Concept of Homeostasis
   c) Mechanisms of cell volume regulation
   d) Nature, levels and mechanisms of adaptation

2. Temperature:
   a) Biochemical effects of temperature
   b) Physiological effects of temperature
   c) Terminology and strategies in thermal biology
   d) Evolution and advantages of varying thermal strategies

3. Homeostasis and physiological integration of animal in different environmental habitat:
   a) Aquatic (freshwater and marine)
   b) Terrestrial
   c) Parasitic animals

4. Biochemical adaptations to extreme living conditions as in:
   a) High altitude animals
   b) Deep diving animals
   c) Freeze tolerant and resistant animals

5. Stress physiology:
   a) Physiological response to body exercise.
   b) Meditation, yoga and their effects.

Neurobiology:

1. Central Nervous System – Structure and functions (in human)
2. Membrane transport and signalling through neurolemma.
3. Nerve impulse generation and propagation.
4. Overview of synaptic function
   a) Ionotropic and metabotropic receptors and neurotransmission
   b) Mechanism of neurotransmitter release
   c) Role of calcium in biochemistry of exocytosis and endocytosis
5. Neuromuscular junction.
   a) Organization and properties of neuromuscular junction
   b) Neurotransmitters, neurohormones and neuromodulators
   Sensory reception: Coding and control of sensory information.
6. Aspects of neuronal disorders

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

a) Strokes
b) Epilepsy
c) Parkinson's disease
d) Alzheimer's disease

SUGGESTED BOOKS:

Environmental Physiology:

1. Animal Physiology: Mechanisms and Adaptation : R. Eckert
2. Biochemical Adaptation: P. W. Hochachka and G. N. Somero
3. General and Comparative Animal Physiology: W. S. Hoar
4. Animal Physiology: Adaptation and Environment: Schmidt- Nielsen
5. Physiology: A Regulatory System Approach: F. L. Strand
6. Environmental and Metabolic Animal Physiology: C. L. Prosser
7. Environmental Physiology: P. G. Stone Willmer and L. Johnston
8. Adaptation to Environment: R. C. Newell
9. Physiological Ecology: An Evolutionary Approach to Resource Use: C. R. Townsend and P. Callow.
10. Optima for Animals : R. M. N. Alexander
11. Physiological Animal Ecology : G. N. Louw

Neurobiology:

1. Medical Physiology: Guyton
2. Human Physiology: Rhodes and Pflang
3. Human Physiology: S.I. Fox
4. Molecular Cell Biology, Lodish et al, Scientific American Book Inc. USA.
5. Molecular Biology of the Cell: Alberts et. al.
6. Neuroscience: Purves
7. Foundations of Neurobiology: Fred Delcomyn

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

DZCT 203: Cell and Molecular Biology **L.H: 76.5; Credits: 2.5**

1. Biomembranes:
    a) Molecular composition and arrangement functional consequences.
    b) Transport across cell membranes – Diffusion, active transports and pumps, uniport, symport and antiport.
    c) Membrane potential.
    d) Co-transport by symporters or antiporters.
    e) Transport across epithelia.

2. Cytoskeleton:
    a) Microfilaments and microtubules – structures and dynamics.
    b) Microtubules and mitosis.
    c) Cell movements – intracellular transport, role of kinesin and dynein, signal transduction mechanisms.

3. Cell cycle:
    a) Cyclines and cycline dependent kinases.
    b) Regulation of CDK-Cycline activity.

4. Cancer: Basic concepts.

5. Genetic code
    a) Characteristics of genetic code
    b) Start codons and stop codons
    c) Degeneracy of the code: Wobble hypothesis and isoacceptor tRNAs
    d) Special features of the genetic code in mitochondria, mitochondrial tRNA
    e) Point mutations that alter genetic code (missense, nonsense & frameshift)
    f) Suppressor mutation, suppressor genes & suppressor tRNA

6. Structural organisation of different types of chromosomes.

SUGGESTED BOOKS:

1. Molecular Cell Biology: J. Darnell et. al.
2. Molecular Biology of the Cell: Alberts et. al.
3. Cell Biology : Cooper
4. Cell and Molecular Biology : De Robertis and De Robertis
5. Molecular Cell Biology, Lodish et al, Scientific American Book Inc. USA.
6. Cell and Molecular Biology, G. Karp, John Wiley and Sons

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

7. Molecular Biology, Pollard
8. Fundamental Molecular Biology, L.A. Allison, Blackwell Publisher.
9. Molecular Biology of the gene, J.D.Watson , Benjamin Publishing house

DZCT 204: Ecology and Climate Change Biology

L.H: 76.5; Credits: 2.5

Ecology

1. Structure of community: Guild concepts, random gradient analysis and ordination, geometric series models of species abundance, random niche model.
2. Habitat fragmentation and ecotone dynamics.
3. Ecological efficiency in relation to assimilation and production efficiency.
4. Energy transfer and accumulation.
5. Population growth: Life Tables, Reproductive Rate, deterministic models and stochastic models.
6. Global patterns in species richness, species diversity.

Climate Change Biology

1. Greenhouse gases and green house effect, ozone layer depletion.
2. Global warming, global patterns of temperature and precipitation, Carbon sequestration, Carbon trading, Carbon foot print, Concept of REDD (reducing emission through destruction and deforestation) and REDD+.
3. Policies initiatives for climate change and conservation.
4. Introduction to Intergovernmental Panel on Climate Change (IPCC) and their reports.
5. El niño, La niña, southern oscillation and their ecological impact.
6. Impact of Climate Change Impact on ecosystem process , the physical environment: glacial melt including glacial retreat in the Himalayas, sea level rise, glacial lake outburst flood (GLOF), landslides, drought, changes in rainfall patterns, snow fall events, coral reef bleaching, etc.

