



**THE MADURA COLLEGE (Autonomous), MADURAI – 625 011**  
(AFFILIATED TO MADURAI KAMARAJ UNIVERSITY)  
RE-ACCREDITED (3<sup>rd</sup> Cycle) WITH “A” GRADE BY NAAC

**PROGRAMME : B.Sc., Zoology**

**COURSE CODE : 2Z1 (Upto 2016)**

**COURSE TITLE : Agricultural  
Entomology**

**QN.NO : 4610**

**TIME : 3 Hours**

**MAX.MARKS :75**

**UNIT - I**

Insect classification up to orders and economic classification.

Nature of attack, biology and control measures of important pests infecting Paddy, Sugarcane and cotton, Pests of vegetables (Brinjal, Tomato and Bhendi) and fruits (Mango, Banana and Grape wine).

**UNIT - II**

Insect – Plant interactions

Insect pests of stored products and their control.

Insects as Medicine, Insects as food, Insects as pollinators, Insects as weed control agents, Insects as scavengers

**UNIT - III**

Principles and methods of pest control.

Pesticides and their classification.

Integrated Pest Management

Third generation pesticides

**UNIT - IV.**

Introduction to biological control - Biology of parasitoids – Use of parasitoids against pest control – Biology of bacterial, fungal and viral pathogens – Biology of entomopathogenic nematodes – conservation and augmentation of pathogens – Biotechnology in biological control.

**REFERENCE BOOKS:**

Economic Entomology by Vasantha Raj David.

Agricultural Entomology by Krishnan

Handbook of Economic Entomology for South India by T.V. Ramakrishna Iyer

Plant protection and Pest Management by Mishra

Entomology and Pest Management by L. P. Pedigo

A hand book of Identification of insects of Medical importance by John Smart

A Guide on Crop Pests by Regupathy *et al*

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## UNIT - I

- ✓ Definition, scope of Aquaculture, Types of Aquaculture in India – Freshwater, Coastal and Marine aquaculture. Culturable fishes (Carps, Tilapia)

## UNIT - II

- ② Construction of fish pond, Management of fish farms, Induced breeding (Hypophysation), Transportation of fish seeds-open and closed system, preservation of fishes-Methods of preservation.

## UNIT-III

- ✓ Fish feed- Live feed - Culture of *Daphnia & Brachionus*.  
Artificial feed- Qualities of good artificial feed, food conversion ratio, Feeding rates and schedule.

## UNIT-IV

- ✓ Prawn culture: Culture of marine prawn (*Penaeus monodon*), culture of freshwater prawn (*Macrobrachium rosenbergii*).

Edible Oyster culture: Spat collection, culture methods.

## REFERENCE BOOKS:

- A Manual of Freshwater Aquaculture by R. Santharam et al.  
Profitable Poultry Farming by Gnanamani.  
Alikunhi, K.H. : Fish culture in India ICAR  
Kurian and Sebastian : Prawn and prawn fisheries in India  
Sukla and Upadhyay : Economic Zoology  
Fresh water fish culture by S. K. Sarkar  
Text Book of Economic Zoology by Ravindranath



Department of Zoology, The Madura College (Autonomous), Madurai. 625 011

Time: 3 hrs

FUNDAMENTALS OF INVERTEBRATES

Total Marks 75

Section -A

Answer all the Questions

10 x 1 = 10

Four questions from I unit and Two questions from rest of the units /

Section -B

Answer any five Questions

5 x 4 = 20

Two questions from each unit (2)

Section -C

Answer any three Questions

3 x 15 = 45

Two questions from Unit I and one question from rest of the units

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THE MADURA COLLEGE (AUTONOMOUS) MADURAI - 11  
REACCREDITED BY NAAC

U.G. ZOOLOGY

MEDICAL ZOOLOGY

**UPTO 2016**

SUB.CODE : 2SZ (2005) (4616)

ON-NO: 4616

Skill based Elective to Zoology students - to be offered in 1 year (30 hours)

Unit I: Diseases- Mention communicable and non communicable diseases, Hereditary and nutritional diseases, metabolic diseases, allergic diseases, pollutional diseases, occupational diseases, zoonotic diseases, gerontological diseases, traumatic diseases, sexually transmitted diseases, diseases transmitted through blood transfusion

Unit II: Protozoan diseases (Modes of infection, brief life cycle, pathogenesis, lab, Diagnosis, and prophylaxis) Amoebiasis, Trypanosomiasis, Malaria  
Helminthiasis- Infection and pathogenesis of Fasciolopsis, Schistosoma Cestodes, nematodes (Ascaris, Ancylostoma, Guinea-worm and Pin worm)

Unit III: Disease causing arthropods other than vectors and their clinical manifestations (very brief note)  
itch mite (Sarcoptes scabiei), Hair follicle mite (Demodex folliculorum), Mites causing dermatitis.

**REFERENCES**

Park I.E. and Park K. -Text Book of Preventive and Social Medicine

Sobti R.C. - Medical Zoology (Vishal Publ.)

A Text book of Parasitology by S. K. Kochar

A Hand book of Medical Entomology & Elementary Parasitology by Rathinaswamy

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*Kindly Connected by S. Sathinathan  
on 18/3/15*

*VMJ  
18/3/15*

*A - 3 + 3 + 3  
B - 2 + 2 + 1  
C - 2 + 2 + 2*

Blue Print

Time: 3 hours.

2 SZ (2305 20) Medical Zoology.

Total marks: 75

Section A

Answer any FIVE: (5 x 3 = 15 marks)

5/9.

Nine questions to be asked three from each unit. (3+3+3)

Section B

Answer any THREE: (3 x 8 = 24 marks)

3/5 (1+2+2)

One question from Unit III and two each from Units I and II. (total 5 questions) to be asked.

Section C

Answer any THREE: (3 x 12 = 36 marks)

3/6 (2+2+2)

Two questions from each unit (total 6 questions) to be asked.

Final copy corrected by S. Dharmarajan  
on 18/3/09  
MMF  
18/3/09

ANCILLARY ZOOLOGY (For both B.Sc. Chemistry and Botany Students)  
2C / ABZ ( ) ECONOMIC ZOOLOGY

4618

Q.N. NO: 4618

**UNIT- I**

**APICULTURE:** Types of Honey Bees, Bee Colony, Bee Keeping (Primitive Hives & Modern Hives), Care and Management of an Apiary, Uses of Honey, bee wax, bee venom. **SERICULTURE:** Life cycle of Mulberry Silkworm (*Bombyx mori*), Silkworm Rearing, Moriculture. **LAC CULTURE:** Life History of Lac Insect, Rearing, Processing of Lac.

**UNIT- II**

**POULTRY:** Breeds of Poultry, Hosing, Management, Nutrition, Disease & Control. Economically important cattle, Principles of Dairy Farming.

**UNIT- III**

**PISCICULTURE:** Types of Culturable Fishes (Fin Fishes & Shell Fishes), Culture of Indian Major Carps, Economic Importance of Fishes. **PRAWN CULTURE:** Culture of Marine Prawn-Culture Operations. **PEARL CULTURE:** Types of Pearls, Pearl formation, Culture of Pearls.

**UNIT- IV**

Pests of Paddy, Sugarcane & Cotton (any three pests). Chemical method and Biological method of pest control, Integrated Pest Management.

**TEXT BOOKS:**

1. B.Vasantharaj David. Economic Entomology.
2. N.Arumugam S.Murugan, J.Johnson Rajeshwar & R.Ram Prabhu. 2005. Applied Zoology. Saras publication.
3. K.R.Ravindranathan.2003. Economic Zoology. Dominant Publishers and Distributors. New Delhi.
4. N.Arumugam.2008. Aquaculture. Saras Publication.

**REFERENCE BOOKS:**

1. M.Johnson & M.Kesary.2008. Sericulture.

Department of Zoology, The Madura College (Autonomous), Madurai. 625 011

(2CAZ... (4618)

4BAZ

Time: 3hrs

Total Marks: 38 (75) *ans*

Answer any five questions Two questions from each unit	Section -A	5 x 3 = 15
Answer any two questions One question from each unit	Section -B	2 x 10 = 20
Answer any two questions One question from each unit	Section -C	2 x 20 = 40

S. Srinivasan  
WM  
10/9/08



THE MADURA COLLEGE (AUTONOMOUS) MADURAI - 11

B.Sc.,

**UPTO 2016** (up to 2016)

**BIOCHEMISTRY AND BIOCHEMICAL TECHNIQUES**

SUB.CODE : 3Z (4622) ON. NO : 46 2 2

**UNIT- I**

Classification, structure and functions of carbohydrates, proteins and lipids. Vitamins – Water soluble and fat soluble vitamins, occurrence, functions and deficiency diseases.

**UNIT- II**

Enzymes – Classification, Properties, Chemical nature and mechanism of enzyme action – Factors affecting enzyme action – Enzyme inhibition.

**UNIT- III**

Metabolic pathways of Carbohydrates – Glycogenesis, Glycolysis, Krebs's cycle and gluconeogenesis, Protein metabolism – Deamination, Transamination. Lipid metabolism – Beta oxidation of fatty acids.

**UNIT- IV**

Principles and applications of tracer techniques in biology; Radiation dosimetry; radioactive isotopes, Effect of radiation on biological system. Autoradiography.

**UNIT- V**

Separation techniques - Chromatography (Paper, TLC), Electrophoresis (PAGE), Principles and applications of Centrifugation. Analytical techniques – pH meter, Spectrophotometer, Biochemical analysis of carbohydrates, proteins and enzymes.

**TEXT BOOKS**

1. N. Gurumani - Research Methodology for Biological Sciences (2006), MJP Publishers, Chennai
2. L. Veerakumari Biochemistry (2004) MJP Publishers, Chennai
3. Ambika Shanmugam - Fundamentals of Biochemistry
4. Jain et al - Fundamentals of Biochemistry
5. Palanichamy - Principles of biochemistry and biotechniques

**REFERENCE BOOKS**

1. J.Jayaraman - Lab manuals in Biochemistry, New age International (p) Ltd. Mumbai.
2. Plummer - An Introduction to practical biochemistry, Tata McGraw Hill, Bombay.
3. Instrumental methods of Chemical analysis B.K. God Publishing House, Meerut.
4. Slater - Radiomolecules in Biology, IRL Press Oxford.
5. David - Handbook of Histological and Histochemical techniques - CBS Publishers.
6. Barron Chapman and Hail London - Using the Microscopes.
7. W.H. Freeman & Co, - Lodish et al (1999) Molecular cell Biology, New York.

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THE MADURA COLLEGE (AUTONOMOUS), MADURAI - 11 WEF N.20

Department of ZOOLOGY

BIOCHEMISTRY AND BICHEMICAL TECHNIQUES - 3Z (C & Z)

BLUE PRINT

Time : 3 Hours

Max : 75 Marks

SECTIONS	UNIT-I	UNIT-II	UNIT-III	UNIT-IV	UNIT-V	Remarks
SECTION - A (10x2= 20 marks)	1, 2	3,4	5,6	7,8	9,10	Answer All
SECTION - B (5x5= 25 marks)	11a, 11b	12a, 12b	13a, 13b	14a, 14b	15a, 15b	Answer All. 'either' 'or' type
SECTION - C (3x10= 30 marks)	16	17	18	19	20	Answer any THREE

*L. Sujitha.*

Head

Department of Zoology

DEPARTMENT OF ZOOLOGY  
B.Sc. (Chemistry) DEGREE COURSE - THIRD SEMESTER  
SKILL BASED ELECTIVE

**UPTO 2016**

FISHERIES SCIENCE

452 / 4624 QN-NO. 4624  
352 (upto 16)

**UNIT - I**

Fisheries - Scope of fisheries, Scenario of Indian fisheries. Types of Fisheries - Inland, Marine, Coastal and metahaline fisheries.

Culturable organisms - Qualities, types-Fin fishes.

Role of institutions - FFDA, ICAR, CMFRI, FSI

**UNIT - II**

Water quality parameters and Assessment of water quality. Causes, effects and prophylaxis method of water pollution (brief account only).

Preparation of fish pond. Integrated fish farming - Paddy cum fish culture and fish cum poultry culture. Composite fish culture.

Preservation of fishes - Fish spoilage, drying, smoking and canning.

**Reference Books**

Arumugam, N. *et. al.*, 2008. Aquaculture. Saras Publications. Nagercovil.

Santhanam, R. 1990. Fisheries Science. Daya Publishing House. New Delhi.

Rath, R.K. 1993. Freshwater Aquaculture. Scientific Publishers. Jodhpur.

Revised on 30.3.16

**Blue Print**

Time : 3hrs

Fisheries Science

Max. Marks : 75

352 / 452

Units No.	Section A	Section B	Section C
I	3 questions	3 questions	2 questions
II	4 questions	4 questions	2 questions
	5/7	5/7	2/4

*L. Luvitha*

H.O.D

PROFESSOR & HEAD,  
Department of Zoology,  
Madura College (Autonomous)  
Madurai-625 011.

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Received on 30.3.10

**BLUE PRINT**

**Fisheries Science**

**(Ancillary Zoology for Chemistry students)**

**Section A**

**( 5 x 2 = 10 Marks)**

**(Five Questions to be answered out of seven)**

**Section B**

**( 5 x 7 = 35 Marks)**

**(Five Questions to be answered out of seven)**

**Section C**

**(2 x 15 = 30 Marks)**

**(Two Questions to be answered out of four)**

<b>Total</b>	<b>75 Marks</b>
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THE MADURA COLLEGE (AUTONOMOUS) MADURAI - 11

B.Sc. - III SEMESTER

**UPTO 2016**

ANCILLARY ZOOLOGY (For B.Sc. Chemistry Students)

SUB. CODE : 3C AZ (15 to 16) (4626) QN. NO: 4626

ESSENTIALS OF PHYSIOLOGY AND MICROBIOLOGY

**UNIT- I**

Structure of Alimentary canal, digestive glands (secretion and its functions only); Excretory system of Man - structure of kidney, nephrons, Formation of urine. Menstrual cycle, Oestrogen, Androgen, Prolactin, Relaxin, birth control methods.

**UNIT- II**

Microbiology- bacterial growth curve, culture medium –composition of a typical medium. Pasteurization, Autoclave. Microbial Diseases: Causative organisms, mode of transmission, pathogenicity, symptoms and their preventive measures of Cholera, Tuberculosis, Rabies and AIDS.

**TEXT BOOKS**

1. Mariakuttikan, A. and N. Arumugam. 2008. Animal Physiology, Saras publication. Nagercoil.
2. Mani, A., A.M. Selvaraj, L.M. Narayanan and N. Arumugam. 2007. Microbiology. Saras publication.

**REFERENCE BOOKS**

1. Verma, P.S., B.S. Tyagi and V.K. Agarwal. 2005. Animal Physiology. S. Chand & Company Ltd. New Delhi.
2. Rastogi, S.C. 2003. Essentials of Animal Physiology. New Age International (P) Ltd. New Delhi.
3. Dubey, R.C. and D.K. Maheswari, 2005. A Textbook of Microbiology. S. Chand & Company Ltd. New Delhi.
4. Anathanarayan, R. and C.K.J. Paniker. 2002. Textbook of Microbiology. Orient Longman. Hyderabad.

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The Madura College (Autonomous), Madurai 625 011.

Department of Zoology

3C AZ 2003, 3B AZ 2003, A CAZ 2003

Time: 3 Hours

Total Marks 75

Answer any five questions  
Four questions from each unit

Section - A

5 x3 =15

Answer any two questions  
Two questions from each unit

Section -B

2X10=20

Answer any two questions  
Two question from each unit

Section - C

2X20=40



THE MADURA COLLEGE (AUTONOMOUS) MADURAI - 11

B.Sc., - III SEMESTER

**UPTO 2016**

ANCILLARY ZOOLOGY (For B.Sc. Botany Students)

SUB. CODE : 3B AZ (upto 16) (4628)

Q.N. NO: 4628

FUNDAMENTALS OF INVERTEBRATES AND CHORDATES

**UNIT-1:**

Parasitic Protozoa (Life History of Plasmodium in detail). Mouth parts in insects. Respiration in Arthropods. Water vascular system in Starfish.

**UNIT: II**

Migration in Birds. Poisonous snakes of South India. Flight adaptation in Birds. Adaptive radiation in Mammals.

**TEXT BOOKS**

1. Invertebrate Zoology, E.L.Jordon, Chand Publications, Newdelhi, 2007.
2. A Textbook of Chordates, A.Thangamani et al., Saras Publications, Nagerkoil, 2005.
1. Manual of Zoology, M.Ekambaranathaiyer, S.Chand Publications, NewDelhi.

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DEPARTMENT OF ZOOLOGY  
B.A/B.COM./B.Sc. DEGREE COURSE - THIRD SEMESTER  
NON-MAJOR ELECTIVE

**UPTO 2016**

ECONOMIC ZOOLOGY

3Z.NM (upto 16) 4627

QN. NO: 4629

UNIT-I

APICULTURE: Organization of bee colony -Queen, worker, Drones, rearing of bees-Newton's beehive, problems in Apiculture-Natural enemies.

SERICULTURE: Life cycle of Mulberry Silkworm, Rearing of Silkworm.

LAC CULTURE: Life History of Lac Insect, Rearing of Lac.

UNIT-II

PISCICULTURE: Cultivable fishes (Fin Fishes & Shell Fishes), Culture of Carps, Economic Importance of Fishes.

PEARL CULTURE: Types of Pearls, Culture methods.

UNIT-III

POULTRY: Breeds of Poultry, Hosing, Management, Nutrition, Disease &Control, Economically important cattle, Principles of Dairy Farming.

TEXT BOOKS

1. B.Vasantharaj David. Economic Entomology.
2. N.Arumugam S.Murugan, J.Johnson Rajeshwar & R.Ram Prabhu. 2005. Applied Zoology. Saras publication.
3. K.R.Ravindranathan.2003. Economic Zoology. Dominant Publishers and Distributors. New Delhi.
4. N.Arumugam.2008. Aquaculture. Saras Publication.

REFERENCE BOOKS

1. M.Johnson & M.Kesary.2008.Sericulture.

**NME APPLIED ENTOMOLOGY - 65267**

Total Marks: 75

Answer any five Three questions from each units	Section -A	5 x 3 = 15
Answer any three Three questions from Unit III and two questions from rest of the units	Section -B	3 x 8 = 24
Answer any three Two questions from each unit.	Section -C	3 x 12 = 36

*Answered*

**UPTO 2016**

CORE PAPER: 4Z ( ) - CELL AND DEVELOPMENTAL BIOLOGY

UNIT-I

4630

QN. NO: 4630

Microscopy: Principles of light and electron microscope SEM & TEM. Plasma Membrane: Ultra structure - Chemical composition and functions, Endoplasmic reticulum: Morphology, structure types and functions. Mitochondria: Structure, Chemical composition - Functions - Krebs' Cycle - Oxidative Phosphorylation. Nucleus: Structure and functions - Structure of Chromosome, Giant chromosomes. Cell division - Mitosis & Meiosis.

UNIT-II

Gametogenesis: Spermatogenesis, Types of Sperm: Oogenesis - Types of eggs and egg membranes; Fertilization: Acrosomal reaction, Cortical reaction, Physiological and Biochemical changes, significance. Blastulation and Gastrulation in Chick and Mammal - Organogenesis: Development of eye in Chick;

Human reproduction - Puberty, Menstrual cycle - Menopause, pregnancy and related problems - Parturition - lactation. Test tube baby: merits and demerits - Infertility causes.

**TEXT BOOKS**

1. Verma, S. and Agarwal, V.K., 2000, Chordate Embryology, S.Chand & Co., New Delhi
2. Powar C. B - Cell biology
3. Verma and Agarwal - Cytology
4. Gilbert - Developmental biology
5. Turyman - Developmental biology

**REFERENCE BOOKS**

1. Balinsky, B.I., 1981, An Introduction to Embryology, Holt Saunders, New York.
2. Berrill, N.J., 1986, Developmental Biology, McGraw.Hill, New Delhi.
3. Patten, B.M., 1958, Foundations of Embryology, McGraw Hill, New York.
4. Saunders, J.W., 1982 Developmental Biology - Patterns and Principles, Macmillan, New York.

Revised on 30.3.10

**Blue Print**

Time : 3hrs

Max. Marks : 75

Units No.	Section A	Section B	Section C
I	3 questions	3 questions	2 questions
II	4 questions	4 questions	2 questions
	5/7	5/7	2/4

*L. Luthra*

H.O.D.  
PROFESSOR & HEAD,  
Department of Zoology,  
Madura College (Autonomous),  
Madurai-625011.

Received on 30.3.10

**BLUE PRINT**

**Section A** ( 5 x 2 = 10 Marks)

(Five Questions to be answered out of seven)

**Section B** ( 5 x 7 = 35 Marks)

(Five Questions to be answered out of seven)

**Section C** (2 x 15 = 30 Marks)

(Two Questions to be answered out of four)

<b>Total</b>	<b>75 Marks</b>
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UPTO 2016

ORNAMENTAL FISH CULTURE

UNIT-I

<sup>479</sup>Ornamental fish culture - Introduction, types and significance. World scenario of ornamental fish culture - exporting and importing countries. Different types of ornamental fishes. <sup>482</sup>242

UNIT-II

<sup>479</sup>Aquarium - setting of aquarium, commonly used in Aquarium fishes. Precautions in purchasing the ornamental fishes. Water quality management, <sup>483</sup>Feeding, <sup>487</sup>Feeding schedule, Management of fish culture. <sup>488</sup>Aquaculture

UNIT-III

Breeding in ornamental fishes-various techniques used by breeders. Importance of ornamental fish culture. Salient features of Gold fish, Angol fish, <sup>488</sup>Fighter fish, <sup>489</sup>Koi fish, <sup>490</sup>Gourami, <sup>491</sup>Molly, <sup>495</sup>Guppy.

TEXT BOOKS

Arumugam, N. 2008. Aquaculture. Saras Publications. Nagercoil.

Ravindranath, K.R. 2003. Economic Zoology. Dominant publishers and distributors. New Delhi.

Arumugam, N., S. Murugan, J.J. Rajeshwar, R. and Ram Prabhu. 2005. Saras publication. Nagercoil.

REFERENCE BOOKS

Day, F. 1971. The Fishes of India. Today & Tomorrow Publishers. New Delhi.

Kewin M Fox, K.M. 1992. The Tropical Fishkeeper's Hand Book. Argus Books, Herts, England.

Cole, H.H. and M. Ronning. 1974. Animal Agriculture. W.H. Freeman and Company. San.Francisco.

PTO →

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Received on 30.3.10

**BLUE PRINT**

**Section A**

( 5 x 2 = 10 Marks)

(Five Questions to be answered out of seven)

**Section B**

( 5 x 7 = 35 Marks)

(Five Questions to be answered out of seven)

**Section C**

( 2 x 15 = 30 Marks)

(Two Questions to be answered out of four)

**Total**

**75 Marks**

291  
**UPTO 2016**

DEPARTMENT OF ZOOLOGY  
B.Sc. DEGREE COURSE – FOURTH SEMESTER

ANCILLARY ZOOLOGY (For B.Sc. Chemistry Students)  
4C AZ - MOLECULAR BIOLOGY AND IMMUNOLOGY

4636

DN-NO: 4636

UNIT- I

MOLECULAR BIOLOGY: Nucleic acids: Molecular structure of DNA and RNA, types of RNA, DNA replication, protein synthesis, Lac-operon.

UNIT- II

IMMUNOLOGY: Types of immunity-Natural & Acquired, active and passive, Antigen - antibody reaction(precipitation, Agglutination), Lymphoid organs-primary and secondary, Lymphocytes-stem, T and B cells, macrophages, Immunoglobulin- Structure and functions.

TEXT BOOKS

1. Satyanarayanan, U., 2007. Biotechnology, Arunabha Sen Books and Allied (p) Ltd. Kolkotta.
2. Kumaresan, V. Biotechnology, , Saras publication, Nagercoil.
3. Gupta P.K., 2003. Cell and Molecular Biology. IInd Edition, Rastogi Publication, India.
4. Eli Benjamini et al., 2004. Immunology, 4<sup>th</sup> Edition, A John wiley & Sons INC publication.
5. Dulsy Fatima & N.Arūmugam Immunology, 2007. Saras publication. Nagercoil
6. Prakash S.Lohar, 2005. Biotechnology. MJP Publishers. Chennai.
7. Dubey, R.C. 2005. A textbook of Biotechnology. S.Chand & Company Ltd.

The Madura College (Autonomous), Madurai 625 011.

Department of Zoology

3C AZ 200304, 3B AZ 200304, 4C AZ 200304

Time : 3 Hours

Total Marks 75

Answer any five questions  
Four questions from each unit

Section - A

5 x 3 = 15

Answer any two questions  
Two questions from each unit

Section - B

2X10=20

Answer any two questions  
Two question from each unit

Section - C

2X20=40

**UPTO 2016**

**DEPARTMENT OF ZOOLOGY**  
B.A./B.Com./B.Sc. DEGREE COURSE – FOURTH SEMESTER  
NON-MAJOR ELECTIVE

**ESSENTIALS OF ZOOLOGY**

4ZNM/5-3-4641  
QN. NO: 4641

**UNIT - I**

Classification of animals – Invertebrata and Vertebrata (up to class level). Outline classification of animals. Principles of classification, Binomial nomenclature. Advantages of Nomenclature

**UNIT - II**

**General characters and Structure**

- Protozoa – Paramecium
- Coelenterata - coral reefs
- Platyhelminthes – Tapeworm
- Annelida – Earthworm
- Arthropoda - Prawn
- Echinodermata - Starfish

**UNIT - III**

**General characters and Structure**

- Pisces - Tilapia
- Amphibians – Frog
- Reptilia – Snake (Poisonous snakes of South India)
- Aves – Migration of birds and flight adaptations
- Mammals - Rabbit

**TEXT BOOKS**

1. Manual of Zoology - Volume I by M. Ekambaranatha Iyer.
2. Invertebrate Zoology by R.D. Barnes (W.B.Saunders Co)
3. Hyman, L.H: The invertebrates, Vol. I (McGraw Hill)
4. Hyman, L.H: The invertebrates, Vol. II (McGraw Hill)
5. Biology of Animals - Volume I by Ganguly, Sinha & Adhikari.
6. A Text book of invertebrates by Nair et al.,
7. Invertebrate Zoology by Jordan & Verma
8. The Chordates by R. M. Alexander (Cambridge University Press)
9. The Chordates by A. R. Monielth (Cambridge University Press)
10. Life of Vertebrates by J. Z. Young (Oxford University Press)
11. Evolution of Vertebrates by Colbert.
12. Chordate Zoology by E.L. Jordan.
13. Biology of Animals - Volume II by Sinha, Ganguly and Adhikari.

Total Marks: 75

Answer any five Three questions from each unit	Section -A	5 x 3 = 15
Answer any three Three questions from Unit III and two questions from rest of the units	Section -B	3 x 8 = 24
Answer any three Two questions from each unit.	Section -C	3 x 12 = 36

*Answered*



THE MADURA COLLEGE (AUTONOMOUS) MADURAI - 11  
Re accredited with 'A' grade by NAAC

B.Sc., (Zoology Major)

**UPTO 2016**

**Title : BIODIVERSITY & CONSERVATION BIOLOGY**

**CODE : SZ1**

**QN.NO. :(4642)**

**UNIT- I**

Population : Natalty, Mortality, Population fluctuation, Dispersal; Community Ecology - Characteristics of Community, Niche, Guild. Ecosystem - Components (e.g., Forest Ecosystem), Ecotone, Edge Effect.

**UNIT- II**

Biodiversity: Definitions, Levels of biodiversity, Values of biodiversity, Global biodiversity, biological diversity at National level, Hotspots of biodiversity, Ecosystem diversity in India, Threats to biodiversity, Endemic and endangered species in India.

**UNIT- III**

Techniques for Biodiversity studies: Census techniques, four main types, total counts, sample counts, stratification, census operation for primates, birds. Transect method, quadrat method. Diversity indices - Shannon index, Simpson's index, Morisita Horn Index and Jaccard index (including calculations)

**UNIT- IV**

Conservation of Biodiversity: *In situ* conservation - National parks, sanctuaries and sacred grooves (any two examples). *Ex situ* conservation - Gene banks and cryopreservation. Legal aspects: Forest Act, 1927; Wildlife (protection) Act, 1972; Environment (protection) Act, 1986, CITES, Red Data Book.

**UNIT- V**

Organizations associated with Biodiversity Management: Framing policies and methodologies for Execution: IUCN, UNEP, UNESCO, FAO, WCMC; Financing Biodiversity management: GEF, WWF. Ministry of Environment and Forest, India. National Biodiversity Authority, Central Zoo Authority.

**TEXT BOOKS**

1. Verma, P.S. and V.K. Agarwal, 2004. Environmental biology. S.chand & company, Ltd. New Delhi. Pp591.
2. Kumar, V. and M.J. Asija. 2005. Biodiversity principles and conservation. Student Edition. Jodhpur. Pp234.
3. Rodgers, W.A. 1991. Techniques for Wildlife census in India A Field Manual. Wildlife Institute of India. Dehradun. Pp82.
4. Krishnamurthy, K.V. 2003. An advanced Textbook on Biodiversity. Principles and Practice. Oxford & IBH publishing Co. Pvt. Ltd. New Delhi. Pp260.

**REFERENCE BOOKS**

1. Chapman, J.L. and M.J. Reiss. 1995. Ecology Principles and applications. Cambridge University Press. Pp294.
2. Stiling, P.D. 1996. Ecology : Theories and Applications. Prentice Hall International. Inc. Pp539.
3. Odum, E.P. 1963. Ecology. Amerind Publishing Co. Pvt. Ltd. Pp152.
4. Benton, A.H. and W.E. Werner. 1980. Field Biology and Ecology. Tata Mc Graw Hill Publishing Company Ltd. New Delhi. Pp564.
5. Seshadri, B. 1969. The twilight of India's Wildlife. John Baker Publishers. London. Pp212.

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THE MADURA COLLEGE(AUTONOMOUS) MADURAI-11

DEPARTMENT OF ZOOLOGY

BLUE PRINT FOR ALL ZOOLOGY

5Z1,5Z2,5Z3

&

6Z1,6Z2,6Z3 (-008 ON)

TIME: 3 HOURS

MAX.MARK : 75

SECTION-A 10 OUT OF 12 QUESTIONS (10 X 1=10)

1. }  
2. }  
3. } - FROM UNIT -1  
4. }

5. }  
6. } - FROM UNIT-2

7. }  
8. } - FROM UNIT -3

9. }  
10. } - FROM UNIT-4

11. }  
12. } - FROM UNIT-5

SECTION-B 5 OUT OF 10 QUESTIONS (5 X 4 =20)

2 QUESTIONS FROM EACH UNIT

SECTION-C 3 OUT OF 6 QUESTIONS (3 X 15 =45)

2 QUESTIONS FROM UNIT-1

1 QUESTION FROM EACH OF UNITS 2,3,4,5

*Y.M.*

*5/4/11*

Y.M. SUNDARAM, M.Sc., M.Phil.,  
CONTROLLER OF EXAMINATIONS  
THE MADURA COLLEGE (AUTONOMOUS)  
MADURAI - 625 011



THE MADURA COLLEGE (AUTONOMOUS) MADURAI - 11  
Re accredited with 'A' grade by NAAC

B.Sc., (Zoology Major)

**UPTO 2016**

Title : MOLECULAR BIOLOGY AND GENETICS

CODE : 5Z2

QN.NO. :(4644)

**UNIT- I**

Nucleic Acids: Molecular structure of DNA & RNA - Types of RNA - DNA replication, Role of RNA and ribosomes in protein synthesis, Regulation of protein synthesis.

**UNIT- II**

Fine structure of the gene - Cistron, recon, muton - Operon concept, genetic code, Mutation - Molecular basis of mutation - Gene mutation, chromosomal aberrations, mutagens.

**UNIT- III**

One gene - one protein - basic paradigm - DNA as a genetic material; The Griffith effect - Avery's in - vitro transformation - The Harshey - Chase experiment.

**UNIT- IV**

Genetic recombination and replication: homologous recombination - Holiday structure - Replication of DNA - Semi - conservative replication, DNA Polymerase - Okazaki fragments - The complex replication apparatus.

**UNIT- V**

Animal breeding, inbreeding, out breeding - heterosis in Hybrid Vigour, Eugenics, Euphenics and Euthenics, Inborn errors of metabolism and inherited disorders in Man. Twin studies.

**References:**

1. De Robertis E.D.P. & De Robertis E.M.F. (1988) Cell and Molecular Biology
2. Verma P.S. & Agarwal V.K. (1991) Cytology. S. Chand & Co, New Delhi
3. Swanson C.P (1990). The Cell - 8<sup>th</sup> Edn. Prentice Hall of India Pvt. Ltd. New Delhi.
4. Hans S.S. (1986) Cell Biology - Allen & Unwin.

**Books for study**

1. Verma, P.S. and Agarwal V.K. (2004) - Genetics, S.Chand & Co. New Delhi.
2. Dalela R.C., and Verma, S.R., 1970, A text book of Genetics, Jaiprakash Nath and Company, Meerut.

**Books for Reference:**

1. Sinnot E.W, L. C. Dunn and T. Dobzhansky, Principles of Genetics (1973) 4<sup>th</sup> Edn, Tata Mc Graw Hill Pub. Co. Ltd.,
2. Rothwell, N.V. 1979, Human Genetics prentice Hall of India, New Delhi.
3. Weaver, R.F. and Hedrick, P.W. 1997, Genetics, W.H.C. Brown Publishers - London.
4. Gupta P.K., 2000, Genetics, Rastogi Publications, Meerut.
5. Brown, T.A. 1998, Genetics - A molecular approach, Champion Hall, London.

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THE MADURA COLLEGE(AUTONOMOUS) MADURAI-11

DEPARTMENT OF ZOOLOGY

BLUE PRINT FOR ALL ZOOLOGY

521,522,523 and.

6Z1,6Z2,6Z3 (2008 ON)

TIME: 3 HOURS

MAX.MARK : 75

SECTION-A

10 OUT OF 12 QUESTIONS

(10 X 1=10)

1. }  
2. }  
3. } -FROM UNIT -1  
4. }

5. }  
6. } - FROM UNIT-2

7. }  
8. } - FROM UNIT -3

9. }  
10. } - FROM UNIT-4

11. }  
12. } - FROM UNIT-5

SECTION-B

5 OUT OF 10 QUESTIONS

(5 X 4 =20)

2 QUESTIONS FROM EACH UNIT

SECTION-C

3 OUT OF 6 QUESTIONS

(3 X 15 =45)

2 QUESTIONS FROM UNIT-1

1 QUESTION FROM EACH OF UNITS 2,3,4,5

VM  
6/4/11



THE MADURA COLLEGE (AUTONOMOUS) MADURAI - 11  
Re-Accredited with 'A' Grade by NAAC

B.Sc., (Zoology Major)

**UPTO 2016**

Title : ANIMAL PHYSIOLOGY & ANIMAL BEHAVIOUR

CODE : 5Z3

QN.NO. :(4648)

#### UNIT- I

Nutrition: Digestion and absorption of carbohydrates, proteins and lipids, Role of gastro intestinal hormones in digestion; Respiration: Respiratory pigments — Types, Properties and function. Exchange and transport of gases ( $O_2$  and  $CO_2$ ), Respiratory quotient.

#### UNIT- II

Circulation — Composition and Functions of blood, Cardiac cycle, cardiac rhythm, Pace maker, Origin of heart beat and its regulation, ECG. Excretion — Classification of animals based on excretory products, Ornithine cycle, Mechanism of urine formation and hormonal control. Endocrine glands — structure, secretions and functions of pituitary, thyroid and gonads.

#### UNIT- III

Osmoregulation — Osmo - iono - regulation in freshwater, marine and migratory fishes, Thermoregulation — Acclimatization, heat death, cold death, physiology of hibernation and aestivation.

#### UNIT- IV

Nerve Physiology — Types of neuron, conduction of nerve impulse along a nerve fibre, Muscle physiology — Types of Muscles, Ultra structure and properties, Theories of muscle contraction, Isotonic and Isometric contraction.

#### UNIT- V

Animal behaviour : Introduction, types of behaviour – stereotyped and variable. Tropism, taxis, kinesis, reflexes, Learning – Habituation. Conditioned reflexes. Trial and error, Imprinting and reasoning. Biological rhythm – Introduction, Circadian, Lunar. Biological clock : definition with any five examples.

#### Books for Study

1. Verma P.S., Tyagi B.S. and Agarwal V.K. 1995. Animal Physiology, S.Chand & Co, New Delhi
2. Gunadevia H.S. & Hare Govinda Singh, Text book of Animal Behavior (2000)

#### Books for Reference

1. Goyal & Sastri "Animal Physiology" Rastogi Publication, Meerut.
2. Nagabhushanam "Animal Physiology" Oxford and IBH Publishing Co.
3. Jam, P.C. Anantharaman, M.S. Animal Physiology and related Biochemistry" Vishal Publications, Jalandhar.
4. Prosser C.L. Comparative Animal Physiology" Prentice Hall.
5. Saradha Subramanian, Madavankutty K. Text book of Human Physiology S.chand and Co. Ltd.
6. Berry A.K. "A text book of Animal Physiology with related Biochemistry" Emkay Publications, New Delhi.
7. Prakash S.Lohar (2005) 'Endocrinology - Hormones and Human Health, M.I.P.Publishers, Chennai -5.
8. Meenakumari S. (2005), Microbial Physiology, MJP Publisher, Chennai.
9. Hinde R.A, Animal behaviour (2nd ed) Mc Graw Hill 1970.
10. Manning A, An introduction to Animal Behaviour Addeson Wesley 1972.

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THE MADURA COLLEGE(AUTONOMOUS) MADURAI-11

DEPARTMENT OF ZOOLOGY

BLUE PRINT FOR ALL ZOOLOGY

5Z1,5Z2,5Z3

&

6Z1,6Z2,6Z3 (2008 ON)

TIME: 3 HOURS

MAX.MARK : 75

SECTION-A

10 OUT OF 12 QUESTIONS

(10 X 1=10)

1. }  
2. }  
3. }  
4. }

-FROM UNIT -1

5. }  
6. }

- FROM UNIT-2

7. }  
8. }

- FROM UNIT -3

9. }  
10. }

- FROM UNIT-4

11. }  
12. }

- FROM UNIT-5

SECTION-B

5 OUT OF 10 QUESTIONS

(5 X 4 =20)

2 QUESTIONS FROM EACH UNIT

SECTION-C

3 OUT OF 6 QUESTIONS

(3 X 15 =45)

2 QUESTIONS FROM UNIT-1

1 QUESTION FROM EACH OF UNITS 2,3,4,5

*VM*  
6/4/11

V.M. SUNDARAM, M.Sc., M.Phil.,  
CONTROLLER OF EXAMINATIONS  
THE MADURA COLLEGE (AUTONOMOUS)  
MADURAI - 625 011

**UPTO 2016**

ANCILLARY ZOOLOGY (For B.Sc. Botany Students)

Sub code: 5B AZ - PHYSIOLOGY AND MICROBIOLOGY

Q.N. NO:- 4650

( This applies only to those who joined in 2009 onwards )

By Dr SD  
2/12/11  
→ on  
COT

**UNIT-I**

Digestive system of Man - structure of Alimentary canal, digestive glands (secretion and its functions only); Excretory system of Man - structure of kidney, nephrons, Formation of urine. Reproductive system of man-structure of male and female reproductive system, Menstrual cycle, Oestrogen, Androgen, Prolactin, Relaxin, birth control methods.

**UNIT-II**

Microbiology- Five kingdom concept, bacterial growth curve, Microbial Diseases :Causative organisms, mode of transmission, pathogenicity, symptoms and their preventive measures of Cholera, Tuberculosis, Botulism, Viral Hepatitis, Rabies and AIDS.

**TEXT BOOKS**

1. Mariakuttikan, A. and N. Arumugam. 2008. Animal Physiology, Saras publication. Nagercoil.
2. Mani, A., A.M. Selvaraj, L.M. Narayanan and N. Arumugam. 2007. Microbiology. Saras publication.

**REFERENCE BOOKS**

1. Verma, P.S., B.S. Tyagi and V.K. Agarwal. 2005. Animal Physiology. S. Chand & Company Ltd. New Delhi.
2. Rastogi, S.C. 2003. Essentials of Animal Physiology. New Age International (P) Ltd. New Delhi.
3. Dubey, R.C. and D.K. Maheswari, 2005. A Textbook of Microbiology. S. Chand & Company Ltd. New Delhi.
4. Anathanarayan, R. and C.K.J. Paniker. 2002. Textbook of Microbiology. Orient Longman. Hyderabad.