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

SUGGESTED BOOKS:

Ecology

1. Fundamentals of Ecology by Odum
2. Ecology by Krebs
3. Ecology by Riclefs and Miller
4. Fundamentals of Ecology by Dash
5. Envirnmental Science by Wright
6. Ecology by Begon Harper.
7. Ecological theories and applications by Peter Stiling

Climate Change Biology

1. IPCC . Fourth assessment report of the Intergovernmental Panel on Climate
2. Change (IPCC). Cambridge University Press, Cambridge, United Kingdom.
3. General Issues on Environmental Ecology, Bio diversity and Climate change. B. Ramasamy. Pragun Publication.
4. Environment and Ecology: Biodiversity, Climate Change and Disaster Management. M. Hussain, Access Publishing House.
5. The Little Data Book on Climate Change (2011) World Bank Publications.
6. Hand Book of Climate Change Science. S.S Negi, Bishen Singh MahendraPal Singh.
7. The Rough Guide to Climate Change.Rr.Henson,2011. Rough Guides Publisher.
8. General Issues on Environment, Biodiversity and Climate Change.R.Kaur 2014, New Vishal Publication.
9. Global Carbon Cycle and Climate Change. K.Y . and Kondratyev, V. F. Krapivin. 2014, Springer publications.
10. Remote Sensing in Snow Hydrology: Runoff Modelling, Effect of Climate Change. K. Seidel and J. Martinec ,2014. Springer publications.
11. Preparing for Climate Change. M.D. Mastrandrea and S.H. Schneider, 2010. MIT Press.

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

Practical Core Course **L.H: 255; Credits: 2.0**

DZCP 201: Ecology and Developmental biology **L.H: 127.5; Credits: 1.0**

Ecology:

1. Study of species diversity index – Shannon index, Richness index, Relative abundance, Species evenness, Importance value index.

2. BOD of water sample.

3. Ecological comments on blood parasite, gut parasite, flat fish, tree frog, Himalayan bird, mole, hermit crab, *Balanus*, red spider mite, *Helopeltis*, red panda, flying squirrel, Himalayan mouse.

Developmental biology

1. Study on different developmental stages of vertebrate and invertebrate.

2. Identification of developmental stages of chick embryo and toad embryo.

DZCP 202: Histology and Histochemistry **L.H: 127.5; Credits: 1.0**

1. Cytochemical staining – PAS, Feulgen, Sudan – staining of lipid Mercury bromophenol test of proteins.
2. Histological staining.
3. Identification of tissues.
4. Microtechniques.

Continuation Evaluation **L.H: 51; Credits: 4.0**

DZCC 201,202,203,204 : Class Test **L.H: ; Credits: 3.0**

DZCE 201: Review of a scientific paper **L.H: 51; Credits: 1.0**

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

Students will be provided with peer reviewed scientific paper of which the students will be asked to make their observations. The students will be assessed on their study observations.

SEMESTER – III **L.H: 612; Credits: 16**

Theoretical core course **L.H: 229.5; Credits: 7.5**

DZCT 301: Taxonomy and Biodiversity **L.H:76.5; Credits: 2.5**

Taxonomy:

1. Recent Trends in Taxonomy: Cytotaxonomy, Chemotaxonomy, Molecular Taxonomy; Basics of Barcoding, Applications of DNA Barcode, Constraints of DNA Taxonomy; Parataxonomy
2. Phenetic and Cladistic Schools: Numerical Taxonomy: Analysis, Methodology; Construction of Phenogram and Cladogram; Polarity decision; Parsimony; Out group comparison; Phylogenetic groups : Monophyly, Paraphyly, Polyphyly; Determination of Genetic Distance
3. Phylogenetic Trees: Understanding Phylogenetic Trees; Kinds of Phylogenetic Trees
4. Dimensions of speciation and taxonomic characters:
    a) Dimensions of speciation – types of lineage changes, production of additional lineage.
    b) Mechanism of speciation in panmictic and apomictic species.
    c) Species concept – species category, different species concepts, sub-species and other infra-specific categories.
    d) Theories of biological classification, hierarchy of categories.
    e) Taxonomic characters – different kinds, origin of reproductive isolation – biological mechanisms of genetic incompatibility.

Biodiversity

1. Evaluation of different biodiversity indices:
    a) Shannon – Wiener index, dominance index.
    b) Similarity and dissimilarity index.
    c) Association index.
2. Biodiversity basic concepts:
    a) á, â, ã diversity
    b) Regional aspects and diversity
    c) Hotspots and mega diversity centres.
    d) Biodiversity status, monitoring and documentation.
    e) Values of Biodiversity.
3. Global pattern of biodiversity
    a) Diversity in biogeographical region and marine zones
    b) Diversity clines in relation to area, latitude, altitude and deep sea

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

c) Theories on biodiversity dispersions

4. Agro biodiversity and centres of origin.

SUGGESTED BOOKS:

Taxonomy:

1. Principles of Systemic Zoology: E. Mayr & Ashlock – McGraw Hill Pub.
2. Elements of taxonomy: E. Mayer.
3. Animal Taxonomy: Kapoor Oxford and IBH Pub. Co. 2000
4. Molecular Systematics: Li and Graur – Sinaeur Associates, Sunderland.
5. Genomes: Brown – Blackwell Science.
6. Evolutionary Biology: D. Futuyama - Sinaeur Associates, Sunderland.
7. Evolution: Volpe & Rossenbaum – McGraw Hill Pub.
8. Taxonomy – Quicke.

Biodiversity:

1. Biodiversity: Krishnamoorthy Oxford & IBH Pub. Co.
2. Biodiversity: Ashija & Kumar Agrobios.
3. Biodiversity: Swaminathan Macmillan India Ltd.
4. Ecology: Chapman and Reiss Cambridge Low Priced Edition
5. Ecology: Ricklefs and Miller

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

DZCT 302: Biotechnology and Biophysical Technique **L.H:76.5; Credits: 2.5**

Biotechnology:

1. Recombinant DNA technology: restriction endonucleases, strategies and application.
2. Cell culture methods and applications.
   a) Design and functioning of tissue culture laboratories.
   b) Cell proliferation measurements.
   c) Cell viability testing.
   d) Culture media preparation and cell harvesting methods.
3. Tools and techniques applied in biotechnology.
4. Basic applications and tools in bioinformatics .
5. Gene and Somatic cloning techniques
   a) Transgenic technology; production, prospects, advantages and disadvantages
   b) Animals as bioreactores
   c) Knockout model systems & their utility

Biophysical Technique:

1. Microscopy: Principles of light transmission, phase – contrast, fluorescence, electron cryo, confocal, SEM, TEM.
2. Principles and uses : Spectrophotometer, spectroflurometer and mass spectrophotometer.
3. Cryotechnologies:
   a) Cryopreservations for cells, tissue, organisms.
   b) Cryotechniques for microscopy.
   c) Freeze – drying for physiologically active substances.

4. Separation techniques:
   a) Molecular separation by chromatography,
   b) Electrophoresis
   c) Organelle separation by centrifugation.
   d) Cell separation by flowcytometry and FACS.

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

SUGGESTED BOOKS:

Biotechnology:

1. Molecular Cloning: A laboratory manual: Sambrook and Russell. Vol. I, II, III, Cold Spring Harbour Laboratory Press, New York.
2. Concepts in Biotechnology: Balasubramanium.
3. Text book of biotechnology: R. C. Dubey.
4. Biotechnoogy: P. K. Gupta.
5. Animal Cell Culture - a practical approach: R. W. John (Ed.)
6. Introduction to Instrumental analysis: R. Braun
7. A Biologists Guide to Principles and Techniques of Practical Biochemistry: K. Wilson and K. H. Goulding
8. Biotechnology: H. D. Kumar

Biophysical Technique:

1. Practical Biochemistry-Wilson and Wilmer
2. Biochemical Calculations-Sigel
3. Biochemistry and Molecular Biology, Elliot, W. H. and D. C. Elliot, Oxford University Press
4. Text Book of Biochemistry with clinical correlation, Devlin T. M., Wiley-Liss, New.
5. Lehninger's Principles of Biochemistry, Nelson D.L. and M. M. Cox, Worth Publishers, New York.
6. Biochemistry, Stryer L., W. H. Freeman and Company, New York.
7. Biochemistry, Voet and Voet.
8. Biophysical techniques: Frifelder.

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

DZCT 303: Population Genetics and Evolution L.H:76.5; Credits: 2.5

Population Genetics

1. Concept of: Population, gene pool, gene frequency, Hardy – Weinberg law.

2. Destabilising forces influencing allelic frequency ; mutation and mutation rates, natural selection, migration and genetic drift.

3. Molecular population genetics:
   a) Pattern of change in nucleotide and amino acid sequence.
   b) Ecological significance of molecular variations.
   c) Neutral hypothesis.

4. Genetic structure of population ; optimum phenotype, selection pressure, Fisher's Theorem of natural selection, Genetic Homeostasis, Genetic Load and Mutational Load.

5. Inbreeding: Measures of inbreeding, inbreeding depression, heterosis.

Evolution

1. Speciation:
   a) Phylogenetic, biological and evolutionary species concept.
   b) Isolation mechanism.
   c) Speciation models: Allopatric, sympatric, statispatric and parapatric.

2. Molecular evolution and phylogenetics:
   a) Gene evolution.
   b) Nucleic acid phylogeny – DNA – DNA hybridization, nucleotide sequence comparison and homologies.
   c) Molecular clocks.
   d) Molecular drive.

3. Origin of higher categories:
   a) Micro and macro evolution.
   b) Phyletic gradualism and punctuated equilibria.
   c) Concept of co-evolution.
   d) Heterochrony.

4. The Origin and Evolution of Primates
   a) Evolution of Anthropoid Primates
   b) The first hominids and origin of modern man

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

SUGGESTED BOOKS:

Population Genetics

1. Population Genetics: A Concise Guide: John H. Gillespie.
2. Principles of population genetics: Daniel L. Hartl.
3. Population genetics and microevolutionary theory: Alan Templeton.
4. An introduction to population genetics theory: James F. Crow.
5. Genetics of populations: Philip W. Hedrick.
6. Elements of human genetics: Luigi Luca Cavalli-Sforza.
7. Human population genetics: John H. Relethford.
8. Introduction to Population Genetics: Richard Halliburton.
9. Introduction to Theoretical Population Genetics: Thomas Nagylaki.
10. Theoretical Population Genetics: J. S. Gale.

Evolution

1. Evolutionary Biology: D. J. Futuyama - Sinaeur Associates, Sunderland.
2. Genes and Evolution: Jha – McMillan India Ltd.
3. Evolution: Ridley – Blackwell Science.
4. Evolution and Genetics: Merrel
5. Evolutionary Genetics: M. Smyth - Blackwell Science.
6. Evolution: Strickberger
7. Molecular Evolution: Li and Graur - Sinaeur Associates, Sunderland.
8. Life: Adaptation, Evolution and Ethology: S. Chattopadhyay. Books and Allied.

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

Choice Based Optional Theoretical Course **L.H:76.5; Credits: 3.0**

DZOT 301: Parasitology and Medical Entomology **L.H:76.5; Credits: 3.0**

Parasitology

a) Life history and pathogenicity of:
a) Entamoeba.
b) Brief review on: *E. coli, Endolimax, Iodamoeba*, Human trichomoniasis, Primary amoebic meningoencephalitis, Giardiasis.
b) Life history, physiology and biochemistry of malarial parasites.
c) Life cycle, transmission and pathogenicity of *Toxoplasma*, human *Trypanosoma* and Trypanosomiasis.
d) *Leishmania* and leishmaniasis.
e) Importance of *Babesia* and *Theileria.*
f) *Balantidium coli* and Balantidiasis, rumen ciliates – some basic principles.

Helminthology

a) Parasitic adaptations in Helminths.

b) Life cycle and control of:
a. *Ancylostoma* sp
b. *Wuchereria* sp
c. *Schistosoma* sp
d. *Paragonimus* sp
e. *Echinococcus* sp
f. *Dracunculus* sp
g. *Enterobius* sp
h. *Trichinella* sp

c) Physiology and biochemistry of helminth parasites.

Medical Entomology

1. Importance in disease transmission of Culicidae, Simuliidae, Tabanidae, Phlebotomidae.
2. Arthropods as ectoparasites – Pediculidae, Ixodidae and Argasidae.
3. Myiasis – causative agents, types and pathogenicity.

SUGGESTED BOOKS:

1. Parasitism: The Diversity and Ecology of Animal Parasites – Bush and Fernandez
2. Veterinary Parasitology – Reference Manual – William J. Foreyt
3. Practical Exercises in Parasitology – Halton, Behnke and Marshall
4. Illustrated guide to Protozoa – Leedale, Bradbury, Lee and Soldo
5. Biology of Parasitism – Tschudi and Pearce
6. Protocols in Protozoology – Lee and Soldo

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

7. The Biology of Nematodes – Donald L. Lee

DZOT 302: Environmental Biology **L.H:76.5; Credits: 3.0**

1. Life history strategies (r and k selection), concept of Metapopulation – demes and dispersal, interdemic extinctions, age structural population.