**UPTO 2016**

SKILL BASED ELECTIVE : SERICULTURE

Sub. Code. <sup>V Sem.</sup> 5S2002, Qn. No. 4652

**UNIT - I**

Sericulture – Importance, Sericulture industry in India. Services of Central Silk Board.  
Moriculture – Varieties of mulberry, optimum conditions for mulberry cultivation. Different methods of propagation – seedling, Vegetative propagation – Cutting, grafting, layering. Harvesting methods and preservation of leaves.

**UNIT - II**

Lifecycle of mulberry silkworm, *Bombyx mori*. Rearing of Silkworm -Rearing house, rearing appliances, Silk reeling. Testing of raw silk – Visual and mechanical tests.  
Silkworm disease – Causes and prevention of Pebrine, Flacherie, Septicemia and Muscardine and Grasse

**Reference Books**

1. Johnson, M. and M. Kesary. 2008. **Sericulture**. Fourth Edition. N.M.C. College, Marthandam.
2. Arumugam, N. et. al. 2005. **Applied Zoology**. Saras Publications. Nagercoil.
3. Kanga, G. and J. Sulochanachetty. 2000. **An Introduction to Sericulture**. Oxford & IBH publishing Co Pvt. Ltd. New Delhi.
4. Ravindranathan, K.R. 2003. **Economic Zoology**. Dominant publishers and Distributors. New Delhi

Revised on 30.3.10

**Blue Print**

Time : 3hrs

Max. Marks : 75

Units No.	Section A	Section B	Section C
I	3 questions	3 questions	2 questions
II	4 questions	4 questions	2 questions
	5/7	5/7	2/4

*L. Luvitha*

H.O.D

PROFESSOR & H.E.D.  
Department of Zoology,  
Madura College (Autonomous)  
Madurai-625 011.

Received on 30.3.10

**BLUE PRINT**

**Section A**

(5 x 2 = 10 Marks)

(Five Questions to be answered out of seven)

**Section B**

(5 x 7 = 35 Marks)

(Five Questions to be answered out of seven)

**Section C**

(2 x 15 = 30 Marks)

(Two Questions to be answered out of four)

<b>Total</b>	<b>75 Marks</b>
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Q.N. No:- A654

(2008 on &amp; up to 2007)

## UNIT-I

History and Scope of Microbiology, Whittaker's Five Kingdom Concept, Structure of bacteria (*E. coli*), Virus (T<sub>4</sub>phage) and Yeast. Bacterial growth curve.

Dairy Microbiology: Pasteurization, Milk products — Curd, and Cheese; Food Microbiology: Physico-chemical methods in food preservation. Soil Microbiology: Biological nitrogen fixation — types and mechanism. Water Microbiology: MPN.

## UNIT-II

Study of Common bacterial and viral diseases of man — Causative organisms, mode of transmission, pathogenicity, symptoms & their preventive measures. of Cholera, Viral Hepatitis, Tuberculosis, Polio, Rabies and AIDS

## UNIT-III

Immune System — Types of Immunity — Innate, acquired Immunity—passive and active; Lymphoid organs — Primary and Secondary Organs (Spleen and Lymphnode Lymphocytes — T&B Cells; Immunoglobulin — structure, types and functions.

Immune Response — Humoral Immunity and Cell Mediated Immunity; Antigen — Antibody reactions — Agglutination and precipitation reactions.

## TEXT BOOKS

1. Ananthanarayanan, R. & C.K.Jayaram Panicker, 1990. Text Book of Microbiology, Orient Longman.
2. Chakravarthy A.K. (1996) Immunology, Tata Mc Graw, New Delhi.

## REFERENCE BOOKS

1. Sharma, P.D., 1998, Microbiology, Rastogi Publications.
2. Mani, A., Narayanan, L.M., Selvaraj, A.M., & N.Arumugam (1996)
3. Pelczer, M.J. (2000) Microbiology, McGraw Hill Book Company, New Delhi.
4. Meena Kumari, S. 2005, Microbial Physiology, M.J.P.Publishers, Chennai.
5. Vijaya Ramesh, K. 2005, Environmental Microbiology, M.J.P.Publishers, Chennai.
6. Roitt, I. 1987, Essential Immunology, P.G. Publishing Pvt. Ltd. New Delhi.
7. Kuby, T. (1994) Immunology, P.G.Publishing Pvt. Ltd. New Delhi.
8. Tizard, I.R. (1995) Immunology - An Introduction IV Ed. Saunders College Publication, Philadelphia.



THE MADURA COLLEGE(AUTONOMOUS) MADURAI-11  
DEPARTMENT OF ZOOLOGY

BLUE PRINT FOR ALL ZOOLOGY  
5Z1,5Z2,5Z3(2008 ON)  
&  
6Z1,6Z2,6Z3 (2008 ON)

TIME: 3 HOURS

MAX.MARK : 75

SECTION-A                    10 OUT OF 12 QUESTIONS                    (10 X 1=10)

- 1. }  
2. }  
3. } - FROM UNIT -1  
4. }
- 5. }  
6. } - FROM UNIT-2
- 7. }  
8. } - FROM UNIT -3
- 9. }  
10. } - FROM UNIT-4
- 11. }  
12. } - FROM UNIT-5

SECTION-B                    5 OUT OF 10 QUESTIONS                    (5 X 4 =20)

2 QUESTIONS FROM EACH UNIT

SECTION-C                    3 OUT OF 6 QUESTIONS                    (3 X 15 =45)

2 QUESTIONS FROM UNIT-1  
1 QUESTION FROM EACH OF UNITS 2,3,4,5

*VM*  
6/4/11

V.M. SUNDARAM, M.Sc.,M.Phil.,  
CONTROLLER OF EXAMINATIONS  
THE MADURA COLLEGE (AUTONOMOUS)  
MADURAI - 625 011



THE MADURA COLLEGE (AUTONOMOUS) MADURAI - 11  
Re-Accredited with 'A' Grade by NAAC

B.Sc., (Zoology Major)

Title : BIOTECHNOLOGY

CODE : 6Z 2 (2008 ON)

QN.NO. : (4656)

(2008 on 2) up to 2007

**UNIT- I**

Origin and Definition - Scope and Importance of Biotechnology - Biotechnology in India - GATT, IPR, TRIPS - recombinant DNA technology — Genetic Engineering — Restriction Enzymes — Gene cloning — Cloning Vectors — Plasmids, Phages, Cosmids — Polymerase chain Reaction - cDNA Library - Electroporation and Microinjection

**UNIT- II**

Animal Biotechnology. Animal tissue culture — In vitro fertilization — embryo transfer in man and Cattle — Transgenic animals, Biotechnology and medicine - Hybridoma - Monoclonal anti bodies — hormone production — Viral Vaccines — Edible and designer Vaccines, interferons — Gene Therapy.

**UNIT- III**

Plant Biotechnology. Plant tissue culture — Protoplast culture — Disease resistant Plants — Stress tolerant plants — Ti-Plasmids — Nif genes — genetically transformed Plants — Terminator gene technology — Plant vectors — Phytoremediation — Biosafety — Safety issues — Ecological, Social, Legal Issues regarding

**UNIT- IV**

Microbial biotechnology. Bioreactors — Fermentation process — Fermentation Industry — Microbial Enzymes and their application - Products of Microbial Fermentation - Biogas Plant structure — Biogas Production — Biofertilizers — Bioinsecticides — Biosensors — Biopolymers — Application of genetically engineered bacteria.

**UNIT- V**

Environmental Biotechnology. Renewable Energy — Energy and Fuel using Micro organisms — Biomass production through forestry — Gene Banks — Species conservation — Solid waste management — Vermi composting — Bioremediation — Bio - Leaching.

**Books for Study**

1. F.C. Dubey - Biotechnology, 2005, U. Satyanarayanan - Ref. Biotechnology, 2005.
2. S.B. Primrose - Molecular Biotechnology,

Contd . . . 2

**Title : BIOTECHNOLOGY**

**CODE : 6Z 2 (2008 ON) QN.NO. :(4656)**

**Books for Reference**

1. Murugesan, A.G. and Raj Kumar, C. - Environmental Science and Biotechnology, 2005 — MJP Publishers — Triplicane, Chennai — 600 005.
2. Kalaichelvan, P.T. - Microbiology and Biotechnology - A Laboratory Manual,
3. Lohar P.S., - Biotechnology, 2005 - MJP Publishers - Triplicane, Chennai — 5.
4. Prema, L.P. - Applied Biotechnology, 2006 — MJP — Publishers, Chennai -5.
5. Roitt, I.M., Brostoff and Male — Immunology — 1994, 1995 2nd, 3rd, 4th Ed. Gower Medical Publishing.
6. Jogdand, S.N., - Environmental Biotechnology, 1995. Himalaya Publishing House, Bombay.
7. Pathade, G.P., God, P.K. - Environmental Pollution and Management of waste waters by Microbial techniques, 2001, ABD Publishers.
8. Subbaram N.R., - Handbook of Indian Patent Law and Practice, 1998, S.Vishwanathan Publishers, Chennai.
9. Mansi, E.M., - Fermentation Microbiology and Biotechnology, 2002, Taylor and Francis Group, USA.
10. Freshney, R.I., - Culture of Animal Cells — A Manual of Basic techniques, 2000, Wiley Liss Publication.
11. Trivedi, P.C. - Plant Biotechnology — Recent advances, 2000, Panimar Publishing Corporation, New Delhi.
12. Narayanasamy S., - Plant Cell and Tissue culture, 1999, Tata McGraw - Hill Publishing Company, New Delhi.
13. Pareck, L.K., - Trends in Plant tissue culture and Biotechnology, 2002, Agrobios, Jodhpur,
14. Vijaya K., - Environmental Microbiology, Ramesh, 2005, MJP Publishers, Chennai -5.

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THE MADURA COLLEGE(AUTONOMOUS) MADURAI-11

DEPARTMENT OF ZOOLOGY

BLUE PRINT FOR ALL ZOOLOGY

5Z1,5Z2,5Z3(2008 ON)

&

6Z1,6Z2,6Z3 (2008 ON)

TIME: 3 HOURS

MAX.MARK : 75

SECTION-A                    10 OUT OF 12 QUESTIONS                    (10 X 1=10)

1. }  
2. }  
3. } -FROM UNIT -1  
4. }

5. }  
6. } - FROM UNIT-2

7. }  
8. } - FROM UNIT -3

9. }  
10. } - FROM UNIT-4

11. }  
12. } - FROM UNIT-5

SECTION-B                    5 OUT OF 10 QUESTIONS                    (5 X 4 =20)

2 QUESTIONS FROM EACH UNIT

SECTION-C                    3 OUT OF 6 QUESTIONS                    (3 X 15 =45)

2 QUESTIONS FROM UNIT-1

1 QUESTION FROM EACH OF UNITS 2,3,4,5

  
6/4/11

V.M. SUNDARAM, M.Sc.(Zool),  
CONTROLLER OF EXAMINATIONS  
THE MADURA COLLEGE (AUTONOMOUS)  
MADURAI - 625 011



B.Sc., (Zoology Major)

Title : BIOPHYSICS, BIOSTATISTICS AND BIOINFORMATICS

CODE : 6Z3 (2008 ON) QN.NO. :(4658)

UNIT-I

Scope of Biophysics: Colloids - Description, types and properties, Electro kinetic properties, Tyndall effect, surface tension, Brownian movement, filtration, osmosis, dialysis and Absorption, Instrumentation. Law of thermodynamics - entropy, enthalpy. Protein Structure - Primary, secondary, Tertiary and quaternary

UNIT- II

Data Collection - Sources of Primary and secondary data - Classification and Tabulation, Organization of data: Individual, discrete frequency Series Types of variables - Derived variables.

UNIT- III

Diagrammatic Representation of Data - Bar diagram, Pie diagram, Histogram, Frequency polygon, Frequency Curve, Ogive, Pictograph, Scatter diagram, Measurement of Central tendency, Measures of dispersion - standard deviation, Chi-square test, students t test, Analysis of Variance, Correlation and Regression.

UNIT- IV

History and Generation of Computer, Basic components of Computer, Input/ Output devices, CPU - Memory and its types. Brief account on packages - MS Word and MS Excel for data entry. Basic ideas about internet - Website, Email - other uses of Internet.

UNIT- V

Bioinformatics: History Definition Scope, Databases: Protein databases - DNA data base, Comparison of sequences - FASTA and BLAST - Methods to access and download genome sequences of several organisms from GENBANK, EMBL and other sources.

Books for Study

1. Das, D. 1996, Biophysical and Biological Chemistry, Academic Publishers, Kolkata.
2. Subramanian, M.A.2005, Biophysics, Principles and Techniques, M.J.P. Publishers, Chennai
3. Upadhyay, Upadhyay and Nath, K. 1993. Biophysical Chemistry. Himalaya Publishing House.
4. Gurumani, N. 2004, Introduction to Biostatistics, M.J.P. Publishers, Delhi
5. Arder T. (2002), Information Technology, Pitman Publishers.

**Title : BIOPHYSICS, BIostatISTICS AND BIOinformatics**

**CODE : 6Z3 (2008 ON)**

**QN.NO.:(4658)**

**Books for Reference**

1. Daniel, M. 1992, Biophysics Biologist, Wiley International, New Delhi.
2. Das, D, and Das, A. 2004, Statistics in Biology and Psychology Acad. Publishers, Kolkata.

**Biostatistics**

1. Ramakrishnan, P. 1996, Biostatistics, Saras Publications, Nagercoil.
2. Sokal, R.J. and Rohlf, S.J. 1981, Introduction to Biostatistics, W.H.Freeman, London.

**Bioinformatics and Computer Applications**

1. Leon F. and Lean M. (2004) Fundamentals of Computer Science and Communications Engineering, Lean Tech World.
2. Mittal C. (2003) Fundamentals of Information Technology, Pragathi Prakasam, Meerut.
3. Murthy, C.S.V. (2004) Bioinformatics, Himalaya Publishing House, New Delhi.
4. David W. Mount, (2001) Bioinformatics Sequence and genome analysis, Cold Spring Harbor Press, New York.

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THE MADURA COLLEGE(AUTONOMOUS) MADURAI-11

DEPARTMENT OF ZOOLOGY

BLUE PRINT FOR ALL ZOOLOGY

5Z1,5Z2,5Z3(2008 ON)

&

6Z1,6Z2,6Z3 (2008 ON)

TIME: 3 HOURS

MAX.MARK : 75

SECTION-A

10 OUT OF 12 QUESTIONS

(10 X 4=40)

1. }  
2. }  
3. } - FROM UNIT -1  
4. }  
5. }  
6. } - FROM UNIT -2  
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8. }  
9. } - FROM UNIT -4  
10. }  
11. }  
12. } - FROM UNIT -5

SECTION-B

5 OUT OF 10 QUESTIONS

(5 X 4 =20)

2 QUESTIONS FROM EACH UNIT

SECTION-C

3 OUT OF 6 QUESTIONS

(3 X 15 =45)

2 QUESTIONS FROM UNIT-1

1 QUESTION FROM EACH OF UNITS 2,3,4,5

*VM*  
6/4/11

V.M. SURESHKANTH, M.Sc. (ZOOLOGY)  
CONTROLLER OF EXAMINATIONS  
THE MADURA COLLEGE (AUTONOMOUS)  
MADURAI - 625 011



THE MADURA COLLEGE (AUTONOMOUS) MADURAI - 11  
Re-Accredited with 'A' Grade by NAAC

B.Sc., (Zoology Major SBE)

Title : ANIMAL FARMING

CODE : 6SZ (2008 ON)

QN.NO. :(4664)

UNIT - I

Poultry - Breeds of Poultry, Housing, Management - Growers, Layers, Broilers, Lighting, Summer and Winter Management - Debeaking, Nutrition - Feed Stuffs, Feed Formulations. Diseases - Virus, Bacteria, Fungal and Parasites. Role of eggs in Human Nutrition.

UNIT - II

DAIRY FARMING - Important breeds of cattle. Management of cow - New born calf, Heifer, Milking cow. Breeding management. Livestock diseases - Foot and Mouth diseases and Mastitis. Nutritive value of milk.

UNIT - III

PIGGERY - Selection of breeds - English class breed, American class breed. Feeding and Management, Artificial insemination. Products. The pork, Sausage and lard. Bristles and other uses. Diseases and control.

TEXT BOOKS

Ravindranath K.R. 2003 Economic Zoology Dominant publishers and distributors, New Delhi.

Anmugam, N.S. Murugan, J.J. Rajeswar, R. and Ram Prabhu, 2005, Saras publication, Nagarcovil.

Gnanamani, R. 1978. Modern aspects of Commercial Poultry Keeping, Hytone Publications, Madurai.

REFERENCE BOOKS

Gopalakrishnan, C.A. and G.M.M.Iai, 1985, Livestock and Poultry Enterprises for Rural Development Vani Educational books, New Delhi.

Singh, H. and E.N. Moore. 1982. Livestock and Poultry Production, Prentice Hall of Indian Pvt. Ltd. New Delhi.

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Blue Print

Time: 3 hours.

Total marks: 75

Section A

Answer any FIVE: (5 x 3 = 15 marks)

Nine questions to be asked three from each unit.

Section B

Answer any THREE: (3 x 8 = 24 marks)

One question from Unit III and two each from Units I and II. (total 5 questions ) to be asked.

Section C

Answer any THREE: (3 x 12 = 36 marks)

Two questions from each unit (total 6 questions) to be asked.

11/11  
12/10/07

**ANCILLARY ZOOLOGY (For B.Sc. Botany Students)**  
**6B AZ (2008 On) - MOLECULAR BIOLOGY, BIOTECHNOLOGY AND IMMUNOLOGY**

**UNIT-I**

**MOLECULAR BIOLOGY:** Nucleic acids: Molecular structure of DNA and RNA, types of RNA, DNA replication, protein synthesis. Fine structure of Gene: Cistron, recon, muton, Lac-operon, genetic code, mutation-molecular basis of mutation, -gene mutation, chromosomal aberrations, mutagens.

**UNIT- II & III**

**BIOTECHNOLOGY:** Transgenic animals(Dolly, Transgenic fish), Hybridoma technology(MAb production) Gene cloning-vectors(PBR322, phage), biofertilizers (Rhizobium, Azospirillum), Biopesticides(Bt toxin).

Biosensors-structure and application. Application genetically engineered bacteria-Super Bug, role of Thiobacillus thiooxidans in ore leaching.

**UNIT-IV**

**IMMUNOLOGY:**

Types of immunity-Natural & Acquired, active and passive, Antigen-antibody reaction(precipitation, Agglutination), Lymphoid organs-primary and secondary, Lymphocytes-stem, T and B cells, macrophages, Immunoglobulin- Structure and functions.

**TEXT BOOKS**

1. Satyanarayanan, U., 2007. Biotechnology, Arunabha Sen Books and Allied (p) Ltd. Kolkata.
2. Kumaresan, V. Biotechnology, Saras publication, Nagercoil.
3. Gupta P.K., 2003. Cell and Molecular Biology. IInd Edition, Rastogi Publication, India.
4. Eli Benjamini et al., 2004. Immunology, 4<sup>th</sup> Edition, A John wiley & Sons INC publication.
5. Dulsy Fatima & Naramugam Immunology, 2007. Saras publication, Nagercoil.
6. Prakash S.Lohar, 2005. Biotechnology. MJP Publishers. Chennai.
7. Dubey, R.C. 2005. A textbook of Biotechnology. S.Chand & Company Ltd



No. of pages in the Q.P : 1

**THE MADURA COLLEGE (Autonomous) MADURAI – II**  
**(RE-ACCREDITED WITH "A" GRADE BY NAAC)**  
**SEMESTER EXAMINATIONS – APRIL 2012**

**CLASS:** B.Sc., Botany Anc: Zoology

**QN.NO :** 4666

**TITLE:** Molecular Biology, Biotechnology &  
Immunology

**CODE :** 6B AZ (2008on)

**TIME :** 3 Hours

**MAX.MARKS :** 75

**PART – A**

**Answer any FIVE**

**5 x 3 = 15**

1. Briefly explain the structure of +rRNA.
2. Enumerate the salient features of genetic code.
3. Write a note on Bt toxin.
4. Write a brief account on pBR 322.
5. What is Biosensors? Explain the uses of Glucose biosensor.
6. Give short note on Transgenic fish.
7. What is acquired immunity? Explain.
8. Write a short note on B – cells.

**PART – B**

**Answer any TWO**

**2 x 10 = 20**

9. Describe the molecular structure of DNA.
10. Write an account on Biofertilizer.
11. Discuss, role of thioaxillus thiooxidant in ore leaching.
12. Write an essay on secondary lymphoid organ.