2. Ecological modelling:
    a) Ecosystem modelling.
    b) Prey predator systems modelling.

3. Ecosystems and Communities:
    a) Types of ecosystem
    b) Structure and functions of marine and freshwater ecosystems, grassland, desert and forest ecosystems, abiotic and biotic components of ecosystems

4. Natural Resources and Management
    a) Natural resources- Renewable and non-renewable natural resources.
    b) Depletion of natural resources and its effects.
    c) Their over exploitation and environmental problems citing case studies from India.
    d) Water as a resource –Characteristics of water. Major water compartments, Hydrological cycle, Water resources management.
    e) Conventional energy sources (coal, Oil and natural gas and oil shale)
    f) Non conventional energy sources - Solar energy, Wind energy, Geothermal energy, Hydropower, biogas, Tidal energy, Energy from waste, Hydrogen, and Nuclear energy.
    g) Renewable Energy
    h) Promise of solar energy.
5. Relationship between economic development and the environment.
6. Moving toward sustainable communities.

SUGGESTED BOOKS:

1. Fundamentals of Ecology by Odum
2. Ecology by Krebs
3. Ecology by Riclefs and Miller
4. Fundamentals of Ecology by Dash
5. Envirnmental Science by Wright
6. Ecology by Begon Harper.

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

DZOT 303: Cytogenetics and Molecular Biology L.H:76.5; Credits: 3.0

1. Cell-Cell Signalling:
   a) Cell surface receptor.
   b) Second messenger system.
   c) MAP kinase pathway.
   d) Signalling from plasma membrane to nucleus.
   e) Cross talk between signal transduction pathways.

2. Cell-Cell Adhesion and Communication:
   a) Ca^{2+} dependent homophilic cell-cell adhesion.
   b) Ca^{2+} independent homophilic cell-cell adhesion.
   c) Animal cell junctions: Structure and function of Gap junctions.

3. Cell Matrix Adhesion:
   a) Integrin.
   b) Collagen.
   c) Non-collagen components.

4. Intracellular Protein Traffic:
   a) Translocation of secretory protein across the ER membrane.
   b) Insertion of proteins into the ER membrane.
   c) Protein modification, folding and quality control in ER.
   d) Vesicular traffic, secretion and endocytosis.

5. Cancer Biology:
   a) Biochemistry and Molecular Biology.
   b) Oncogenes and tumor suppressor genes: Role in cancer development.
   c) Chemical carcinogenesis.
   d) Angiogenesis.
   e) Therapy.

6. Basic techniques of gene manipulation: Strategies and applications -
   a) Restriction endonucleases.
   b) Ligation of DNA fragments.
   c) Polymerase Chain Reaction (PCR).
   d) Cloning vectors: Plasmids, bacteriophage, cosmid, M13, phagemid, YAC, BAC, MAC, HAC, retroviruses.
   e) Cloning strategies, gene libraries, cDNA libraries.
   f) Recombinant selection and screening.
   g) Introduction of genes into animal cell, gene targeting and transgenic animals.
   h) Application of recombinant DNA technology in medicine, food technology, research and gene therapy,Social and ethical issuesof RDT.

7. DNA Damage and repair mechanisms.

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

SUGGESTED BOOKS:

1. Cell Biology: Alberts et al
2. Cell Biology: Lodish
3. Cell Biology: Becker et al
4. Molecular Biology of the Gene: Watson
5. Cell Biology: Pollard and Earnshaw
6. Genes VIII: Lewin
7. Cell: A Molecular Approach: Cooper
8. Molecular Biology: Karp

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

DZOT 304: Entomology (Basic) **L.H:76.5; Credits: 3.0**

1. External morphology:

a) Integuments- Epidermis: cuticle structure, types, formation, function
b) Head, thorax and abdomen.
c) Pre and post genital appendages.

2. Structure and functions:

a) Metamorphosis and hormonal control
b) Feeding and digestion
c) Movement- Insect fight.

3. Anatomy and physiology:

a) Nervous and sensory system
i) Learning, eyes and vision- occurrence and structure of compound eyes, light reception, functioning, image formation.
ii) Sound production- structure associated mechanisms, control and significance, mechanoreception, chemoreception, light production.

b) Blood and circulatory system –
i) Structure- Heart, types of haemocytes, structure, function, mechanism.

c) Excretory system-
i) Excretion – Definition and types.
ii) Special types of excretory organs/ conditions.

d) Reproductive system-
i) Reproduction and development.
ii) Male and female reproductive organs, Spermatogenesis and oogenesis.

e) Endocrine organs and hormones
i) Endocrine organs, mode of action of hormones, chemical nature and functions.
ii) Exocrine glands and hormones.
iii) Pheromones, semi chemicals and defensive secretion.

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

SUGGESTED BOOKS:

1. Ananthakrishnan, T.M. Biotechnological perspectives in Chemical ecology of Insect (Edition Book) Oxford & IBH.
2. Atwal: A Qgricultureal pests of India and South-East Asia Kalyani Publishewrs
3. Atwal, A.S & Singh Balraj: pest population and assessment of crop loss.publication & Information division, India Council of agricultural Research
4. Chatterjee, P.B: Plant protection Technique, Bharati Bhawan. (P & nD).
5. D. De Sarkar, The Silkworm: Biology Genetics and Breeding, Vikas New Delhi.
6. Dey, S. and Raziuddin, M.: The female reproductive system of aak grasshopper : A histomorphological study. Lambert Academic Publishing.
7. Gullan, P.J. and P.S Cranstor : The Insect: An outline if Entomolopgy, Chapman & Hall.
8. G.A Kerkut & L.I Gilbert .Comprehenshive Insect Physiology, Biochemistry and Pharmacology, Vols. 1-2. Ed. Pergamon Press, Oxford.
9. Gupta, AP. Immunology of Insect and other arthropods.
10. Gavian C. Essential Entomology- An order by order introduction.
11. Howell. V. et.al Introduction to Insect Biology and diversity.
12. Hill, D. S : Agricultural Insect pest of the tropics and their control, Cambridge University Press, Cambridge (Rept. End.).
13. Kettle, D.S : Medical and vetenary entomology, CAB International
14. Mayer & Yadav. Breeding in Insect.
15. Manual;s of Sericulture, Vol. 1-4.EAO of the United Natoins, Rome.
16. Price, P.W. Insect Ecology, John Wiley & Sons Inc.
17. Presley, G. J.
18. Biotechnology and Inrtegreted pest management, CAB International
19. Pfadt, R.E.: Fundamental of Applied Entomology, Macmillan Publishing Company
20. Pedigo, L, P .:Entomology and Pest management, Pretice: Hall of India Pvt. Ltd. (reoprint End).
21. Chapman R. F.: The Insect: Structure and Function, 4th End. Cambridge Low price End. Cambridge Univ. Press.
22. Sree Ramlu, U.S: Chemistry of Insecticides and Fungicides, Oxford and IBH Publishing Co. Pvt. Ltd (Reprinted End).
23. Speight, M.R Hunter, M.D and Watt, A. K.: Ecology of Insects, Concept and Application, Blackwell Science.
24. Srivastava, K.P.: A text Book of Applied Entomology Vol. I & II, Kalyani Publishers.
25. S.Singh, Bee Keeping in India, I.C.A.R. New Delhi.
26. S.Morohoshi. De4velopment Physiology of Silkworms, Oxford and IBH. New Delhi.
27. S.R. Ullal & M.N. Narasimhanna, Hand Book of Practical Sericulture, Cental Silk Board, Bangalore.
28. Thakur, M.L. Forest Entomology, (Ecology + Management).
29. V.B. Wigglesworth, Methuen, The Principles of Insect Physiology,London.
30. Wall, R and Shearer, D Veterinary Entimology.
31. Xu Junliang at at. Silkworm Physiology, Ed. Jhejiang Agric.

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

DZOT 304: Fish and Fisheries (Basic) L.H:76.5; Credits: 3.0

1. Classification of Fishes upto Order as per L. S. Berg, 1940. Origin and evolution of fishes.
2. Respiration in fishes: Gill structure (Holobranch and Hemibranch) and evolution of accessory respiratory organs.
3. Digestive system and its modification in Elasmobranchs and Teleosts.
4. Hill stream fishes and Deep sea fishes.
5. Origin of paired fins. Cave adaptation.
6. Cardio-vascular system. Reproduction and development of bony fishes.
7. Anatomy and histophysiology of pituitary, inter-renal and thyroid glands. Structure and functions of caudal neurosecretory organs. Pineal and adrenal gland. Corpuscles of Stannius and Ultimobranchial gland.

SUGGESTED BOOKS:

Fish and Fisheries:

1. Advances in fish biology: H. R. Singh.
2. Air breathing fishes of India: J. S. Dutta Munshi and G. M. Hughes.
3. Aquaculture: T. V. R. Pillai.
4. Biology of fishes: Bone and Moore.
5. Ecology of aquatic system: M. Dobson and C. Frid.
6. Fish and fisheries: S. Kumar and M. Tembhre.
7. Fish and fisheries: S. S. Khanna.
8. Fish and fisheries of India: V. G. Jhingran.
9. Fish and fisheries products: FAO.
10. Fisheries bioeconomics: FAO.
11. Fisheries in India: R. Mitra.

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

Practical Core Course **L.H: 127.5; Credits: 1.5**

DZCP 301: Taxonomy and Biophysical Technique **L.H:127.5: Credits: 1.5**

1. Preparation of key of invertebrate specimens (as available at the market or from laboratory specimens) upto subclasses / order.

2. Preparation of key of vertebrate specimens (as available at the market or from laboratory specimens) upto subclasses / order.
3. Handling of different types of microscopes

4. Photomicrography technique.

5. Paper Chromatographic technique/ T L C.

6. Gel Electrophoresis technique.

Continuation Evaluation **L.H: 51; Credits: 4.0**

DZCC 301,302 : Class Test **L.H: ; Credits: 1.5**

DZCE 301: Choice Based Seminar **L.H:51; Credits: 1.0**

This is to evaluate the knowledge, presentation technique, presence of mind, and over all smartness of a student. Students need to produce at least three seminar topics as per their choice. From those topics any one will be selected as per their preference for presentation. 15 minutes will be allotted for presentation and 10 minutes for interaction with audience.

DZCE 302: Scientific Excursion **L.H:127.5; Credits: 1.5**

.

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

SEMESTER –IV **L.H.: 612; Credits: 16**

Theoretical Core Course **L.H: 153; Credits: 06**

DZCT 401: Biometric Analysis and Conservation biology **L.H: 76.5; Credits: 3.0**

Biometric analysis

1. Basic ideas on Biostatistics and its use.
2. Measures of central tendency and dispersal.
3. Probability distribution (Binomial, Poison and Normal).
4. Sampling distribution.
5. Different between parametric and non parametric statistics.
6. Confidence level and errors levels of significance.
7 Regression and correlation.
8. t-test, X^2 – test, Analysis of variance.

Conservation biology

1. History and distinctions of conservation biology
2. Legal foundations of conservation biology; NEPA, CITES, Convention on Biological Diversity, Kyoto protocol, Nagoya Protocol, Ramsar Convention on conservation of wetlands, Forest Conservation Act of India (1927), Environment Protection Act of India(1986), Indian Biodiversity law and rules.
3. Use of Bioresources and Conservation Ethics: Diverse uses of bioresources; history of exploitation and causes of overexploitation of bioresources; importance of conservation. Social awareness and social movements concerning conservation issues.
4. Use of Remote Sensing and GIS: Principles and practical applications of remote sensing techniques, including aerial photography and satellite imagery. GIS Applications in wildlife. Use and values of GIS approaches to wildlife ecology and management integrating wildlife into forest and human land use systems.

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

SUGGESTED BOOKS:

Biometric Analysis

1. Biostatistical Analysis: N.G. Das.
2. Biostatistics: Zar.
3. Biostatistics: P. Bhattacharyya.
4. Biostatistics: N. Shetty.
5. Biostatistics: V. B. Rastogi.

Conservation Biology

1. Caughley, G., and A. Gunn.: Conservation Biology in Theory and Practice. Blackwell Science, Cambridge, Massachusetts, U.S.A.
2. Cox, G. W.: Conservation Biology: Concepts and Applications. McGraw-Hill, Dubuque, Iowa, U.S.A.
3. Dasmann, Raymond Fredric: Wildlife Biology, 2nd ed. John Wiley & Sons,
4. NY. Dobson, A. P.: Conservation and Biodiversity. Scientific American Library, New York, New York, U.S.A.
5. Hunter Jr., M. L.: Fundamentals of Conservation Biology. Blackwell Science, Malden, Massachusetts, U.S.A.
6. Jeffries, M. J.: Biodiversity and Conservation. Routledge, New York, New York, U.S.A. Leveque, C., and J.-C. Mounolou.: Biodiversity. John Wiley and Sons, West Sussex, England.
7. Lyndermayer DB & JF Franklin: Conserving forest biodiversity: a comprehensive multiscaled approach. Island Press.
8. Conservation Bioloy: Foundations Concepts and Applications ,Fred Van Dyke, Springer
9. Remote Sensing and GIS for Site Characterization: Applications and Standards By Vernon Singhroy, D. Nebert, Arnold Ivan Johnson Published by ASTM International.
10. Environmental Modelling with GIS and Remote Sensing By Andrew K. Skidmore, Hendrik Prins Published by CRC Press.
11. GIS and Remote Sensing in Hydrology, Water Resources and Environment By Yangbo Chen, International Association of Hydrological Sciences Published by IAHS.