**PART – C**

**Answer any TWO**

**2 x 20 = 40**

13. Give a detailed essay on Protein synthesis.
  14. Describe the production of MAb through Hybridoma technology.
  15. Explain the contribution of A.M.Chakraborty in Oil pollution control.
  16. Explain the structure and function of Immunoglobulin.
- =====



**PROGRAMME: B.Sc., Zoology**

**COURSE CODE : 17U1ZMC1**

**COURSE TITLE : Life and Diversity of  
Invertebrates**

**QN.NO : 9201**

**TIME : 3 Hours**

**MAX.MARKS :75**

**Unit -1**

Protozoa - General characters and classification up to classes with examples –*Amoeba*: locomotion, nutrition, reproduction - Life history of *Plasmodium* - Brief account on parasitic protozoans:*Entamoeba*, *Trypanosoma* and *Leishmania*.

Porifera - General characters and classification up to classes - Structure of simple sponge – General characters of *Olyntus*- Canal system in sponges.

**Unit -2**

Coelenterata - General characters and classification up to classes with examples - Organization of Polyps and Medusa - Polymorphism in Hydrozoa - Corals and Coral reefs. General characters and affinities of ctenophora.

Helminthes - General characters and classification up to classes with examples -*Taenia solium*: Scolex –*Wucheria*: General features, Elephantiasis – Parasitic adaptation in helminthic worms.

**Unit -3**

Annelida - General characters and classification up to classes with examples - Earth worm: General characteristic features, Metamerism, Nervous system and Excretory system – Leech:Coelom, Nephridia.

**Unit -4**

Arthropoda - General characters and classification up to classes with examples – Cockroach: Digestive system and circulatory system - Peripatus as a connective link- Appendages of prawn - Mouthparts of insects and larval forms of insects - Types of metamorphosis in insects and role of hormones in brief.

**Unit -5**

Mollusca - General characters and classification up to classes with examples - Torsion in gastropods.

Echinodermata - General characters and classification up to classes with examples - Star fish: water vascular system - Echinoderm larvae and their significance.

**Text book:**

1. Nair, N.C., S. Leelavathy, N. Soundarapandian, T. Murugan, and N. Arumugam. 2006. A text book of Invertebrates, Saras Publication, Nagercoil.

**Reference books:**

1. Kotpal, R.L. 2012. Modern Text Book of Zoology Invertebrates, Rastogi Publications, Meerut.
2. Parker & Hashwell, Textbook of Zoology Vol. I (Invertebrates) A.Z.T.B.S. Publishers & Distributors, New Delhi.
3. Jordan, E.L. and P.S.Verma. 2013. Invertebrate Zoology, S. Chand & Co. Ltd. New Delhi.
4. Hickman C. P. Jr., Hickman & L.S. Roberts. Integrated principles of zoology, Mosby college publication. St. Louis.
5. Iyer, E.K., And T.N. Ananthkrishnan, Manual of zoology Vol. I, Invertebrata, Part I and II S.Viswanathan (Printers and Publishers) Pvt. Ltd. Madras.



**THE MADURA COLLEGE (Autonomous), MADURAI – 625 011**  
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RE-ACCREDITED (3<sup>rd</sup> Cycle) WITH “A” GRADE BY NAAC

**PROGRAMME: B.Sc., Zoology**

**COURSE CODE : 17U1ZSM1**

**COURSE TITLE : Applied Entomology**

**QN.NO : 9202**

**TIME : 3 Hours**

**MAX.MARKS :75**

**Unit – 1**

Sericulture – Types of silk worm – Life history of mulberry silk worm *Bombyx mori* – Mountage – Diseases of silk worm: pebrine, muscardine and flacherie.

**Unit – 2**

Moriculture – Cultivation of mulberry trees, harvesting and storage methods, Role of Central Silk Board in sericulture.

**Unit – 3**

Apiculture – Different species of honey bees – Life history of bees – Newton’s bee hive – Uses of honey.

**Unit – 4**

Lac culture – Lac insect classification – Life history of lac insects – Cultivation of lac – Harvesting and processing of lac – Composition and uses of lac.

**Unit – 5**

Forensic Entomology – Insects of forensic importance – Corpse feeders – Maggots – Life cycle analysis – Role of insects in crime investigation.

**Text book(s):**

1. Tomer, B. S. 2011. Economic Zoology. Emkay publications, Delhi.
2. Arumugam, N., S. Murugan, J. Johnson Rajeshwar, and R. Ramprabhu, 2005. Applied Zoology. Saras publication, Nagercoil.

**Reference books**

1. Johnson, M and M. Kesary. 2008. Sericulture.
2. Ravindranathan, K.R. 2005. A text book of economic zoology. Dominant publishers and distributors, New Delhi.
3. Shukla, G. S. and V.B. Upadhyay. 2011. Economic Zoology. Rastogi Publications, Meerut, New Delhi.
4. Vasantharaj David,B. and Kumaraswamy, T. (1996). Elements of Economic Entomology. Popular book depot, Chennai.

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**PROGRAMME: B.Sc., Zoology**

**COURSE CODE : 17U1ZAC1**

**COURSE TITLE : Fundamentals of  
Invertebrates and Chordates**

**QN.NO : 9203**

**TIME : 3 Hours**

**MAX.MARKS :75**

**Unit- 1**

General characters and outline classification of invertebrates up to phylum. Life cycle of Plasmodium - Canal system in sponges - Corals and coral reefs.

**Unit- 2**

Parasitic adaptation in helminthic worms – metamerism - mouth parts and metamorphosis in insects.

**Unit- 3**

Torsion in mollusc – economic importance of mollusc – Water vascular system in star fish – General characters and outline classification of vertebrates up to phylum.

**Unit- 4**

General characters of Hemichordates, Eurochordates and Cephalochordates with examples – Parental care in fishes– migration of fishes.

**Unit- 5**

Neoteny in Amphibians – poisonous snakes of south India (Cobra and krait) - identification of poisonous and non poisonous snakes – flight adaptations in birds – Egg laying and pouched mammals – Adaptive radiation in mammals.

**Text book**

1. Thangamani, A., Prasanakumar, S., Narayanan, L. M. and Arumugam, N. 2005. A text book of Chordates. Saras publication, Nagercoil.

**Reference Books**

1. Kotpal, R.L. Modern Text Book of Zoology Invertebrates, Rastogi Publication, Meerut.
2. Parker & Hashwell, Textbook of Zoology Vol. I (Invertebrates) A.Z.T.B.S. Publishers & Distributors. New Delhi.
3. E.L. JORDEN & P.S. VERMA, Invertebrate Zoology, S. Chand & Co. Ltd. New Delhi.
4. Hickman C. P. Jr., Hickman & L.S. Roberts. Integrated principles of zoology, Mosby college publication. St. Louis.
5. Iyer, E.K., And T.N. Ananthakrishnan, Manual of zoology Vol. I, Invertebrata, Part I and II S.Viswanathan (Printers and Publishers) Pvt. Ltd. Madras.
6. A Text Book of Zoology, Vertebrates, Vol-II, Jeffery Parker and W.A. Haswel, Edited by Marshall and Williams, CBS Publication, New Dehli.
7. Chordate Zoology, 1982, P.S Dhami and J.K.Dhami, R.Chand and Co., New Dehli.
8. A Text Book of Zoology, 1984, R.D. Vidyarthi, R. Chand and Co., Dehli.
9. Modern Text Book of Zoology, Vertebrates. R. L. Kotpal, 3rd edn. Rastogi Publications, Meerut.
10. Chordate Zoology, E.L. Jordon. S. Chand & Co., New Dehli.



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**PROGRAMME: B.Sc., Zoology**

**COURSE CODE : 17U2ZMC2**

**COURSE TITLE : Life and Diversity of  
Vertebrates**

**QN.NO : 9204**

**TIME : 3 Hours**

**MAX.MARKS :75**

### **Unit – 1 Prochordata & Agnatha**

General characters and classification of Prochordates up to classes with examples - Geological time scale-General characters of Urochordates – Ascidian: feeding mechanism, Ascidian tadpole larva and retrogressive metamorphosis in Ascidia – Salient features of Amphioxus – Affinities of Amphioxus - General characters of Agnatha - Migration of Petromyzon.

### **Unit – 2 Pisces**

General characters and outline classification of fishes – Shark: Circulatory system and reproductive system – Accessory respiratory organs – Parental care in fishes – Migration of fishes – Evolutionary significance of Dipnoi.

### **Unit – 3 Amphibia & Reptilia**

General characters and outline classification of Amphibians - Frog: Respiratory system- Parental care in amphibians-Metamorphosis in amphibians-Neoteny in amphibians.

General characters and classification of Reptiles in brief - Calotes: Digestive system - Poisonous snakes: Types of venom, biting mechanism and venomous snakes of south India- Identification of poisonous and non poisonous snakes.

### **Unit – 4 Aves**

General characters and outline classification of Aves - Pigeon: Digestive system and reproductive system – Bird migration – Flight adaptation in birds – Flightless birds – Evolutionary significance of Archaeopteryx.

### **Unit 5 Mammalia**

General characters and outline classification of Mammalia – Characters and examples of Prototheria, Metatheria and Eutheria – Rabbit: Digestive system and Sense organs – Adaptation in aquatic mammals.

### **TEXT BOOK**

1. Thangamani, A., S. Prasanakumar, L.M. Narayanan and N. Arumugam. 2005. A text book of Chordates. Saras publication, Nagercoil.

### **REFERENCE BOOKS**

1. Kardong, K.V. (2005) Vertebrates Comparative Anatomy, Function and evolution. IV Edition. McGrawHill Higher Education.

2. Kent, G.C. and Carr R.K. (2000). Comparative Anatomy of the Vertebrates. IX Edition. The McGraw-Hill Companies.
3. Young, J.Z. (2004). The life of vertebrates. III Edition. Oxford university press.
4. Hall B.K. and Hallgrimsson B. (2008). Strickberger's Evolution. IV Edition. Jones and Bartlett Publishers, Inc.
5. A Text Book of Zoology, Vertebrates, Vol-II, Jeffery Parker and W.A. Haswel, Edited by Marshall and Williams, CBS Publication, New Dehli.
6. Chordate Zoology, 1982, P.S Dhami and J.K.Dhami, R.Chand and Co., New Dehli.
7. A Text Book of Zoology, 1984, R.D. Vidyarthi, R. Chand and Co., Dehli. 4. Modern Text Book of Zoology, Vertibrates. R. L. Kotpal, 3rd edn. Rastogi Publications, Meerut.

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### **PATTERN OF QUESTION PAPER**

**TIME: 3 Hours**

**MAXIMUM MARKS: 75**

#### **SECTION – A (10 x 1 =10)**

**Answer All the Questions (Multiple Choice Questions)**

<b>Question No. 1, 2 from</b>	<b>Unit – I</b>
<b>Question No. 3, 4 from</b>	<b>Unit - II</b>
<b>Question No. 5, 6 from</b>	<b>Unit - III</b>
<b>Question No. 7, 8 from</b>	<b>Unit – IV</b>
<b>Question No. 9, 10 from</b>	<b>Unit - V</b>

**SECTION – B (5 x 7 = 35)**

**Answer All the Questions (Either OR Pattern) each answer not exceeding 3 pages**

Question No. 11(a) (OR) Question No. 11(b)	}  }	<b>From Unit -I</b>
Question No. 12(a) (OR) Question No. 12(b)	}  }	<b>From Unit -II</b>
Question No. 13(a) (OR) Question No. 13(b)	}  }	<b>From Unit -III</b>
Question No. 14(a) (OR) Question No. 14(b)	}  }	<b>From Unit -IV</b>
Question No. 15(a) (OR) Question No. 15(b)	}  }	<b>From Unit -V</b>

**SECTION – C (3 x 10 = 30)**

**Answer 3 out of 5 Questions (Open choice) each answer not exceeding 4 pages.**

<p>Question No. 16 from Unit - I</p> <p>Question No. 17 from Unit - II</p> <p>Question No. 18 from Unit - III</p> <p>Question No. 19 from Unit - IV</p> <p>Question No. 20 from Unit - V</p>
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**PROGRAMME: B.Sc., Zoology**

**COURSE CODE : 17U2ZSM2**

**COURSE TITLE : Medical Zoology**

**QN.NO : 9206**

**TIME : 3 Hours**

**MAX.MARKS :75**

**Unit – 1**

Science of diseases – Communicable and non-communicable diseases – Vectors: Biological (Mosquito) and Mechanical (Musca) vectors – Endemic, epidemic and pandemic diseases.

**Unit – 2**

Vector borne diseases – Dengue, Rabies, Plaque and kala-azar (Transmitting vectors, mode of transmission, symptoms and prophylaxis).

**Unit – 3**

Protozoan diseases – Amoebiasis, Malaria, Pyorrhoea, Trypanosomiasis (Life cycle of causative organism, pathogenecity and prophylaxis).

**Unit – 4**

Helminthic diseases – Fascioliasis, Taeniasis, Ascariasis and Ancylostomiasis (Mode of infection, pathogenecity and prophylaxis).

**Unit – 5**

Ectoparasites: Head louse, bed bug, ticks and mites – General characters - Medicinal importance and control measures.

**Text book**

1. Rathinaswamy, S. K. 1986. A hand book of medical entomology and elementary parasitology. Vishwanathan (Printers & Publishers), Pvt. Ltd. Ananda Book Depot, Madras.

**Reference books**

1. Ghai O.P. and Piyush gupta, 1999. Essential preventive medicine (1<sup>st</sup>). Vikas publishing house Pvt Ltd .
2. Kotpal, R.L. 2012. Modern Text Book of Zoology Invertebrates, Rastogi Publications, Meerut.
3. Park I.E. and Park K. (2007).Text Book of Social and Preventive Medicine. M/s Banarsidas Bhanot publishers, Jabalpur.

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**THE MADURA COLLEGE (Autonomous), MADURAI – 625 011**

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RE-ACCREDITED (3<sup>rd</sup> Cycle) WITH “A” GRADE BY NAAC

**PROGRAMME: B.Sc.,**

**COURSE CODE : 17U2ZAC2**

**COURSE TITLE : Economic Zoology**

**QN.NO : 9208**

**TIME : 3 Hours**

**MAX.MARKS :75**

**Unit – 1**

Apiculture - Types of honey bees - Bee colony - Newton bee hives - Management of an apiary- Uses of honey - Bee wax and Bee venom.

Lac culture - Life history and rearing of lac insects - uses of lac.

**Unit – 2**

Sericulture - Types of silk worm - Lfe history of silk worm - Rearing of silk worm - Silk glands - Diseases of silk worm (Pebrine, muscardine and flacherie) - Role of Central Silk Board in Sericulture.

**Unit – 3**

Poultry - Breeds of poultry - Housing and management – Nutrition - Diseases and control - Dairy farming – Principles of economically important cattle.

**Unit – 4**

Pisciculture - Types of culturable fishes (fin fishes and shell fishes) - polyculture of carps - economic importance of fishes.

Vermiculture – Species – method – vermiwash - uses of vermi compost.

**Unit – 5**

Pests of paddy (*Tryporyza incertulas*, *Baliothrips biformis*), sugarcane (*Chilo infescatellus*, *Holotrichia consanguinea*) and cotton (*Pempherus offinis*, *Oxycarenius laetus*) - Cultural, chemical and biological methods of pest control – Integrated pest management.

**Text book(s):**

1. Tomer, B.S. 2011. Economic Zoology. Emkay publications, Delhi.
2. Arumugam, N., S. Murugan, J. Johnson Rajeshwar, and R. Ramprabhu, 2005. Applied Zoology. Saras publication, Nagercoil.

**Reference Books**

1. Arumugam, N. 2008. Aqua culture. Saras publication, Nagercoil.
2. Ravindranathan, K.R. 2005. A text book of economic zoology. Dominant publishers and distributors, New Delhi.
3. Vasantharaj David, B. and Kumaraswamy, T. 1996. Elements of Economic Entomology. Popular book depot, Chennai.

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RE-ACCREDITED (3<sup>rd</sup> Cycle) WITH “A” GRADE BY NAAC

**PROGRAMME: B.Sc., Zoology**

**COURSE CODE : 17U3ZMC3**

**COURSE TITLE : Biochemistry and  
Biochemical Techniques**

**QN.NO : 9211**

**TIME : 3 Hours**

**MAX.MARKS :75**

### **OBJECTIVES**

- ❖ To understand the importance of biochemical components.
- ❖ To explore and learn the biochemical techniques.

### **LEARNING OUTCOME**

1. Acquire knowledge on biomolecules, bioenergetics, metabolism and biological techniques.
2. Provides applications in various fields like medicine and agriculture.

### **UNIT – I**

Classification, structure and function of carbohydrates, protein and lipids. Vitamins – Water soluble and fat soluble vitamins, occurrence, functions and deficiency diseases.

### **UNIT– II**

Enzymes – Classification, Properties, Chemical nature and mechanism of enzyme action, Factors affecting enzyme action, Enzyme inhibition.

### **UNIT – III**

Metabolic pathways of Carbohydrates – Glycogenesis, Glyconeogenesis, Glycolysis, Krebs's cycle, Oxidative phosphorylation pentose and HMP shunt. Protein metabolism – Deamination, Transamination. Lipid metabolism – Beta oxidation of fatty acids.

### **UNIT – IV**

Separation techniques – Types of Chromatography – Paper, Thin Layer, Electrophoresis (PAGE). Principles and application of Centrifugation, Analytical techniques – pH meter, Spectrophotometer.

### **UNIT – V**

Principles and applications of tracer techniques in biology, radioactive isotopes, Dosimetry

### **TEXT BOOKS**

1. N.Gurumani - Research Methodology for Biological Sciences (2008) MJP Publishers, Chennai.
2. Ambika Shanmugam – Fundamentals of Biochemistry (2004) Ambika Shanmugam Publishers, Chennai.
3. Sathyanarayanan – Essentials of Biochemistry (2002), Arunabha Sen Publishers, Kolkata.

### **REFERENCE BOOKS**

1. Jayaraman, J. – Lab manuals in Biochemistry, New age International (p) Ltd, Mumbai.
2. Plummer – An introduction to practical biochemistry, Tata Mc Graw Hill. Bombay.
3. Instrumental methods of Chemical analysis B.K. God Publishing House, Meerut.
4. Slater – Radiomoliques in Biology. IRL Press Oxford.
5. David – Handbook of Histological and Histochemical techniques – CBSPublishers.
6. Barron Chapman and Hail London – Using the Microscopes
7. W. H. Freeman & Co – Lodish *et al* (1999) Molecular Cell Biology, New York.
8. Berg, J.M., Tymoczko, J.L. and Stryer, L. (2007). *Biochemistry*, VI Edition, W.H. Freeman and Co., New York.
9. Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. and
10. Well, P.A. (2009). Harper's Illustrated Biochemistry, XXVIII Edition, International Edition, The McGraw- Hill Companies Inc.



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RE-ACCREDITED (3<sup>rd</sup> Cycle) WITH “A” GRADE BY NAAC

**PROGRAMME: B.Sc.,**

**COURSE CODE : 17U3ZAC3**

**COURSE TITLE : Essentials of Physiology and Microbiology**

**QN.NO : 9212**

**TIME : 3 Hours**

**MAX.MARKS :75**

### **OBJECTIVES**

- ❖ To learn the importance of physiology and microbiology.
- ❖ To study the growth of microbes and their role in human.

### **LEARNING OUTCOME**

1. Creates awareness in human and animal systems.
- pp . 2. Helps in identifying the nature of living beings.
3. Exploring knowledge in physiology and microbiology motivates the students to be placed in research and clinical laboratories.

### **UNIT-I**

Digestive system – Structure of Alimentary canal, Digestive glands - salivary glands, liver, pancreas (Secretions and functions).

### **UNIT-II**

Excretory system of Man – Structure of Kidney, nephrons, Formation of urine, urinary infections (Glomerulo nephritis, renal stones).

### **UNIT -III**

Reproductive system – Reproductive system - Hormones, menstrual cycle, Oestrogen, Androgen, Prolactin, Relaxin, birth control methods & test-tube baby.

### **UNIT-IV**

Introduction to microbiology: Sterilization - Autoclave – structure and functions. Culture medium (Solid, Liquid and its composition, types of culture medium, bacterial growth, growth rate, growth curve, preservation-pasteurization of milk.

### **UNIT-V**

Microbial Diseases: Cholera, Tuberculosis, Rabies and AIDS – causative organism, pathogenicity, mode of transmission, symptoms and their preventive measures.