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

DZCT 402: Parasitology and Immunology **L.H: 76.5; Credits: 3.0**

Parasitology:

1. Terminologies related to animal associations.
2. Parasitic transmission – types and mechanism.
3. Origin and evolution of parasitism.
4. Cellular, molecular and physiological aspects of host – parasite interactions.

Immunology:

1. Innate and acquired immunity.

2. Phylogeny and ontogeny of immune system:
   a) Organisation and structures of lymphoid organs.
   b) Cells of immune system and their differentiation.
   c) Lymphocyte traffic.

3. Nature of antigens and superantigens:
   a) Antigenicity and immunogenicity.
   b) Factors influencing immunogenicity.
   c) Epitopes and haptens.

4. Structures and functions of antibodies:
   a) Classes and sub-classes.
   b) Gross and fine structure.
   c) Antibody mediated effector functions.

5. Complement system.

6. MHC in mouse and HLA in human:
   a) MHC haplotypes.
   b) Class I and Class II molecules.
   c) Cellular distribution.
   d) Peptide binding.
   e) Expression and diversity.
   f) Disease susceptibility and MHC / HLA.

7. Cytokines.

8. Vaccines.

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

SUGGESTED BOOKS:

Parasitology

1. Foundation of Parasitology: Janovy and Roberts
2. Animal Parasitology: Smyth
3. Clinical Parasitology: Beaver
4. Parasitology: Cheng
5. Parasitic Protozoa: Krier and Baker
6. Helminths, Arthropods and Protozoa of Domesticated Animals: Soulsby

Immunology

1. Essentials of Immunology: I. M. Roitt
2. Immunology: J. Kuby
3. Advances in: Parasitology: Baker et. al
4. Immunology: Abbas
5. Immunology: Rao
6. Immunology: N. Shetty
7. Immunology: Weir & Stewart
8. Immunology: A.K. Chakravarty – Oxford University Press.
9. Schaum series Immunology

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

Choice Based Optional Theoretical Course **L.H: 76.5; Credits: 3.0**

DZOT 401: Parasitology and Medical Entomology **L.H: 76.5; Credits: 3.0**

Parasite Systematics

1. Zoonoses – with reference to protozoan and helminthic diseases.
2. Zoo–parasites (basic idea on parasitism in phyla other than protozoa and Helminths).
3. Host – Parasite Interactions.
4. Opportunistic Parasites.
5. Ecology of Parasitism.

Microbes

1. Virus – Influenza virus, HIV, Hepatitis – B and Ebola.
2. Bacteria – *Mycobacterium tuberculae*, *Shigella* sp., *Yersinia pestis*, *Helicobacter*, and Listeria, Spirochaete and Rickettsia.

Parasite Immunology

1. Immunity against virus, bacteria, fungi, invertebrates and vertebrate.
2. Mechanism of evasion by parasites.
3. Immunity, resistance and immunopathobiology to malaria.
4. Immunity to leishmaniasis.
5. Antigenic variations and protective immunity in African trypanosomiasis.
6. Immune response and immunopathology in filariasis.
7. Inflammatory responses induced by tick feeding on naïve and immune hosts.
8. Immunological control of parasitic diseases – principles of vaccination, current status of vaccine of malaria, leishmaniasis and trypanosomiasis.

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

SUGGESTED BOOKS:

1. Parasitism: The Diversity and Ecology of Animal Parasites – Bush and Fernandez
2. Veterinary Parasitology – Reference Manual – William J. Foreyt
3. Practical Exercises in Parasitology – Halton, Behnke and Marshall (Ed.).
4. Illustrated guide to Protozoa – Leedale, Bradbury, Lee and Soldo (Ed.).
5. Biology of Parasitism – Tschudi and Pearce
6. Protocols in Protozoology – Lee and Soldo
7. Foundation of Parasitology: Janovy and Roberts
8. Animal Parasitology: Smyth
9. Clinical Parasitology: Beaver
10. Parasitology: Cheng
11. Parasitic Protozoa: Krier and Baker
12. Helminths, Arthropods and Protozoa of Domesticated Animals: Soulsby
13. Essentials of Immunology: I. Roitt
14. Immunology: J. Kuby
15. Advances in: Parasitology: Baker et al.
16. Immunology: Abbas
17. Immunology: Rao
18. Immunology: N. Shetty
19. Immunology: Weir & Stewart
20. Immunology: A.K. Chakravarty – Oxford
21. Schaum series Immunology

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

DZOT 402: Environmental Biology **L.H: 76.5; Credits: 3.0**

1. Environmental health and toxicology,
    a) Types of environmental health hazards, Air pollution, Water pollution, Solid waste, Noise pollution, Radioactive pollution.
    b) Xenobiotic – absorption, translocation and excretion of toxic substances
    c) Biotransformation, Bioaccumulation & Biomagnification of Xenobionts in food chain
    d) Hazardous heavy metals and their toxicity and probable antidotes
    e) Toxicity test & bioassay: LC50, LD50, Dose response curve
    f) Endocrine disruptors
2. Environmental biotechnology
    a) Bioremediation
    b) Biosensors
3. Environmental Impact Assessment, Environmental Risk Assessment; Environmental Biomonitoring – methods and tools.
4. Life table and fecundity table

SUGGESTED BOOKS:

1. Environmental Physiology PG Willmer and L Johnston
2. Biochemical Adaptation : PW Hochachka and GN Somero
3. Practical Microbiology by Cappucino
4. Biochemistry by Boyer
5. Toxicology by Pandey *et al*
6. Pollution by Kataliya
7. Statistical Methods in Ecology by bailey
8. Biostatistical Analysis by Zar
9. Statistics by NG Das
10. Probit Analysis by Finney
11. Ecological Methods by Southwood

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

DZOT 403: Cytogenetics and Molecular Biology L.H: 76.5; Credits: 3.0

1. Nucleic acids:
    a. Topology, hybridization and renaturation kinetics.
    b. Protein-nucleic acid interaction.

2. Genome Analysis:
    a. C- value paradox, detailed account of various models of prokaryotic genomes, viral and prokaryotic genomes, organization of genes in organelle genomes.
    b. DNA Sequencing methods, strategies for genome sequencing.
    c. Methods for analysis of gene expression at RNA and protein level.

3. Genetic and Physical Mapping: Strategies for different levels of genome mapping.

4. Gene function analysis: Random mutagenesis, site specified mutagenesis, targeted mutagenesis, molecular mechanism of gene silencing.

5. Genetic counselling.

6. Imprinting of genes, chromosomes and genomes.

7. Somatic cell genetics:
    a) Cell fusion and hybrids.
    b) Heterokaryon – selecting hybrids and chromosome segregation.
    c) Radiation hybrids, hybrid panels and gene mapping.

8. .Human genetics:
    a) Human karyotype – banding – nomenclature.
    b) Human genome Project.
    c) Stem cell biology

SUGGESTED BOOKS:

1.Cell Biology: Alberts et al
2. Cell Biology: Lodish
3. Cell Biology: Becker et al
4. Molecular Biology of the Gene: Watson
5. Cell Biology: Pollard and Earnshaw
6. Genes VIII: Lewin
7. Cell: A Molecular Approach: Cooper
8. Molecular Biology: Karp

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

DZOT 404: Entomology (Applied) **L.H: 76.5; Credits: 3.0**

1. Insect and agriculture:

a) Insects as pest, Assessment of pest Status, EIL, ETL etc., important pest of jute, paddy, sugarcane, vegetable, mango, stored products and tea- their distribution, nature of damage, biology and control measures.
b) Insect control- chemical control nature, mode of action of common insecticides (organochlorine, organophosphorous, carbamates botanical insecticides). Biological, cultural, toxicity of pheromones and other attractants. Biotechnology in insect control, IPM.

2. Economic entomology:

a) Sericulture.
b) Apiculture.
c) Lac culture.

3. Insect and Acarines of public health importance:

a) Insect vectors and its importance in transmission of parasites.

b) Biology and medical importance of -

i) Mosquitoes (*Anopheles* and *Culex*).
ii) Sand flies.
iii) Tsetse flies.
iv) Hard tics and soft tics.
v) *Pediculus*.
vi) Trombicuted and allergic mites.

c) Epidemiology:

Classification, landscape epidemiology, epidemiology of malaria, Leishmania and Filaria. Methods of epidemiology study.

4. Forest entomology:

a) Insect colonization – adaptation to forest/ woodland ecology.
b) Forest pests-
i) Termites and their management.
ii) Pests of teak and their management.
c) Insect diversity and conservation- an overview.

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

SUGGESTED BOOKS:

1. Ananthakrishnan, T.M: Biotechnological perspectives in Chemical Ecology of Insect (Edition Book) Oxford & IBH.
2. Atwal :Agricultural pests of India and South-East Asia Kalyani Publishers
3. Atwal, A.S & Singh Balraj :Pest population and assessment of crop loss. publication & Information division, India Council of agricultural Research
4. Chatterjee, P.B : Plant protection Technique, Bharati Bhawan. (P & nD).
5. D.De Sarkar, The Silkworm: Biology Genetics and Breeding, Vikas New Delhi.
6. Gullan, P.J. and P.S Cranstor. : The Insect: An outline if Entomology, Chapman & Hall.
7. G.A Kerkut & L.I Gilbert .Comprehensive Insect Physiology, Biochemistry and Pharmacology, Vols. 1-2. Ed. Pergamon Press, Oxford.
8. Gupta, AP. Immunology of Insect and other arthropods.
9. Gavian C. Essential Entomology- An order by order introduction.
10. Howell. V. et.al Introduction to Insect Biology and diversity.
11. Hill, D.S :Agricultural Insect pest of the tropics and their control, Cambridge University Press, Cambridge (Rept. End.).
12. Kettle, D.S :Medical and veterinary entomology, CAB International
13. Mayer & Yadav. Breeding in Insect.
14. Manuals of Sericulture, Vol. 1-4.EAO of the United Nations, Rome.
15. Price, P.W. Insect Ecology, John Wiley & Sons Inc.
16. Presley, G.J.
17. Biotechnology and Integrated pest management, CAB International
18. Pedigo, L, P. : Entomology and Pest management, Prentice: Hall of India Pvt. Ltd. (Reprint End).
19. Chapman R.F.: The Insect: Structure and Function, 4th End. Cambridge Low price End. Cambridge Univ. Press.
20. Sree Ramlu, U.S.: Chemistry of Insecticides and Fungicides, Oxford and IBH Publishing Co. Pvt. Ltd (Reprinted End).
21. Speight, M.R Hunter, M.D and Watt, A.K. : Ecology of Insects, Concept and Application, Blackwell Science.
22. Srivastava, K.P., 1998 A Text Book of Applied Entomology Vol. I & II, Kalyani Publishers.
23. Singh S., Bee Keeping in India, I.C.A.R. New Delhi.
24. S.Morohoshi. Development Physiology of Silkworms, Oxford and IBH. New Delhi.
25. S.R. Ullal & M.N. Narasimhanna, Hand Book of Practical Sericulture, Central Silk Board, Bangalore.
26. Thakur, M.L. Forest Entomology, (Ecology + Management).
27. V.B. Wigglesworth, Methuen, The Principles of Insect Physiology,London.
28. Wall, R and Shearer, D Veterinary Entimology.
29. Junliang *et al*. Silkworm Physiology, Ed. Jhejiang Agric.

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

DZOT 405: Fish and Fisheries (Applied) **L.H: 76.5; Credits: 3.0**

8. Exploring Aquaculture: Different types of fisheries. Modern techniques of fishery management.

9. Cultivable water, water quality and quantity, physical and chemical properties of water.

10. Marine, fresh-water, estuarine, reservoir and cold-water fishes of India.

11. Fish culture – Pond culture, Paddy-field culture. Carp cultivation in India. Spawning, collection, rearing and stocking of fishes. Transport and mortality of fish-fry. Fish preservation, processing, transport and marketing in India.