### **TEXT BOOKS**

1. Rastogi, S.C. 2007. Essentials of Animal Physiology, New Age International Publishers
2. Baveja, C.P. 2017. Textbook of Microbiology, Arya Publications

### **REFERENCE BOOKS**

1. Richard.W Hill, Gordon A. Wyse & Margaret Anderson. 2012. Animal Physiology
2. Surinder Kumar, 2012, Textbook of Microbiology. Jaypee Brothers Medical Publishers P (Ltd), New Delhi.
3. Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. W.B. Saunders Company.
4. Vander A, Sherman J. and Luciano D. (2014). Vander's Human Physiology: The Mechanism of Body Function. XIII Edition, McGraw Hills □

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**PROGRAMME: B.Sc., Zoology**

**COURSE CODE : 17U3ZSA1**

**COURSE TITLE : Fisheries Science**

**QN.NO : 9213**

**TIME : 3 Hours**

**MAX.MARKS :75**

**OBJECTIVES**

- ❖ To understand the need and scope of fishery science.
- ❖ To study its economic importance, culture practices, management and participation of Government organization
- ❖ To promote students interest in the field for self employment.

**LEARNING OUTCOME**

1. Acquire knowledge on fisheries science with a particular emphasis on types of culture system, feeding, preservation and fish diseases
2. Motivates the students to enter a career in fisheries.

**UNIT-I**

Fisheries- Definition, scope of fisheries, scenario of Indian fisheries, economic importance of fishes, types of fisheries- inland, brackish water and coastal.

**UNIT-II**

Cultivable organisms- qualities, types- fin and shell fishes  
Culture practices- extensive, semi-intensive, intensive, monoculture, monosex culture, poly culture, cage culture, pen culture, race way culture.

**UNIT -III**

Integrated fish farming types - paddy cum fish culture-, fish cum poultry culture  
Fish feed- live feed, artificial feed- simple and compound, composition of ideal fish feed, qualities of good artificial feed

**UNIT-IV**

Feeding- feeding rates, feeding schedule, FCR  
Fish spoilage- preservation of fishes- drying and canning

**UNIT-V**

Fish Diseases-protozoan (white spot ) bacterial (Erythroderma), viral ( Epizootic ulcerative syndrome) , fungal ( gill rot )

**TEXT BOOKS**

1. Arumugam, N. 2010. Aquaculture. Saras Publications, Nagercoil.

**REFERENCE BOOKS**

1. Shukla, J.P. and Pandey 2012. Fish and Fisheries. Rastogi Publications. New Delhi.
2. Rath, R.K. 1993. Freshwater Aquaculture, Scientific Publishers, Jodhpur.
3. Zade,S.B., Khune, C.J., Sitre, S.R and Tijare, R.V. Himalaya Publishing House, New Delhi.

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RE-ACCREDITED (3<sup>rd</sup> Cycle) WITH “A” GRADE BY NAAC

**PROGRAMME: B.Sc., Zoology**  
**COURSE TITLE : Essentials of Invertebrates  
& Chordates**

**COURSE CODE : 17U3ZAC1**  
**QN.NO : 9214**

**TIME : 3 Hours**

**MAX.MARKS :75**

**OBJECTIVES**

- ❖ To learn the essentials of Invertebrates and chordates.
- ❖ To study vital adaptations of animal kingdom.

**LEARNING OUTCOME**

1. Acquire basic knowledge on invertebrates and chordates.
2. Create awareness to conserve and protect the living system.

**UNIT - I**

Parasitic protozoa (Life history of Plasmodium in detail), Organization of Polyp and Medusa, Parasitic adaptations -Tapeworm and *Ascaris*.

**UNIT - II**

Mouth parts in insects, Metamorphosis in insects, Respiration in arthropods, Water vascular system in starfish.

**UNIT - III**

Migration in fishes, Developmental stages of Frog. Parental care in amphibians, Golden age of reptiles

**UNIT - IV**

Identification of poisonous and non-poisonous snakes, Poisonous snakes of South India, Flight Adaptation in birds, Migration in birds.

**UNIT-V**

Adaptive radiation in mammals, Exoskeleton in fishes, birds and mammals, Marsupials.

**Text book:**

Nair, N.C., S. Leelavathy, N. Soundarapandian, T. Murugan, and N. Arumugam. 2006. A text book of Invertebrates, Saras Publication, Nagercoil.

Thangamani, A., S. Prasanakumar, L.M. Narayanan and N. Arumugam. 2005. A text book of Chordates. Saras publication, Nagercoil.

**Reference books:**

Kotpal, R.L. 2012. Modern Text Book of Zoology Invertebrates, Rastogi Publications, Meerut.

Parker & Hashwell, Textbook of Zoology Vol. I (Invertebrates) A.Z.T.B.S. Publishers & Distributors, New Delhi.

Jorden, E.L. and P.S.Verma. 2013. Invertebrate Zoology, S. Chand & Co. Ltd. New Delhi.

Hickman C. P. Jr., Hickman & L.S. Roberts. Integrated principles of zoology, Mosby college publication. St. Louis.

Iyer, E.K., And T.N. Ananthkrishnan, Manual of zoology Vol. I, Invertebrata, Part I and II S.Viswanathan (Printers and Publishers) Pvt. Ltd. Madras.

Thangamani, A., S. Prasanakumar, L.M. Narayanan and N. Arumugam. 2005. A text book of Chordates. Saras publication, Nagercoil.

Kardong, K.V. (2005) Vertebrates Comparative Anatomy, Function and evolution. IV Edition. McGrawHill Higher Education.

Kent, G.C. and Carr R.K. (2000). Comparative Anatomy of the Vertebrates. IX Edition. The McGraw-Hill Companies.

Young, J.Z. (2004). The life of vertebrates. III Edition. Oxford university press.

Hall B.K. and Hallgrimsson B. (2008). Strickberger's Evolution. IV Edition. Jones and Bartlett Publishers, Inc.



**THE MADURA COLLEGE (Autonomous), MADURAI – 625 011**

**(AFFILIATED TO MADURAI KAMARAJ UNIVERSITY)**

**RE-ACCREDITED (3<sup>rd</sup> Cycle) WITH "A" GRADE BY NAAC**

**PROGRAMME: UG NME - Zoology**

**COURSE CODE : 17U3ZNM1**

**COURSE TITLE : Economic Zoology**

**QN.NO : 9215**

**TIME : 3 Hours**

**MAX.MARKS :75**

### **OBJECTIVES**

- ❖ To learn the economic importance of Economic Zoology.
- ❖ To implement this practice for self employment.

### **LEARNING OUTCOME**

1. Gain knowledge in different culture systems.
2. Waves path for self employment in sericulture, pisciculture, apiculture and poultry farming.

### **UNIT-I**

Income and employment & trade generation. APICULTURE: Organization of bee colony-Queen, worker, Droner, rearing of bees-Newtons beehive, problems in Apiculture .Natural enemies.

### **UNIT-II**

SERICULTURE: Life cycle of Mulberry Silkworm, Rearing of Silkworm – appliances.

### **UNIT-III**

PISCICULTURE: Cultivable fishes (fin Fishes & Shell Fishes), Culture of Carps, Economic Importance of Fishes.

### **UNIT-IV**

PEARL CULTURE: Types of Pearls & Culture methods. POULTRY: Breeds of Poultry (Indigenous Breed, American Class, English Class, Asiatic Class, Mediterranean Class), Housing, Management, Nutrition, Disease & Control.

### **UNIT-V**

Economically important cattle (Draft Breeds, Dairy Breeds, Dual Purpose Breeds & Exotic Breeds of Cattle), Principles of Dairy farming. Economically important dairy products (Powdered milk, Processed cheese, Ice cream, Ghee)

### **TEXT BOOKS**

1. Ravindranathan, K.R. 2003. Economic Zoology. Dominant Publishers & Distributors. New Delhi.
2. Tomar, B.S. 2011. Introduction to Economic Zoology, Emkay Publications, Delhi.

### **REFERENCE BOOKS**

1. Johnson, J. & Kesary, M. 2008. Sericulture.
2. Ahsan, J. & Sinha, S. P. 2009. A Handbook on Economic Zoology, S. Chand & Company Ltd, New Delhi.

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**PROGRAMME: B.Sc., Zoology**

**COURSE CODE : 17U4ZMC4**

**COURSE TITLE : Cell & Molecular Biology**

**QN.NO : 9216**

**TIME : 3 Hours**

**MAX.MARKS :75**

**OBJECTIVES**

- ❖ To understand and explore cell structure and functions.
- ❖ To understand the molecular structure & functions of cellular components and its biological importance.

**LEARNING OUTCOME**

1. Adopting knowledge in cell structures and molecular functions will be useful in getting jobs in pharma companies.
2. Waves path for self employment.

**UNIT: I**

Microscopy – Principles of light and electron microscope. Plasma membrane: Ultra structure – Chemical composition and functions.

**UNIT: II**

Endoplasmic reticulum: morphology, structure, types and functions. Golgi complex: morphology, structure, types and functions. Mitochondria: structure, chemical compositions & functions. Nucleous: structure and functions.

**UNIT: III**

Chromosomes: Structure of chromosome, Giant chromosomes, Chromosomal aberrations. Cancer cells, cell aging, Apoptosis.

**UNIT: IV**

Nucleic acids: Structure, types and functions of DNA & RNA, replication.

**UNIT: V**

Protein synthesis: Transcription, Translation (Activation of amino acids, Initiation, Elongation & Termination of polypeptide chains), Lac operon, Central Dogma of Molecular Biology.

**TEXT BOOKS**

1. Verma, S. and Agarwal, V.K. 2000 – Cytology, S. Chand & Co- New Delhi.
2. Gupta P.K .2003. Cell and Molecular Biology, II<sup>nd</sup> Edition, Rastogi Publication, India

**REFERENCE BOOKS**

1. Karp, G.(2010). Cell and Molecular Biology: Concepts and experiments. VI Edition. John Wiley and Sons.Inc.
2. Cooper, G. M and Hausmen, R.E (2009). The Cell: A Molecular Approach. V Edition. ASM Press and Sunderland, Washington.D.C,: Sinauer Associates, MA.
3. Balinsky, B.I., 1981. An Introduction to Embryology, Holt Saunders, New Yo rk.
4. Berrill, N.J., 1986. Developmental Biology, Mc Graw Hill, New Delhi.
5. De Robertis, E. D. P., 2010. Cell and Molecular Biology, Lippincott Williams & Wilkins.

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**PROGRAMME: B.Sc., Zoology**

**COURSE CODE : 17U4ZSM3**

**COURSE TITLE : Ornamental Fish Culture**

**QN.NO : 9218**

**TIME : 3 Hours**

**MAX.MARKS :75**

### **OBJECTIVES**

- ❖ To learn the basic principles and techniques of Ornamental fish culture.
- ❖ To study the features of popular ornamental fishes.
- ❖ To get an exposure on setting up and maintenance of aquarium.

### **LEARNING OUTCOME**

1. Acquire knowledge on principles, designing and maintenance of an aquarium.
2. Motivation for entrepreneurship through ornamental fish culture.

### **UNIT-I**

Ornamental fish culture: Introduction - Indian and world scenario - Advantages of ornamental fish culture - Setting up home aquarium and marine aquarium - Aquarium tank: types (Metal framed glass tank, All glasses tank, Bonded glass tank, Acrylic tank, Laminated glass tank) - Materials required for the construction of tanks - Features of Aquaponics.

### **UNIT-II**

Water quality management - Heating – Lighting – Aeration - Filtering (mechanical, chemical and biological) - Aquarium equipments - Aquarium plants-hydroponics.

### **UNIT -III**

Salient features of Goldfish, Fighter fish, Molly fish, Parrot fish Butterfly fish, clownfish, Marine angelfish,

### **UNIT-IV**

Food & Feeding: Nutritional requirements for fish, live feed, artificial feed, composition of ideal fish feed - Parasites & Diseases: Fish louse, Ligula, Fin rot disease, Carp pox and Velvet disease.

### **UNIT-V**

Ornamental fish Transportation and packing : Methods (open and closed packing), starvation and sedation, factors to be considered for packaging (Density, temperature, dissolved gases, salinity, anaesthetics).

### **TEXT BOOKS**

1. Tharadevi, C.S. and K.V. Jayashree. 2009. Home Aquarium, Saras Publications, Nagercoil.
2. Arumugam, N. 2010. Aquaculture. Saras Publications, Nagercoil.

### **REFERENCE BOOKS**

1. Shukla, J.P. 2012. Fish and Fisheries. Rastogi Publications. New Delhi.
2. Zade, S.B., C.J. Khune, S.R. Sitre and R.V. Tijare. 2011. Principles of Aquaculture. Himalaya Publishing House. Mumbai.
3. Srivastava, C.B.L. 2006. Aquarium-Fish Keeping. Kitab Mahal, Allahabad.

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**PROGRAMME: B.Sc.,**

**COURSE CODE : 17U4ZAC4**

**COURSE TITLE : Molecular Biology and  
Immunology**

**QN.NO : 9219**

**TIME : 3 Hours**

**MAX.MARKS :75**

### **OBJECTIVES**

- ❖ To learn the basic concepts of molecular biology and immunology.
- ❖ To understand the importance of DNA, protein synthesis and gene expression.
- ❖ To study the role of immune system in animal.

### **LEARNING OUTCOME**

1. Gain knowledge on basics and essentials of molecular biology and immunology.
2. Create awareness on the mechanisms of human body.

### **UNIT-I**

Nucleic acids, DNA structure - Watson and Crick model, Significance of DNA, RNA-structure, types of RNA- mRNA, tRNA and r RNA-structure and functions.

### **UNIT-II**

DNA replication- mechanism, Protein synthesis- transcription, translation- initiation, elongation and termination, processing of post-translation processing.

### **UNIT -III**

Operon Hypothesis, structure of Operon model, mechanism of Lac operon .

### **UNIT-IV**

Immunology: Types of Immunity – Natural (Physical, Biochemical, Cellular, Genetic & other factors). Acquired (Humoral and Cell Mediated). Lymphoidal organs – Primary (Thymus and Bursa of Fabricius), Secondary (spleen and Lymphnode). Lymphocytes – T and B Cells.

### **UNIT-V**

Immunoglobulin – Structure and Functions and types. Immune Response. Antigen – antibody reaction (Agglutination & Precipitation).

### **TEXT BOOKS**

1. Gupta, P. K. 2011. Molecular Biology and Genetic Engineering, Rastogi Publications, Meerut, India.
2. Benjamin et al . 2004. Immunology, 4<sup>th</sup> Edition, A John Wiley & Sons INC Publication.

### **REFERENCE BOOKS**

1. Burton E. Tropp, 2012. Principles of Molecular Biology, Jones & Bartlett Learning.
2. Kuby, J. 1997. Immunology. W.H. Freeman & Company, New York.
3. Karp, G.(2010). Cell and Molecular Biology: Concepts and experiments. VI Edition. John Wiley and Sons.Inc.
4. Cooper, G. M and Hausmen, R.E (2009). The Cell: A Molecular Approach. V Edition. ASM Press and Sunderland, Washington.D.C.: Sinauer Associates, MA.

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RE-ACCREDITED (3<sup>rd</sup> Cycle) WITH “A” GRADE BY NAAC

**PROGRAMME: B.Sc., Zoology**

**COURSE CODE : 17U4ZAC2**

**COURSE TITLE : Applied Zoology**

**QN.NO : 9221**

**TIME : 3 Hours**

**MAX.MARKS :75**

## OBJECTIVES

- ❖ To learn the economic importance of animals.
- ❖ To create awareness among the students about the applied aspects of Zoology.
- ❖ To motivate the students for self employment by learning the applications of zoology.

## LEARNING OUTCOME

1. Gain knowledge on applied aspects of zoology.
2. Motivation for entrepreneurship.
3. Inculcate awareness about the importance of animal in day today life.

## UNIT-I

AQUACULTURE: Definition, Scope-Aquaculture in India - Culturable organisms: Fin fishes, Shell fishes, Feed organisms, Algae, Daphnia and Seaweeds - Integrated fish farming: Paddy cum fish culture, Poultry cum fish culture.

## UNIT – II

Culture of Indian major carps: seed collection, culture practices, feeding, pond fertilization, weed, predator control - Culture of marine prawn: seed collection, culture method (Pokkali, pond, pen, cage culture), harvesting, Preservation - Oyster farming: biology, pearl formation, farming operation (spat collection, culture methods (on bottom, off bottom), harvesting, cleaning, preservation) - Sea weed culture – uses, culture methods (pond culture, field culture),

## UNIT – III

APICULTURE: Definition, Scope - Bee colony - Types of honey bees - Bee keeping (primitive hives and modern hives) - Bee keeping equipments - Honey: Chemical composition, Nutritional and Medicinal values – Bee wax - bee venom.

## UNIT -IV

DAIRY FARMING: Definition, Scope - Livestock in India - Dairy animals: Gir, Red sindhi, Jersey , Buffaloes, Goat - Management of model dairy farm - Livestock diseases: Foot and mouth diseases, Rinder pest. - Nutritive value of milk - Milk products- Powdered milk, Processed cheese, Ice cream, Ghee

## UNIT -V

POULTRY: Definition, scope - Nutritive value of eggs - Commercial layers – Sexing (vent, colour and Feather sexing) - Poultry house: Types, construction of poultry house - Deep litter system – Feeder - Cage system - Layer rearing (Chick, Growers, Layers) - Poultry diseases: Ranikhet, Fowlfox and polyneuritis.

## TEXT BOOKS

1. Ahsan, J. and Sinha, S.P. 2009. A Handbook on Economic Zoology. S. Chand & Company Ltd., New Delhi.
2. Tomar, B.S. and Singh, N. 2011. Economic Zoology. Emkay Publications. New Delhi.

## REFERENCE BOOKS

1. Shukla, G.S. and V.B. Upahyay. 2011. Economic Zoology. Rastogi Publications. Meerut.

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**PROGRAMME: UG NME - Zoology**

**COURSE CODE : 17U4ZNM2**

**COURSE TITLE : Essentials of Zoology**

**QN.NO : 9223**

**TIME : 3 Hours**

**MAX.MARKS :75**

### **OBJECTIVES**

- ❖ To learn the essentials of Zoology.
- ❖ To study basic concepts on classification of animal kingdom.
- ❖ To understand the importance of DNA, blood and common diseases.

### **LEARNING OUTCOME**

1. Basic knowledge of the subject- Zoology.
2. Acquire the importance of DNA and Human blood.
3. Create awareness on communicable and non communicable diseases.

### **UNIT-I**

Principles of classification, Rules of nomenclature, Binomial Nomenclature, General characters of invertebrates and vertebrates with an example.

### **UNIT –II**

Nucleic acids –DNA & RNA- structure, functions and significance, DNA Finger Printing

### **UNIT-III**

Components of Blood, Blood groups- ABO Blood grouping, Rh factor, Blood pressure, Blood clotting.

### **UNIT- IV**

Communicable Diseases: Vector borne (Malaria, Dengue), Airborne (Tuberculosis, Influenza), Waterborne (Cholera, Typhoid).

### **UNIT- V**

Non-communicable Diseases- Obesity, Cancer, Diabetes and Hypertension – causative agent, mode of transmission, symptoms, prevention and control.

### **TEXT BOOKS**

1. Rajapandiyan, K. & Shanthi, S. 2011. Molecular Biology & Microbial Genetics. PBS Book Enterprises, Chennai.
2. Lal, S. S. & Kumar, S. 2012. Immunology, Rastogi Publications, Meerut, India

### **REFERENCE BOOKS**

1. Kotpal, R. L. Modern text book of Zoology, Invertebrates, Rastogi Publications, Meerut.
2. Kotpal, R. L. Modern text book of Zoology, Vertebrates, Rastogi Publications, Meerut.
3. Vaman Rao, C. Immunology, Narosa Publishing House, New Delhi.
4. Arora, P. and Sandhu, S. Genetics, Himalaya Publishing House, Delhi.

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RE-ACCREDITED (3<sup>rd</sup> Cycle) WITH “A” GRADE BY NAAC

**PROGRAMME: B.Sc., Zoology**

**COURSE CODE : 17U5ZMC5**

**COURSE TITLE : Genetics**

**QN.NO : 9224**

**TIME : 3 Hours**

**MAX.MARKS :75**

### **Objectives**

- ❖ To acquire knowledge about the basic principles of heredity
- ❖ To assess the practical application of genetics
- ❖ To review the various genetic disorders in man and animals

### **Learning Outcome**

1. Understanding the basic concepts of Heredity
2. Acquiring knowledge on genetic disorders and Human genetics

### **Unit- I**

Genetics-definition, theories of inheritance - preformation, epigenetic, particulate and germplasm, Mendelism-monohybrid and dihybrid experiments, Mendel's laws, Pedigree analysis, Gene interaction: non-allelic – epistasis, complete, incomplete and co-dominance, Pleiotropism and lethal genes, Multiple alleles: Blood grouping in man, Coat color in rabbits, Polygenic inheritance: Skin pigmentation in man.

### **Unit- II**

Linkage in *Drosophila*, types of linkage-complete and incomplete, theories and factors affecting linkage, Crossing over- mechanism, theories, types and significance, Chromosome map-definition, Construction and factors affecting mapping.

### **Unit- III**

Chromosomal theory, sex determination in man, Gynandromorphism, Sex-linked inheritance: color blindness and haemophilia in man, maternal inheritance- coiling of shell in snail and kappa particles in *Paramecium*.

### **Unit- IV**

Mutation: Molecular basis of gene mutation, types of gene mutation, Mutagens: types and their mode of action. Genetic recombination: Bacteria – Transformation, Conjugation and Transduction, Bacteriophages - Lytic and Lysogenic cycle.

### **Unit- V**

Human Genetics: Simple Mendelian traits, twins, chromosomal aberrations, inborn errors of metabolism, Syndromes - Klinefelter's, Turner's and Down's. Population Genetics: Hardy-Weinberg Law, factors affecting gene frequencies, Eugenics, Euthenics and Euphenics.

### **Text Books**

1. Verma, P.S. and V. K. Agarwal. 2009, Genetics, S. Chand & Company Ltd, New Delhi.
2. Bhamrah, H.S. and C.M. Chaturvedi. 2001, A textbook of Genetics, Anmol Publications, New Delhi.
3. Basu, S.B. and M. Hossain. 2006, Principles of Genetics, Books and Allied, Kolkata.

### **Reference Books**

1. Gardner, E. 1975, Principles of Genetics, 5th Ed, Canada, John Wiley and Sons Inc.
2. Strickberger, W. 1991, Genetics, 5th Ed, Boston, Macmillan Pub. Co. Inc.
3. Sinnot, E.W., L.C. Dunn and T. Dobzhansky. 1973, Principles of Genetics, 4th Ed, Tata Mc Graw Hill Pub. Co. Ltd, New Delhi.



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**PROGRAMME: B.Sc., Zoology**

**COURSE CODE : 17U5ZMC6**

**COURSE TITLE : Biodiversity and  
Conservation Biology**

**QN.NO : 9225**

**TIME : 3 Hours**

**MAX.MARKS :75**

### **Objectives**

- ❖ To learn the basic principles and study techniques of Biodiversity.
- ❖ To study methods of biodiversity conservation and learn about organizations associated with Biodiversity and conservation.
- ❖ To get an exposure on health evaluation of wild animals.

### **Learning Outcome**

1. Acquire basic knowledge on principles and methods of biodiversity conservation.
2. Motivation for taking up research in biodiversity studies.

### **Unit- I**

**Biodiversity:** Definitions, Levels of biodiversity, Values and significance of biodiversity, Biogeographical zones of India, Global biodiversity, biological diversity at National level, Hotspots of biodiversity, Ecosystem diversity in India, Threats to biodiversity, Endemic and endangered species in India.

### **Unit- II**

**Techniques for Biodiversity studies:** Sampling techniques for Invertebrates (light traps, pitfall traps, sweep netting, bait traps (aerial attractant traps), Birds (point counts, line transects), Mammals (trapping, dung counting, signs of feeding and foot prints). Radio telemetry, Remote sensing. Diversity indices – Shannon index, Simpson’s index, Morisita Horn Index and Jaccard index (including calculations)

### **Unit- III**

**Health condition evaluation of wild animals:** Chemical immobilization of wild animals, Physical examination of animal in hand, examination of dead animals. Diseases of wild animals in India (Rinderpest, Foot and mouth disease, diseases among non-primates). Case studies for human dimensions in wildlife management and development in Periyar Tiger Reserve, Gujar and the Chilla Wildlife Sanctuary (Problem, analysis, solutions and results).

### **Unit- IV**

**Conservation of Biodiversity:** *In situ* conservation – National parks, wildlife sanctuaries and biosphere reserves. *Ex situ* conservation – Gene banks, cryopreservation and captive breeding. Legal aspects: The Indian Forest Act, 1927; Wildlife (protection) Act, 1972; Biological Diversity Act, 2002, CITES, Red Data Book.

### **Unit- V**

**Organizations associated with Biodiversity and conservation:** IUCN, UNEP, WCMC, WWF. Ministry of Environment and Forest and Climate change, National Biodiversity Authority, ZSI, CES-IISc, SACON, IFGTB, ICAR, WII, and ICFRE.

**Text Books**

1. Krishnamurthy, K.V. 2003, An advanced Textbook on Biodiversity Principles and Practice, Oxford & IBH publishing Co. Pvt. Ltd, New Delhi.
2. Kumar, V. and M.J. Asija. 2005, Biodiversity Principles and Conservation, Student Edition, Jodhpur.
3. Berwick, S.H. and V.B. Saharaia. 1995, Wildlife Research and Management, Oxford University Press, New Delhi.
4. Sutherland, W.J. 1997, Ecology Census Techniques A Hand book, Cambridge University Press, New Delhi.

**References Books**

1. Rodgers, W.A. 1991, Techniques for Wildlife census in India A Field Manual, Wildlife Institute of India, Dehradun.
2. Odum, E.P. 1971, Ecology, Amerind Publishing Co. Pvt. Ltd, New Delhi.
3. Benton, A.H. and W.E. Werner. 1980, Field Biology and Ecology, Tata Mc Graw Hill Publishing Company Ltd, New Delhi.
4. Seshadri, B. 1969, The twilight of India's Wildlife, John Baker Publishers. London.

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**PROGRAMME: B.Sc., Zoology**

**COURSE CODE : 17U5ZMC7**

**COURSE TITLE : Animal Physiology and  
Animal Behaviour**

**QN.NO : 9226**

**TIME : 3 Hours**

**MAX.MARKS :75**

### **Objectives**

- ❖ To learn the importance of animal physiology
- ❖ To study the animal behaviour.

### **Learning Outcome**

1. Create awareness in animal physiology and animal behaviour
2. Motivates the students to be placed in clinical laboratories.

### **Unit-I**

Nutrition: Digestion and absorption of carbohydrates, proteins and lipids. Role of gastro intestinal hormones in digestion; calorie requirements, energy requirements of man, Malnutritional diseases (Kwashiorkor, marasmus, ketosis and night blindness). Respiration: Respiratory pigments – Types, properties and function. Exchange and transport of gases (O<sub>2</sub> and CO<sub>2</sub>), Respiratory quotient.

### **Unit-II**

Circulation: Composition and functions of blood, cardiac cycle, cardiac rhythm. Cholesterol level, urea level and sugar level in blood. Pace maker. Origin of heart beat and its regulation, Electrocardiogram (ECG). Excretion: Classification of animals based on excretory products, Ornithine cycle. Mechanism of urine formation and hormonal control. Endocrine glands: structure and functions of pituitary, thyroid and gonads.

### **Unit –III**

Osmoregulation: Osmoregulation in fishes (freshwater, marine and migratory fishes). Thermoregulation: Acclimatization; Thermoregulatory mechanisms (hibernation, basking and aestivation).

### **Unit-IV**

Nerve Physiology: Types of neuron, conduction of nerve impulse along a nerve fibre. Muscle physiology: Types of muscles, Ultra structure and properties of muscles. Theories of muscle contraction. Isotonic and Isometric contraction

### **Unit-V**

Biological rhythms: Introduction and Types of biological rhythms (Circadian, Lunar and Circannual). Biological clock: Definition with examples.

### **Text books**

1. Rastogi, S.C. 2007. Essentials of Animal Physiology, New Age International Publishers.
2. Verma P.S., Tyagi B.S and Agarwal V.K. 1995. Animal Physiology. S. Chand & Co Ltd, New Delhi.
3. Gunadevia, H.S. & Hare Govinda Singh. 2009. Text book of Animal Behavior, S Chand & Co Ltd, New Delhi.

### **Reference books**

1. Hill, R.W., Wyse, G.A. & Anderson, M. 2012. Animal Physiology. Sinauer Associates.
2. Goyal & Sastri. 2017. Animal Physiology. Rastogi Publication, Meerut.

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**PROGRAMME: B.Sc., Zoology**

**COURSE CODE : 17U5ZME1**

**COURSE TITLE : Developmental Biology and  
Evolution**

**QN.NO : 9227**

**TIME : 3 Hours**

**MAX.MARKS :75**

### **Objectives**

- ❖ To learn the Concepts and study techniques of Developmental biology.
- ❖ To study History of evolutionary concepts and evidences for evolution.
- ❖ To get an exposure on human evolution.

### **Learning Outcome**

1. Acquire knowledge on embryonic development, regeneration and aging.
2. Exploring evolutionary concepts

### **Unit – I (Introduction)**

Phases of development, Cell – cell interaction, pattern formation, differentiation and growth, differential gene expression, cytoplasmic determinants and asymmetric cell division.

### **Unit – II (Embryonic development)**

Gametogenesis, Spermatogenesis, oogenesis; Types of eggs, fertilization (external and internal), Parthenogenesis, Planes and patterns of cleavage; types of blastula; Fate maps; Embryonic induction and organizers (Spemann’s experiment). Metamorphosis: Changes, hormonal regulation in amphibians and insects; Regeneration, Homeotic genes, Aging and teratogenesis.

### **Unit – III**

Historical review of evolutionary concept: Lamarckism, Darwinism, Neo Darwinism; Evidences of evolution: Fossil records – transitional forms, geological time scale, Molecular basis of evolution – Universality of genetic code and protein synthetic machinery, neutral theory of molecular evolution, molecular clock.

### **Unit – IV**

Natural selection, sources of variation: heritable variations and their role in evolution; product of evolution – species concept, isolating mechanisms; modes of speciation – allopatric, sympatric, adaptive radiation. Darwin finches

### **Unit – V**

Origin and evolution of man, important hominid fossils, primate phylogeny from *Dryopithecus* leading to *Homo sapiens*, Cultural evolution of Man, Molecular analysis of human origin.

## References Books

1. Gilbert, S. F. (2006). *Developmental Biology*, VIII Edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA.
2. Balinsky, B.I. (2008). *An introduction to Embryology*, International Thomson Computer Press.
3. Carlson, Bruce M (1996). *Patten's Foundations of Embryology*, McGraw Hill, Inc.
4. Ridley, M. (2004). *Evolution*. III Edition. Blackwell Publishing
5. Barton, N. H., Briggs, D. E. G., Eisen, J. A., Goldstein, D. B. and Patel, N. H. (2007). *Evolution*. Cold Spring, Harbour Laboratory Press.
6. Hall, B. K. and Hallgrimson, B. (2008). *Evolution*. IV Edition. Jones and Bartlett Publishers
7. Campbell, N. A. and Reece J. B. (2011). *Biology*. IX Edition, Pearson, Benjamin, Cummings.
8. Douglas, J. Futuyma (1997). *Evolutionary Biology*. Sinauer Associates.

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**PROGRAMME: B.Sc., Zoology**

**COURSE CODE : 17U5ZAC3**

**COURSE TITLE : Fundamentals of  
Physiology and Microbiology**

**QN.NO : 9228**

**TIME : 3 Hours**

**MAX.MARKS :75**

### **Objectives**

- ❖ To learn the importance of physiology and microbiology.
- ❖ To study the growth of microbes and their role in human.

### **Learning Outcome**

1. Create awareness in human physiology
2. Helps in identifying the nature of living beings
3. Motivates the students to be placed in research and chemical laboratories

### **Unit- I**

Digestive system of Man: Structure of alimentary canal, digestive glands (secretion and its functions only). Respiratory system of Man: Structure of lungs, O<sub>2</sub> and CO<sub>2</sub> transport.

### **Unit-II**

Nervous system of Man: Structure of neuron, conduction of nerve impulse through myelinated and non- myelinated nerve. Excretory system of Man: Structure of kidney, nephrons and formation of urine.

### **Unit- III**

Reproductive system of man: Structure of male and female reproductive system. Menstrual cycle, Oestrogen, Androgen, Prolactin, Relaxin and Birth control methods.

### **Unit-IV**

Microbiology: Five kingdom concept. Sterilization and disinfection, Autoclave, Laminar air flow and Hot air oven. Culture medium (Solid & Liquid) and its composition, types of culture medium. Bacterial growth, growth rate, growth curve. Preservation and pasteurization of milk.

### **Unit- V**

Microbial Diseases: Cholera, Tuberculosis, Botulism, Rabies and AIDS – causative organism, pathogenicity, mode of transmission, symptoms and their preventive measures.

### **Text books**

1. Rastogi, S.C. 2007. Essentials of Animal Physiology, New Age International Publishers.
2. Baveja, C.P. 2017. Textbook of Microbiology, Arya Publications.

### **Reference books**

1. Hill, R.W., Wyse, G.A. & Anderson, M. 2012. Animal Physiology. Sinauer Associates.
2. Surinder Kumar, 2012, Textbook of Microbiology. Jaypee Brothers Medical Publishers P. Ltd, New Delhi.

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**THE MADURA COLLEGE (Autonomous), MADURAI – 625 011**

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RE-ACCREDITED (3<sup>rd</sup> Cycle) WITH “A” GRADE BY NAAC

**PROGRAMME: B.Sc., Zoology**

**COURSE CODE : 17U5ZSA2**

**COURSE TITLE : Sericulture and Moriculture**

**QN.NO : 9229**

**TIME : 3 Hours**

**MAX.MARKS :75**

### **Objectives**

- ❖ To learn the skill based knowledge.
- ❖ To implement this practice for self employment.

### **Learning Outcome**

1. Gain knowledge on applied Zoology
2. Motivation for entrepreneurship

### **Unit – I**

Sericulture: Importance, Sericulture industry in India and Services of Central Silk Board.

### **Unit – II**

Moriculture: Varieties of mulberry, optimum conditions for mulberry cultivation. Different methods of propagation – seedling, vegetative propagation (cutting, grafting and layering). Harvesting methods and preservation of leaves.

### **Unit – III**

Lifecycle of mulberry silkworm, *Bombyx mori*. Brief account on Eri, Tasar and Muga silkworms.

### **Unit – IV**

Rearing of Silkworm: Rearing house and rearing appliances. Silk reeling. Testing of raw silk -Visual and mechanical tests.

### **Unit – V**

Silkworm disease: Causes and prevention of Pebrine, Flacheric, Septicemia, Muscardine and Grasserie.

### **Text Books**

1. Johnson, M. and Kesary, M. 2008. Sericulture. Fourth Edition. N.M.C. College, Marthandam.
2. Ganga, G. and Sulochanachetty, J. 2000. An Introduction to Sericulture. Oxford & IBH Publishing Company Pvt. Ltd. New Delhi.

### **Reference Books**

1. Ravindranathan, K. R. 2003. Economic Zoology. Dominant publishers and Distributors. New Delhi.
2. Venkatanarasaiah, P. 2013. Sericulture. APH Publishing Corporation, New Delhi.

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**PROGRAMME: B.Sc., Zoology**

**COURSE CODE : 17U6ZMC8**

**COURSE TITLE : Microbiology and  
Immunology**

**QN.NO : 9230**

**TIME : 3 Hours**

**MAX.MARKS :75**

### **Objectives**

- ❖ To learn the importance of microbiology and immunology.
- ❖ To study the role of immune system in animal.
- ❖ To study the growth of microbes and their role in human.

### **LEARNING OUTCOME**

1. Create awareness in microbiology and immunology
2. Helps in identifying the nature of living beings
3. Motivates the students to be placed in research and chemical laboratories

### **Unit-I**

History and Scope of Microbiology, Whittaker's Five Kingdom Concept, Structure of typical bacterium, Virus (T<sub>4</sub>phage) and Yeast. Sterilization and disinfection – Autoclave and Laminar air flow, Bacteria - culture, Nutritional requirements, Types, Culture media, growth curve, enumeration and storage.

### **Unit-II**

Dairy Microbiology: Pasteurization, Milk products: Curd and Cheese. Food Microbiology: Food spoilage of meat and fishes. Physico-chemical methods in food preservation, Soil Microbiology: Biological nitrogen fixation - types and mechanism. Water Microbiology: Coli form bacteria, MPN and Estimation of Total Plate Count.

### **Unit –III**

Medical Microbiology: Causative organisms, mode of transmission. pathogenicity, symptoms and their preventive measures of Bacterial diseases (Cholera, Tuberculosis and Typhoid) and Viral diseases (Hepatitis, Polio, Swine flu, Rabies and AIDS).

### **Unit-IV**

Immune System: Types of Immunity – Innate, Acquired Immunity - passive and active; Lymphoid organs - Primary and Secondary Organs (Spleen and Lymphnode); Lymphocytes – T & B Cells; antigens and antibodies – definition, Types of Immunoglobulin, structure, and functions.

### **Unit-V**

Immune Response: Humoral and Cell Mediated Immunity; Complement - Mode of Activation, Classical and Alternate Pathway; Antigen – Antibody reactions. Principles of vaccination and immunization schedule – routes of administration, Immunological techniques: ABO blood testing, Immunoelectrophoresis.

### **Text books**

1. Ananthanarayanan, R & Jayaram Panicker, CK. 1990. Text Book of Microbiology. Orient Longman.
2. Chakravarthy, A. K. 1996. Immunology. Tata Mc Graw, New Delhi.

### **Reference Books**

1. Sharma, P. D. 1998. Microbiology, Rastogi Publications.
2. Pelczer, M. J (2000) Microbiology. McGraw Hill Book Company, Chennai.
3. Meena Kumari, S 2005, Microbial Physiology. M.J.P Publishers, Chennai.
4. Vijaya Ramesh, K. 2005. Environmental Microbiology. MJP Publishers, Chennai.

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RE-ACCREDITED (3<sup>rd</sup> Cycle) WITH “A” GRADE BY NAAC

**PROGRAMME: B.Sc., Zoology**

**COURSE CODE : 17U6ZME2**

**COURSE TITLE : Biophysics, Biostatistics and**

**QN.NO : 9231**

**Bioinformatics**

**TIME : 3 Hours**

**MAX.MARKS :75**

### **Objectives**

- ❖ To learn the basic principles and applications of Biophysics.
- ❖ To study methods of collection, analysis and interpretation of biological data.
- ❖ To motivate the students to learn the basic concepts and applications of bioinformatics.

### **Learning Outcome**

1. Acquire knowledge on principles and applications of biophysics and bioinformatics.
2. Study about handling of biological data for statistical analysis.

### **Unit- I**

Scope of Biophysics: Colloids - Description, properties and types. Diffusion, osmosis, dialysis. Law of thermodynamics - entropy, enthalpy. Protein Structure – Primary, secondary, Tertiary and quaternary

### **Unit- II**

Biostatistics: definition, Types of data (Primary and secondary data), Methods of collection of Primary and secondary data, Classification of data, Tabulation, Organization of data: Individual, discrete and frequency Series. Diagrammatic and graphical presentation of Data: Histogram, frequency curve, bar diagram, pie diagram and pictogram.

**Unit- III** Measurement of Central tendency (mean, median, mode for individual, discrete and frequency series), Measures of dispersion (Range, standard deviation), Chi-square test, students t test, Correlation, Mann-whitney-U test, Kruskal-wallis test.

### **Unit- IV**

History and Generation of Computer, Basic components of Computer, Input and Output devices, Central Processing Unit, Memory and its types. Brief account on packages - MS Word, MS Excel and MS PowerPoint. Basic ideas about internet: Website, Email and other uses of Internet.

### **Unit- V**

Bioinformatics: Definitions, History and Applications of Bioinformatics, Biological Databases: features, classification of Biological databases, PUBMED, ENTREZ, EMBL, ENSEMBL, GENBANK, Swiss-Prot, PDB, RasMol, DDBJ, BOLD (Barcode of Life Data systems). Sequence alignment: BLAST, FASTA,

### **Text Books**

1. Subramanian, M.A.2005, Biophysics, Principles and Techniques, M.J.P. Publishers, Chennai.
2. Ramakrishnan, P. 1996, Biostatistics, Saras Publications, Nagercoil.
3. Ardert T. 2002, Information Technology, Pitman Publishers.
4. Banerjee, P. 2014, Introduction to Bioinformatics, S.Chand and Company Pvt Limited, New Delhi.
5. Lesk, A.M. 2007, Introduction to Bioinformatics, Oxford University Press, New Delhi.
6. Hepsyba, S.G.H. and C.R. Hemalatha. 2009, Basic Bioinformatics. MJP Publishers. Chennai.