12. Fish-seed production by hypophysation, Bandh – breeding and other agents. Procurement of fish – seed from natural resources. Maintenance of nursery, rearing and stocking ponds and hatcheries.

13. Fish processing by chilling, freezing, smoking, salting and canning.

14. Fish bye products.

SUGGESTED BOOKS:

Fish and Fisheries:

1. Advances in fish biology: H. R. Singh.
2. Air breathing fishes of India: J. S. Dutta Munshi and G. M. Hughes.
3. Aquaculture: T. V. R. Pillai.
4. Biology of fishes: Bone and Moore.
5. Ecology of aquatic system: M. Dobson and C. Frid.
6. Fish and fisheries: S. Kumar and M. Tembhre.
7. Fish and fisheries: S. S. Khanna.
8. Fish and fisheries of India: V. G. Jhingran.
9. Fish and fisheries products: FAO.
10. Fisheries bioeconomics: FAO.
11. Fisheries in India: R. Mitra.

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

Practical Core Course **L.H: 127.5; Credits: 2.0**

DZCP: 401: Biometry , Parasitology and Conservation Biology

L.H: 127.5; Credits: 2.0

Biometry:

1. Preparation of data in relation to mean, standard deviation (SD) and standard error (SE).
2. Calculation of correlation among height, weight and age.
3. Calculation of normal and binomial distribution.

Conservation Biology:

1. Determination of log-volume; determination of population size (Quadrate analysis, line transect and point transect methods).
2. Graphical representations using MS Excel, SPSS and Statistica; Data analyses using MS Excel, SPSS and Statistica; use of diversity analyses software (*PAST*, *DISTANCE* etc); use of internet data base.

Parasitology

1. Collection and identification of common gut parasites of Insect /Amphibian/ Mammals

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

Choice Based Optional Practical Course **L.H: 127.5; Credits: 2.0**

DZOP 401: Parasitology and Medical Entomology **L.H: 127.5; Credits: 2.0**

1. Parasite detection and gut examination - Gut content examination of different vertebrates and invertebrates
   and preparation of slides.

2. Histological studies of the digestive and reproductive system of any parasitic flatworm (cestode/ trematode).

3. Biochemical studies on the tegumental and neural enzyme activities of parasitic flatworms.

4. Examination of parasites inhabiting tissues. Permanent slide preparation of trematode, cestoda and nematode.

5. Preparation of blood slides – thick and thin for parasitological investigation.

6. Taxonomic identification (upto species level):

   Plasmodium sp., Trypanosoma, Entamoeba histolytica, Giardia, Coccidia, Wuchereria bancrofti, and microfilaria, *Ancylostoma duodenale, Echinococcus granulosus, Schistosoma mansoni/haematobium. Simulium, Cimex, Pediculus humanus.*

7. Quantitative estimation:

   Isolation, quantitative and qualitative estimation of protein, carbohydrates and lipid (Colorimetric / Spectrophotometrically) from blood/serum/tissue.

8. Immunological techniques -

   ELISA.
   Peritoneal macrophage isolation from rat/ mouse (Market available or laboratory specimens).

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

DZOP 402: Environmental Biology **L.H: 127.5; Credits: 2.0**

1. Analysis of soil and Water:
    1. Free and combined CO_2, Dissolved O_2, Hardness, alkalinity and salinity.
    2. Soil carbon.
2. Microbiology:
    a) Isolation of bacteria from soil / water.
    b) Gram staining of bacteria.
3. Evaluation of LC_{50} and probit analysis.
4. Determination of primary productivity by light and dark bottle method.
5. Evaluation of: Diversity index of communities – terrestrial and aquatic.
6. Evaluation of toxicant on tissues – histochemical and biochemical changes.
7. SDS-PAGE

DZOP 403: Cytogenetics and Molecular Biology **L.H: 127.5; Credits: 2.0**

1. Chromosome karyotyping.
2. DNA isolation.
3. Blotting Techniques.
4. Separation of protein fragments by SDS-PAGE.
5. Mitotic and meiotic chromosome preparation.
6. Polytene chromosome preparation.

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

DZOP 404: Entomology **L.H: 127.5; Credits: 2.0**

1. Study of internal morphology of
   a) Cockroach: Stomatogastric nervous system
   b) House fly: Male and female reproductive system
   c) Honey bee: Digestive system and nervous system
2. Mounting:
   a) Wings, mouth parts, antennae, genitalia of insect, medically important insects.
3. Preparation of keys :
   a) Order level
   b) Family level for major orders
4. a) Quantitative analysis of salivary and gut enzyme
   b) Study of insect population density (any one species)
   c) Determination of LC50 / LD50 of toxic (insecticide) and associated instruments.
   d) Study of insect control measuring technique and associated instrument
6. a) Study of a life cycle of a pest / vector
   b) Submission of insect of different orders
7. Field trip and study of insect diversity.

DZOP 405: Fish and Fisheries **L.H: 127.5; Credits: 2.0**

1. Major Dissection: Dissection of important representative of any teleost fish as specimen available at the market (General anatomy, Afferent branchial system, Efferent branchial system, Cranial nerves).

2. Minor dissection/ Skeleton preparation/ Mounting as specimen available at the market: Electric organ, Poison gland, Otolith, Girdles, Vertebral column, Caudal fin, Ossicles, Different types of scales, Analysis of gut content/ plankton identification.

3. Spot Identification: Common fresh-water and marine fishes (As available at the market).

4. Detail taxonomic description and identification of two fishes upto species level (Economic importance of fishes to be mentioned).

5. Identification With Reasons: Museum specimens (Fresh-water, Estuarine and Marine), Fishing device (Nets and Gears), Bones (All types of fish's bones), Slides (Histology, Endocrinology and Embryology).

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com

Continuation Evaluation **L.H: 51; Credits: 4.0**

DZCC 401,402 : Class Test **L.H: ; Credits: 1.0**

DZCE 401: Dissertation/ Review/ Project **L.H: 127.5; Credits: 2.0**

As directed from department. Whatever type of assignment is issued to the students, they need to study that particular assignment for at least 6 months and then need to prepare a detailed report and need to submit during examination.

DZCE 402: Comprehensive Viva-voce **L.H: ; Credits: 1.0**

Viva – voce on over all syllabus to evaluate a student's intelligence, learning capacity, answering attitude and the attitude to overcome unfamiliar situations.

PDF Creator - PDF4Free v3.0 http://www.pdf4free.com