### **Reference Books**

1. Daniel, M. 1992, Biophysics Biologist, Wiley International, New Delhi.
2. Das, D, and Das, A. 2004, Statistics in Biology and Psychology Acad. Publishers, Kolkata.
3. Das, D. 1996, Biophysical and Biological Chemistry, Academic Publishers, Kolkata.
4. Gurumani, N. 2004, Introduction to Biostatistics, M.J.P. Publishers, Ned Delhi.
5. Sokal, R.J. and Rohlf, S.J. 1981, Introduction to Biostatistics, W.H.Freeman, London.
6. Leon F. and Lean M. 2004, Fundamentals of Computer Science and Communications Engineering, Lean Tech World.
7. Mittal C. 2003, Fundamentals of Information Technology, Pragathi Prakasam, Meerut.
8. Piramal, V. 2006. Biophysics. Dominant publishers and distributors. New Delhi.
9. Zar, J.H. 2011. Biostatistical Analysis. Pearson Education Inc. New Delhi.
10. Murthy, C.S.V. 2004, Bioinformatics, Himalaya Publishing House, New Delhi.

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RE-ACCREDITED (3<sup>rd</sup> Cycle) WITH “A” GRADE BY NAAC

**PROGRAMME: B.Sc., Zoology**

**COURSE CODE : 17U6ZME3**

**COURSE TITLE : Biotechnology**

**QN.NO : 9232**

**TIME : 3 Hours**

**MAX.MARKS :75**

### **Objectives**

- ❖ To study the scope and applications of biotechnology
- ❖ To provide a deep and thorough knowledge in the rapidly expanding field of biotechnology.
- ❖ To motivate the students to learn the basic concepts and applications of bioinformatics.

### **Learning Outcome**

1. Expected to have strong appreciation for scientific research in theoretical and experimental areas
2. Motivation for taking up biotechnological entrepreneurship.

### **Unit – I**

History, scope and importance of biotechnology, Biotechnology in India, Enzymes (restriction endonucleases, ligases, linkers and adapters), Vectors (Plasmids, Phage vectors, Cosmids and artificial chromosomes) Basic steps and techniques in rDNA technology.

### **Unit - II**

Gene libraries, construction of genomic library and cDNA library. PCR technique and DNA amplification. Methods of transfer of desired gene with target cell. Blotting techniques – southern, northern and western blotting.

### **Unit - III**

DNA finger printing (DNA Profiling), and its application. Molecular markers – RFLP. Stem cells – types and potential use, gene therapy, organismal cloning.

### **Unit – IV**

Applications of Plant Biotechnology - Single Cell Proteins (SCP) Biofertilizers – Biopesticides – Bt cotton - Applications of Animal Biotechnology in Medicine, Animal Breeding and Environmental Management - Transgenic animals (Cow & Mice) – Hybridoma technique and production of monoclonal antibodies - Gene therapy.

### **Unit – V**

Principle, techniques and applications of animal cell culture -Environmental Biotechnology - Biofuels – Bioremediation - Genetically Modified Microorganisms (definition); Biosafety, Intellectual Property Rights (IPR) and protection (IPP) – Human Genome project.

P.T.O.

**Text Books**

1. Dubey, R.C. 2004, A text book of Biotechnology, S. Chand and Co., New Delhi.
2. Purohit, S.S. and S.K. Mathur, 1999, Biotechnology – Fundamentals and applications, Agro - Botanica, New Delhi.

**References Books**

1. Brown, T.A. 1995, Gene Cloning, Stanley Thomas Publishers.
2. Masters, J.R.W. 2000, Animal Cell Culture - A Practical Approach, Oxford University Press.
3. Trevan, M.D., S. Boffey, K.H. Goulding and P. Stanbury. 1990, Gene Biotechnology , Himalaya Publishing House, New Delhi.
4. Glick, B.R. and J.J. Pasternak (1994). Molecular Biotechnology, ASM Press.
5. Mitra, S. 1996, Genetic Engineering Principles and Practice, Macmillan India Ltd.
6. Trehen, K. 2002, Biotechnology, New Age International (P) Ltd, New Delhi.

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**PROGRAMME: B.Sc., Zoology**

**COURSE CODE : 17U6ZSM4**

**COURSE TITLE : Forensic Science**

**QN.NO : 9235**

**TIME : 3 Hours**

**MAX.MARKS :75**

### **Objectives**

- ❖ To learn the basics and applications of Forensic science
- ❖ To study about the investigation techniques.

### **Learning Outcome**

1. Acquire knowledge on investigation techniques of forensic science.
2. Explore the information about the role of microbes and insects in crime investigation.

### **Unit - I**

Definition, principles and laws of Forensic Science. Need and background of forensic science in India. Forensic science laboratories: types and divisions.

### **Unit – II**

Crime: Definition, types, causes and prevention. Introduction of Cyber crime and criminal behavior. Crime Scene-introduction, significance and role.

### **Unit – III**

Investigation techniques: Documents-importance, nature and preliminary examination. Ballistics- definition, types. Fingerprints examination-principle, types and characteristics.

### **Unit – IV**

DNA profiling-principle and application. Brain Fingerprinting-Introduction and application. Narco Analysis- principle.

### **Unit – V**

Bacteria and other animals: types and tools for investigation of forensic science. Insects in forensic science-Introduction, types and application.

### **Text Books**

1. Singh, N. 2015, Forensic Science: Principles & Concepts, Ancient Publishing House.
2. Siegel, J. 2016, Forensic Science: A Beginner's Guide, Oneworld Publications.

### **References Books**

1. Nabar, B. S. 2015, Forensic Science in Crime Investigation, Asia Law House, Hyderabad.
2. Narayan Reddy, K.S. 2015, The Essentials of Forensic Medicine And Toxicology, Jaypee Brothers Medical Publishers.



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**PROGRAMME: B.Sc.,**  
**COURSE TITLE : Molecular Biology,**  
**Biotechnology and Immunology**  
**TIME : 3 Hours**

**COURSE CODE : 17U6ZAC4**  
**QN.NO : 9236**  
**MAX.MARKS :75**

### **Objectives**

- ❖ To learn the basic concepts of molecular biology, biotechnology and immunology.
- ❖ To create the awareness regarding benefits of biotechnology.
- ❖ To study the role of immune system in animal.

### **Learning Outcome**

1. Create awareness in molecular biology, biotechnology and immunology.
2. Motivates the students to be placed in research laboratories.

### **Unit-I**

Molecular Biology: Nucleic acids: Molecular structure of DNA and RNA, Types of RNA, DNA replication, protein synthesis. Fine structure of Gene: Cistron, recon, muton, Lac-operon, genetic code, mutation–molecular basis of mutation, gene mutation, chromosomal aberrations, mutagens.

### **Unit-II**

Biotechnology: Transgenic animals (Dolly and Transgenic fish), Hybridoma technology (MAB production). Gene cloning – vectors (PBR322 and phage).

### **Unit –III**

Biofertilizers (Rhizobium and Azospirillum), Biopesticides (Bt toxin). Biosensors – structure and application. Application genetically engineered bacteria – Super Bug, role of *Thiooxillus thiooxidans* in ore leaching.

### **Unit-IV**

Immunology: Types of immunity – natural and acquired, active and passive, antigen-antibody reaction (Precipitation and Agglutination).

### **Unit-V**

Lymphoid organs – primary and secondary lymphocytes. Stem, T and B cells, Macrophages. Immunoglobulin – Structure and functions.

### **Text books**

1. Gupta, P. K. 2011. Molecular Biology and Genetic Engineering, Rastogi Publications, Meerut, India.
2. Satyanarayanan. U. 2007. Biotechnology, Arunabha Sen Books and Allied (P) Ltd, Kolkota.
3. Benjamin et al . 2004. Immunology, 4<sup>th</sup> Edition, A John Wiley & Sons Inc., Publication.

### **References Books**

1. Burton E. T. 2012. Principles of Molecular Biology, Jones & Bartlett Learning.
2. Kuby, J. 1997. Immunology. W.H. Freeman & Company, New York.
3. Dubey. R.C. 2005. A textbook of Biotechnology, S. Chand & Company Ltd.

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**PROGRAMME: B.Sc.,**  
**COURSE TITLE : Invertebrata – I**  
**TIME : 3 Hours**

**COURSE CODE : 20U1ZMC1**  
**QN.NO : 11101**  
**MAX.MARKS :75**

DEPARTMENT OF ZOOLOGY				CLASS: I B.Sc. Zoology				
Semester	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
I	Core	20U1ZMC1	Invertebrata – I	3	3	25	75	100

**Course Objectives:**

1. To understand the concept and systematic classification of animal kingdom.
2. To identify the animals from Protista to Platyhelminthes and to recognize their distinguishing features.
3. To appraise the diversity of animals in a phylogenetic context.
4. To understand how different body designs solve biological problems related to physiological and environmental challenges.
5. To develop an appreciation for the role of invertebrates in biological communities, ecological interactions, and conservation problems.

**Unit-I: Classification**

Concept of five kingdom classification of life. Introduction to Animal kingdom – Systems of classification & nomenclature - Levels of organization - Types of symmetry.

**Unit-II: Protista**

Introduction to Protista, General characters & Classification (up to class) of Protista with examples.

**Type study:** *Paramecium*

**General topics:** Protozoan parasites, Life Cycle of *Plasmodium*, Locomotion & Nutrition in Protozoa.

**Unit-III: Porifera**

Characters & classification (up to class) of Porifera with examples.

**Type study:** *Leucosolenia*

**General topics:** Canal system in sponges.

**Unit-IV: Coelenterata**

Characters & classification (up to class) of Coelenterata with examples – Salient features of *Ctenophora*.

**Type study:** Obelia Colony

**General topics:** Polymorphism in Coelenterata, Diversity (Types) of corals, Structure of coral polyp & coral reefs.

**Unit-V: Platyhelminthes**

Characters & classification (up to class) of Platyhelminthes with examples.

**Type study:** Liver fluke

**General topics:** Parasitic adaptation in helminthic worms.

### **Books for Study**

1. Nair N.C, Leelavathy S, Soundara Pandian N, Murugan T and Arumugam N, 2017. *A Text Book of Invertebrates*, Saras Publication, Nagercoil.
2. Nair N.C, Thangamani A, Leelavathy S, Prasanakumar S, Soundrapandian N, Murugan T, Narayanan L.M and Arumugam N, 2017. *Animal diversity (Invertebrata & Chordata)*, Saras Publication, Nagercoil.
3. Jordan E.L and Verma P.S, 2009. *Invertebrate Zoology*, S. Chand & Co, New Delhi.
4. Kotpal R.L, 2017. *Modern text book of Zoology: Invertebrate*, Rastogi Publication, Meerut.

### **Books for References**

1. Barnes R.D, 2006. *Invertebrate Zoology* (1982) VII<sup>th</sup> Edition, Holt Saunders International Edition.
2. Ekambaranatha Ayyar and Ananthakrishnan T.N. (Recent Edition). *Manual of Zoology Vol-I, Part I & II*, S. Viswanathan Pvt. Ltd. Chennai.
3. Kotpal R.L, Agarwal S.K and Khetarpal, R.P, 1990. *Invertebrates*, Rastogi Publications, Meerut.
4. Anderson D.T, 2001. *Invertebrate Zoology*, Oxford University Press, New Delhi.
5. Barrington E.J.W, 1967. *Invertebrate Structure and Functions*, English Language Book Society.
6. Hyman L.H, 1940-1967. *The Invertebrates (6 vols)*, McGraw-Hill Companies Inc. NY.

### **Web Resources**

1. <https://www.nwf.org/Educational-Resources/Wildlife-Guide/Invertebrates>
2. <https://biologydictionary.net/invertebrate/>
3. <https://basicbiology.net/animal/invertebrates>
4. <https://www.khanacademy.org/science/biology/crash-course-bio-ecology/crash-course-biology-science/v/crash-course-biology-121>
5. <https://www.khanacademy.org/science/biology/crash-course-bio-ecology/crash-course-biology-science/v/crash-course-biology-122>

### **Pedagogy**

Chalk and Talk, PPT, group discussion, seminar, interaction, quiz, tutorial and virtual labs.

Contd.,

**Course Learning Outcomes:**

	<b>CLO Statement</b>	<b>Knowledge level</b>
<b>CLO-1</b>	Understand the diversity and basic taxonomy of Animal kingdom.	K1
<b>CLO-2</b>	Describe the general characters and outline classification from Protista to Platyhelminthes.	K2
<b>CLO-3</b>	Apply the knowledge to identify the fauna based on their unique characters.	K3
<b>CLO-4</b>	Analyse the importance and adaptation of the fauna in their habitat.	K4
<b>CLO-5</b>	Examine the role of Invertebrates in biological communities and ecological interactions.	K4

**Mapping with Programme Specific Outcomes:**

	<b>PSO-1</b>	<b>PSO-2</b>	<b>PSO-3</b>	<b>PSO-4</b>	<b>PSO-5</b>	<b>PSO-6</b>	<b>PSO-7</b>	<b>PSO-8</b>
<b>CLO-1</b>	1	1		2			2	
<b>CLO-2</b>	1	3	2	3			3	
<b>CLO-3</b>	1	3	3	2			2	
<b>CLO-4</b>	1	2	3	3			3	1
<b>CLO-5</b>	1	2	3	3			2	

3- Advance application; 2- Intermediate level; 1- Basic level

**Mapping with Programme Outcomes:**

	<b>PO-1</b>	<b>PO-2</b>	<b>PO-3</b>	<b>PO-4</b>	<b>PO-5</b>
<b>CLO-1</b>	1			2	
<b>CLO-2</b>	2	2		2	
<b>CLO-3</b>	1	2	2	2	2
<b>CLO-4</b>	1	2	1	2	1
<b>CLO-5</b>	2	2	1	3	3

3- Advance application; 2- Intermediate level; 1- Basic level

Contd.,

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**Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)**

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K- Level	No. of Questions	K- Level		
1	CLO 1	Up to K 2	2	K1& K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K 3	2	K1& K2	1	K2	2 (K2&K2)	1(K3)
3	CLO 3	Up to K 3	2	K1& K2	1	K2	2 (K3&K3)	1(K3)
4	CLO 4	Up to K 4	2	K1& K2	1	K2	2 (K4&K4)	1(K4)
5	CLO 5	Up to K 3	2	K1& K2	1	K2	2 (K3&K3)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

- K1- Remembering and recalling facts with specific answers  
K2- Basic understanding of facts and stating main ideas with general answers  
K3- Application oriented- Solving Problems  
K4- Examining, analyzing, presentation and make inferences with evidences

**Distribution of Section-wise Marks with K Levels**

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	2	10	--	<b>17</b>	14.16	<b>42%</b>
K2	5	8	10	10	<b>33</b>	27.5	
K3	-	-	20	30	<b>50</b>	41.67	<b>42%</b>
K4	-	-	10	10	<b>20</b>	16.67	<b>16%</b>
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

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RE-ACCREDITED (3<sup>rd</sup> Cycle) WITH “A” GRADE BY NAAC

**PROGRAMME: B.Sc.,**  
**COURSE TITLE : Invertebrata – II**  
**TIME : 3 Hours**

**COURSE CODE : 20U1ZMC2**  
**QN.NO : 11102**  
**MAX.MARKS :75**

**Qn.No:11102**

DEPARTMENT OF ZOOLOGY				CLASS: I B.Sc. Zoology				
Semester	Course Type	Course Code	Course Title	Credits	Contact Hours/w eek	CIA	Ext	Total
I	Core	20U1ZMC2	Invertebrata– II	3	3	25	75	100

**Course Objectives:**

1. To understand the taxonomy and systematic classification from Aschelminthes to Echinodermata.
2. To identify the animals from Aschelminthes to Echinodermata and to recognize their distinguishing features.
3. To appraise the diversity of animals in a phylogenetic context.
4. To understand how different body designs solve biological problems related to physiological and environmental challenges.
5. To develop an appreciation for the role of invertebrates in biological communities, ecological interactions, and conservation problems.

**Unit-I: Aschelminthes**

Characters & classification (up to class) of Aschelminthes with examples.

**Type study:** *Ascaris*

**General topics:** Nematode parasites & their adaptations.

**Unit-II: Annelida**

Characters & classification (up to class) of Annelida with examples.

**Type study:** *Megascolex*

**General topics:** Coelom & coelomoducts, Metamerism in Annelida, Filter feeding in Polychaetes.

**Unit-III: Arthropoda**

Characters & classification (up to class) of Arthropoda with examples. Brief descriptions of *Limulus* & *Sacculina*,

**Type study:** Prawn

**General topics:** Mouth parts of Insects, Beneficial Insects, Salient features of Arachnids, Affinities of *Peripatus*.

**Unit-IV: Mollusca**

Characters & classification (up to class) of Mollusca with examples.

**Type study:** *Pila*

**General topics:** Torsion & de-torsion in Gastropods, Cephalopods as an advanced Mollusc, Economically important Mollusca.

**Unit-V: Echinodermata**

Characters & classification (up to class) of Echinodermata with examples.

**Type study:** Starfish

**General topics:** Echinoderm larva.

## Books for Study

1. Nair N.C, Leelavathy S, Soundara Pandian N, Murugan T and Arumugam N, 2017. *A Text Book of Invertebrates*, Saras Publication, Nagercoil.
2. Nair N.C, Thangamani A, Leelavathy S, Prasanakumar S, Soundrapandian N, Murugan T, Narayanan L.M and Arumugam N, 2017. *Animal diversity (Invertebrata & Chordata)*, Saras Publication, Nagercoil.
3. Jordan E.L and Verma P.S, 2009. *Invertebrate Zoology*, S. Chand & Co, New Delhi.
4. Kotpal R.L, 2017. *Modern text book of Zoology: Invertebrate*, Rastogi Publication, Meerut.

## Books for References

1. Barnes R.D, 2006. *Invertebrate Zoology* VII<sup>th</sup> Edition, Holt Saunders International Edition.
2. Ekambaranatha Ayyar and Ananthakrishnan T.N. 1982. *Manual of Zoology Vol-I, Part I & II*, S. Viswanathan Pvt. Ltd. Chennai.
3. Kotpal R.L, Agarwal S.K and Khetarpal R.P, 1990. *Invertebrates*, Rastogi Publications, Meerut.
4. Anderson D.T, 2001. *Invertebrate Zoology*, Oxford University Press, New Delhi.
5. Barrington E.J.W, 1967. *Invertebrate Structure and Functions*, English Language Book Society.

## Web Resources

1. <https://www.nwf.org/Educational-Resources/Wildlife-Guide/Invertebrates>
2. <https://biologydictionary.net/invertebrate/>
3. <https://basicbiology.net/animal/invertebrates>
4. <https://www.khanacademy.org/science/biology/crash-course-bio-ecology/crash-course-biology-science/v/crash-course-biology-121>
5. <https://www.khanacademy.org/science/biology/crash-course-bio-ecology/crash-course-biology-science/v/crash-course-biology-122>

## Pedagogy

Chalk and Talk, PPT, group discussion, seminar, interaction, quiz, tutorial and virtual labs.

## Course Learning Outcomes:

	CLO Statement	Knowledge level
CLO-1	Understand the diversity and basic taxonomy from Aschelminthes to Echinodermata.	K1
CLO-2	Recall the general characters and outline classification from Aschelminthes to Echinodermata.	K2
CLO-3	Apply the knowledge to identify the fauna based on their unique characters.	K3
CLO-4	Analyse the importance and adaptation of the fauna in their habitat.	K4
CLO-5	Evaluate the role of Invertebrates in biological communities and ecological interactions.	K4

**Mapping with Programme Specific Outcomes:**

	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7	PSO-8
<b>CLO-1</b>	1	3		2			1	
<b>CLO-2</b>	1	3	2	2			2	
<b>CLO-3</b>	1	3	3	3			2	
<b>CLO-4</b>	1	2	3	3			2	1
<b>CLO-5</b>	1	2	3	2			2	

3- Advance application; 2- Intermediate level; 1- Basic level

**Mapping with Programme Outcomes:**

	PO-1	PO-2	PO-3	PO-4	PO-5
<b>CLO-1</b>	1				
<b>CLO-2</b>	2	2	1	2	
<b>CLO-3</b>	2	2	1	2	1
<b>CLO-4</b>	2	2	2	2	
<b>CLO-5</b>	2	2	2	2	3

3- Advance application; 2- Intermediate level; 1- Basic level

**BLUE PRINT**

**Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)**

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K- Level	No. of Questions	K- Level		
1	CLO 1	Up to K 2	2	K1& K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K 3	2	K1& K2	1	K2	2 (K2&K2)	1(K3)
3	CLO 3	Up to K 3	2	K1& K2	1	K2	2 (K3&K3)	1(K3)
4	CLO 4	Up to K 4	2	K1& K2	1	K2	2 (K4&K4)	1(K4)
5	CLO 5	Up to K 3	2	K1& K2	1	K2	2 (K3&K3)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

**Distribution of Section-wise Marks with K Levels**

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	2	10	--	<b>17</b>	14.16	<b>42%</b>
K2	5	8	10	10	<b>33</b>	27.5	
K3	-	-	20	30	<b>50</b>	41.67	<b>42%</b>
K4	-	-	10	10	<b>20</b>	16.67	<b>16%</b>
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

**Semester I: Mapping of Courses with Programme Specific Outcomes**

**Mapping with Programme Specific Outcomes:**

Course	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7	PSO-8
<b>Invertebrata-1</b>	1	2	3	2			3	
<b>Invertebrata-2</b>	1	2	3	2			3	
<b>Major Practical-1</b>	2	3	3				2	
<b>Value Education &amp; Professional Ethics</b>	2						1	3

3- Advance application; 2- Intermediate level; 1- Basic level

**Semester I: Mapping of Course Learning Outcomes with Programme Specific Outcomes:**

Course		PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7	PSO-8
<b>Invertebrata-I</b>	CLO-1	1	1		2			2	
	CLO-2	1	3	2	3			3	
	CLO-3	1	3	3	2			2	
	CLO-4	1	2	3	3			3	1
	CLO-5	1	2	3	3			2	
<b>Invertebrata-II</b>	CLO-1	1	3		2			1	
	CLO-2	1	3	2	2			2	
	CLO-3	1	3	3	3			2	
	CLO-4	1	2	3	3			2	1
	CLO-5	1	2	3	2			2	

3- Advance application; 2- Intermediate level; 1- Basic level

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**THE MADURA COLLEGE (Autonomous), MADURAI – 625 011**

(AFFILIATED TO MADURAI KAMARAJ UNIVERSITY)

RE-ACCREDITED (3<sup>rd</sup> Cycle) WITH “A” GRADE BY NAAC

**PROGRAMME: B.Sc.,**  
**COURSE TITLE : Fundamentals of**  
**Invertebrates & Chordates**

**COURSE CODE : 20U1ZAC1**  
**QN.NO : 11103**

**TIME : 3 Hours**

**MAX.MARKS :75**

DEPARTMENT OF ZOOLOGY				CLASS: I B.Sc. Chemistry				
Semester	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
I	Allied	20U1ZAC1	Fundamentals of Invertebrates & Chordates	4	4	25	75	100

**Course Objectives:**

1. To understand the general characters and outline classification of Invertebrate and Chordate.
2. To identify the animals and recognize their distinguishing features.
3. To appraise the specific features of animal and their life cycle.
4. To understand the morphology and adaptations of animals in the context of evolution.
5. To learn how different body designs solve biological problems related to physiological and environmental challenges.

**Unit-I: Classification, Protista & Porifera**

Systems of classification and nomenclature, Levels of organization, Types of symmetry. General characters and outline classification of invertebrates (up to phylum) with examples. Life cycle of *Plasmodium*, Canal system in sponges, Corals and coral reefs.

**Unit-II: Platyhelminthes, Annelida & Arthropoda**

Parasitic adaptation in helminthic worms, Metamerism in Annelida, Metamorphosis in insects, Mouth parts in insects, Affinities of Peripatus.

**Unit-III: Mollusca, Echinodermata & Chordata**

Torsion in Mollusca, Economic importance of Mollusca, Water vascular system in starfish. General characters and outline classification of Chordates (up to class) with examples.

**Unit-IV: Prochordates & Fishes**

General characters and classification of Urochordates, Cephalochordates and Hemichordates (up to class) with examples, Parental care in fishes, Migration of fishes.

**Unit-V: Amphibia, Reptilia, Birds & Mammals**

Neoteny in Amphibians, Poisonous snakes of south India (Cobra and krait), Identification of poisonous and non poisonous snakes, Flight adaptations in birds, Egg laying and pouched mammals, Adaptive radiation in mammals.

**Books for Study**

1. Nair N.C, Leelavathy S, Soundara Pandian N, Murugan T and Arumugam N, 2017. *A Text Book of Invertebrates*, Saras Publication, Nagercoil.
2. Thangamani A, Prasannakumar S, Narayanan L.M and Arumugam N, 2017. *A Text Book of Chordates*, Saras Publication, Nagercoil.
3. Nair N.C, Thangamani A, Leelavathy S, Prasanakumar S, Soundrapandian N, Murugan T, Narayanan L.M and Arumugam N, 2017. *Animal diversity (Invertebrata & Chordata)*, Saras Publication, Nagercoil.
4. Arumugam N, 2019. *Animal Diversity – Chordata, Volume - 2*, Saras Publication, Nagercoil.
5. Kotpal R.L, 2017. *Modern Text Book of Zoology: Invertebrate*, Rastogi Publications, Meerut.
6. Kotpal R.L, 2017. *Modern text book of Zoology: Vertebrates*, Rastogi Publications, Meerut.

## Books for References

1. Barnes R.D. 2006. *Invertebrate Zoology* (1982) VII<sup>th</sup> Edition, Holt Saunders International Edition.
2. EkambaranathaAyyar and AnanthakrishnanT.N , *Manual of Zoology Vol-I, Part I &II*, S.ViswanathanPvt. Ltd. Chennai.
3. Kotpal R.L, Agarwal S.K and Khetarpal R.P, 1990. *Invertebrates*, Rastogi Publications, Meerut.
4. Anderson D.T, 2001. *Invertebrate Zoology*, Oxford University Press, New Delhi.
5. Verma P.S, 2010. *Chordate Zoology*, S Chand Publishers, New Delhi.

## Web Resources

1. <https://www.nwf.org/Educational-Resources/Wildlife-Guide/Invertebrates>
2. <https://biologydictionary.net/invertebrate/>
3. <https://basicbiology.net/animal/invertebrates>
4. <https://www.khanacademy.org/science/biology/crash-course-bio-ecology/crash-course-biology-science/v/crash-course-biology-121>
5. <https://www.khanacademy.org/science/biology/crash-course-bio-ecology/crash-course-biology-science/v/crash-course-biology-122>
6. <https://www.khanacademy.org/science/biology/crash-course-bio-ecology/crash-course-biology-science/v/crash-course-biology-123>
7. <https://ucmp.berkeley.edu/vertebrates/vertintro.html>
8. <https://ucmp.berkeley.edu/chordata/chordata.html>

## Pedagogy

Chalk and Talk, PPT, group discussion, seminar, interaction, quiz, tutorial and virtual labs.

## Course Learning Outcomes:

	CLO Statement	Knowledge level
CLO-1	Understand the diversity and basic taxonomy of Invertebrates and Chordates.	K1
CLO-2	List the general characters and outline classification of Invertebrates and Chordates.	K2
CLO-3	Apply the knowledge to identify the Invertebrate and Chordate fauna based on their unique characters.	K3
CLO-4	Analyse the importance and specific adaptation of Invertebrate and Chordates in their habitat.	K4
CLO-5	Examine the role of Invertebrate and Chordates in biological communities and ecological interactions.	K4

## Mapping with Programme Specific Outcomes of Chemistry:

	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7	PSO-8
CLO-1	2		1	1				
CLO-2	2		1	1				
CLO-3	2							
CLO-4	2		1					
CLO-5	2	2	2	1	2	2		

3- Advance application; 2- Intermediate level; 1- Basic level

### Mapping with Programme Outcomes:

	PO-1	PO-2	PO-3	PO-4	PO-5
CLO-1	2	2	1	2	
CLO-2	2	2	2	2	
CLO-3	2	3	3	3	2
CLO-4	2	2	2	3	3
CLO-5	2	2	2	3	3

3- Advance application; 2- Intermediate level; 1- Basic level

### BLUE PRINT

#### Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K- Level	No. of Questions	K- Level		
1	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K 3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
3	CLO 3	Up to K 3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
4	CLO 4	Up to K 4	2	K1 & K2	1	K2	2 (K4&K4)	1(K4)
5	CLO 5	Up to K 3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

#### Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	2	10	--	17	14.16	42%
K2	5	8	10	10	33	27.5	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

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DEPARTMENT OF ZOOLOGY				CLASS: I B.Sc. Zoology		
Semester	Course Type	Course Code	Course Title	Time	Maximum	Question Number
II	Core	20U2ZMC3	Chordata - I	3 hrs	75 marks	11106

**Course Objectives:**

1. To understand the basic and systematic classification of Chordates.
2. To identify the Prochordate to Pisces animals and recognize their distinguishing features.
3. To appraise the affinities of animals in a phylogenetic context.
4. To understand how different body designs solve biological problems related to physiological and environmental challenges.
5. To develop an appreciation for the role of vertebrates in biological communities and ecological interactions.

**Unit-I: Introduction, Prochordata - Urochordates**

General characters and classification of Chordata (up to class) with examples.

General characters and classification of Urochordates (up to class) with examples.

**Type Study:** Ascidian

**General topics:** Retrogressive metamorphosis in Ascidia.

**Unit-II: Prochordata - Cephalochordates**

General characters and classification of Cephalochordates (up to class) with examples.

**Type Study:** *Amphioxus*

**General topics:** Affinities of *Amphioxus*.

**Unit-III: Prochordata - Hemichordates**

General characters and classification of Hemichordates (up to class) with examples.

**Type Study:** *Balanoglossus*

**General topics:** Affinities of Hemichordates.

**Unit-IV: Agnatha**

General characters and classification of Agnatha (up to class) with examples.

**Type Study:** *Petromyzon*

**General topics:** Salient features of Cyclostomata & Ostracoderm.

**Unit-V: Pisces**

General characters and classification of Pisces (up to order with examples) with examples.

**Type Study:** *Scoliodon*

**General topics:** Accessory respiratory organs in fishes, Types of Fins and function, Migration of Fishes.

**Books for Study**

1. Thangamani A, Prasannakumar S, Narayanan L.M, Arumugam N, 2017. *A Text Book of Chordates*, Saras Publication, Nagercoil.
2. Kotpal R.L, 2017. *Modern Text Book of Zoology: Vertebrates*, Rastogi Publications, Meerut.
3. Arumugam N, 2019. *Animal Diversity – Chordata, Volume - 2*, Saras Publication, Nagercoil.

### Books for References

1. EkambaranathaAyyar and Ananthakrishnan T.N. (Recent Edition), *Manual of Zoology Vol-II*, S. Viswanathan Pvt. Ltd. Chennai.
2. Young J.Z, 1950. *Life of Vertebrates*, Clarendon Press, Oxford, UK.
3. Pough Harvey F, Christine M, Janis and John B, Heiser, 2002. *Vertebrate Life*, Pearson Education Inc. New Delhi.
4. Verma P.S, 2010. *Chordate Zoology*, S Chand Publishers, New Delhi.

### Web Resources

1. <https://www.khanacademy.org/science/biology/crash-course-bio-ecology/crash-course-biology-science/v/crash-course-biology-123>
2. <https://ucmp.berkeley.edu/vertebrates/vertintro.html>
3. <https://ucmp.berkeley.edu/chordata/chordata.html>

### Pedagogy

Chalk and Talk, PPT, group discussion, seminar, interaction, quiz, tutorial and virtual labs.

### Course Learning Outcomes:

	CLO Statement	Knowledge level
CLO-1	Understand the diversity and basic taxonomy from Prochordate to Pisces.	K1
CLO-2	Describe the general characters and outline classification from Prochordate to Pisces.	K2
CLO-3	Apply the knowledge to identify the fauna based on their unique characters.	K3
CLO-4	Analyse the importance and adaptation of fauna in their habitat.	K4
CLO-5	Examine the role of Chordates in biological communities and ecological interactions.	K4

### Mapping with Programme Specific Outcomes:

	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7	PSO-8
CLO-1	1	2	2	2			1	
CLO-2	1	3	3	3			2	
CLO-3	1	3	3	3			3	
CLO-4	1	2	3	3			3	
CLO-5	1	2	2	2			3	

3- Advance application; 2- Intermediate level; 1- Basic level

**Mapping with Programme Outcomes:**

	PO-1	PO-2	PO-3	PO-4	PO-5
CLO-1	2	2	1	2	
CLO-2	2	2	2	2	1
CLO-3	2	2	2	2	1
CLO-4	2	2	2	2	3
CLO-5	2	2	2	2	3

3- Advance application; 2- Intermediate level; 1- Basic level

**Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)**

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K- Level	No. of Questions	K- Level		
1	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K 3	2	K1 & K2	1	K1	2 (K2&K2)	1(K3)
3	CLO 3	Up to K 3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
4	CLO 4	Up to K 3	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
5	CLO 5	Up to K 4	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

**Distribution of Section-wise Marks with K Levels**

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	--	<b>19</b>	15.83	<b>42%</b>
K2	5	6	10	10	<b>31</b>	25.83	
K3	-	-	20	30	<b>50</b>	41.67	<b>42%</b>
K4	-	-	10	10	<b>20</b>	16.67	<b>16%</b>
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

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<i>DEPARTMENT OF ZOOLOGY</i>				<i>CLASS: I B.Sc. CHEMISTRY</i>		
<b>Semester</b>	<b>Course Type</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Time</b>	<b>Maximum</b>	<b>Question Number</b>
<b>II</b>	<b>Core</b>	<b>20U2ZMC4</b>	<b>Chordata – II</b>	<b>3 hrs</b>	<b>75 marks</b>	<b>11107</b>

**Course Objectives:**

1. To understand the basic, systematic classification and evolution of higher vertebrates.
2. To identify the animals from Amphibia to Mammals and recognize their distinguishing features.
3. To appraise the diversity of animals in a phylogenetic context.
4. To understand the adaptive mechanisms of the animals to solve the biological problems related to physiological and environmental challenges.
5. To develop an appreciation for the role of vertebrates in biological communities, ecological interactions, and conservation problems.

**Unit-I: Amphibia**

Classification and characters of Amphibia (up to order with examples).

**Type Study:** Frog

**General topics:** Metamorphosis of Amphibian, Limbless Amphibians, Parental care in Amphibian, Paedomorphosis.

**Unit-II: Reptilia**

Classification and characters of Reptilia (up to order with examples).

**Type Study:** *Calotes*

**General topics:** Identification of Poisonous and non-poisonous snakes – Poison apparatus and types of poison, Skull of Reptiles, Salient features of Chelonia & Crocodilia.

**Unit-III: Aves**

Classification and characters of Aves (up to order with examples).

**Type Study:** Pigeon

**General topics:** Flightless Birds, Flight Adaptations in Birds, Feet and Beak modifications, Acoustics in Birds, Migration in Birds.

**Unit-IV: Mammals**

Classification and characters of Mammals (up to order with examples).

**Type Study:** Rabbit

**General topics:** Aquatic mammals and adaptation, Dentition in Mammals

**Unit-V: Chordate Phylogeny**

Geological time scale, Chordate phylogeny, Evolution of Aortic Arches, Evolution of kidney and their ducts, Diversity of Marsupials, Affinities of Prototheria, Adaptive radiation in Mammals.

**Books for Study**

1. Thangamani A, Prasannakumar S, Narayanan L.M, Arumugam N, 2017. *A Text Book of Chordates*, Saras Publication, Nagercoil.
2. Kotpal R.L, 2017. *Modern Text Book of Zoology: Vertebrates*, Rastogi Publications, Meerut.
3. Arumugam N, 2019. *Animal Diversity – Chordata, Volume - 2*, Saras Publication, Nagercoil.

**Books for References**

1. EkambaranathaAyyar and Ananthkrishnan T.N. (Recent Edition), *Manual of Zoology Vol-II*, S. Viswanathan Pvt. Ltd. Chennai.
2. Young J.Z, 1950. *Life of Vertebrates*. Clarendon Press, Oxford, UK.
3. Pough Harvey F, Christine M, Janis and John B, Heiser, 2002. *Vertebrate Life*, Pearson Education Inc. New Delhi.
4. Verma P.S, 2010. *Chordate Zoology*, S Chand Publishers, New Delhi.

**Web Resources**

1. <https://www.khanacademy.org/science/biology/crash-course-bio-ecology/crash-course-biology-science/v/crash-course-biology-123>
2. <https://ucmp.berkeley.edu/vertebrates/vertintro.html>
3. <https://ucmp.berkeley.edu/chordata/chordata.html>

**Pedagogy**

Chalk and Talk, PPT, group discussion, seminar, interaction, quiz, tutorial and virtual labs.

**Course Learning Outcomes:**

	<b>CLO Statement</b>	<b>Knowledge level</b>
CLO-1	Understand the diversity and basic taxonomy from Amphibia to Mammals.	K1
CLO-2	List the general characters and outline classification from Amphibia to Mammals.	K2
CLO-3	Apply the knowledge to identify the fauna based on their unique characters.	K3
CLO-4	Analyse the importance and adaptation of fauna in their habitat.	K4
CLO-5	Assess the role of Chordates in biological communities and ecological interactions.	K4

**Mapping with Programme Specific Outcomes:**

	<b>PSO-1</b>	<b>PSO-2</b>	<b>PSO-3</b>	<b>PSO-4</b>	<b>PSO-5</b>	<b>PSO-6</b>	<b>PSO-7</b>	<b>PSO-8</b>
CLO-1	1	2	1	1			1	
CLO-2	1	3	3	3			3	
CLO-3	1	3	3	3			3	
CLO-4	1	3	3	3			3	
CLO-5	1	3	3	3			3	

3- Advance application; 2- Intermediate level; 1- Basic level

**Mapping with Programme Outcomes:**

	<b>PO-1</b>	<b>PO-2</b>	<b>PO-3</b>	<b>PO-4</b>	<b>PO-5</b>
CLO-1	1	2	1	2	
CLO-2	2	2	2	3	1
CLO-3	1	3	2	3	2
CLO-4	2	3	2	3	2
CLO-5	2	2	2	3	3

3- Advance application; 2- Intermediate level; 1- Basic level

P.T.O.

**BLUE PRINT**

**Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)**

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K- Level	No. of Questions	K- Level		
1	CLO 1	Up to K 2	2	K1& K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K 3	2	K1& K2	1	K1	2 (K2&K2)	1(K3)
3	CLO 3	Up to K 3	2	K1& K2	1	K1	2 (K3&K3)	1(K3)
4	CLO 4	Up to K 4	2	K1& K2	1	K2	2 (K3&K3)	1(K3)
5	CLO 5	Up to K 4	2	K1& K2	1	K2	2 (K4&K4)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

**Distribution of Section-wise Marks with K Levels**

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	6	10	--	<b>21</b>	17.5	<b>42%</b>
K2	5	4	10	10	<b>29</b>	24.16	
K3	-	-	20	30	<b>50</b>	41.67	<b>42%</b>
K4	-	-	10	10	<b>20</b>	16.67	<b>16%</b>
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

**P.T.O.**

## Semester II: Mapping of Courses with Programme Specific Outcomes

### Mapping with Programme outcomes:

	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7	PSO-8
Chordata -1	1	2	3	2			3	
Chordata -2	1	2	3	2			3	
Major Practical-1	2	3	3				2	
Equity & Gender Studies	2							3

3- Advance application; 2- Intermediate level; 1- Basic level

### Semester II: Mapping of Course Learning Outcomes with Programme Specific Outcomes:

		PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7	PSO-8
Chordata –I	CLO-1	1	2	2	2			1	
	CLO-2	1	3	3	3			2	
	CLO-3	1	3	3	3			3	
	CLO-4	1	2	3	3			3	
	CLO-5	1	2	2	2			3	
Chordata –II	CLO-1	1	2	1	1			1	
	CLO-2	1	3	3	3			3	
	CLO-3	1	3	3	3			3	
	CLO-4	1	3	3	3			3	
	CLO-5	1	3	3	3			3	

3- Advance application; 2- Intermediate level; 1- Basic level

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<i>DEPARTMENT OF ZOOLOGY</i>				<i>CLASS: I B.Sc. CHEMISTRY</i>		
<b>Semester</b>	<b>Course Type</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Time</b>	<b>Maximum</b>	<b>Question Number</b>
<b>II</b>	<b>Allied</b>	<b>20U2ZAC2</b>	<b>Applied Zoology</b>	<b>3 hrs</b>	<b>75 marks</b>	<b>11108</b>

**Course Objectives:**

1. To understand the economic importance of animals.
2. To create awareness among the students about the applied aspects of Zoology.
3. To gain knowledge on various techniques employed in different culture systems.
4. To apply efficiently and execute the methodology for field practice.
5. To motivate the students for the self employment.

**Unit-I: Apiculture & Lac culture**

Introduction to Apiculture, Types of honey bees, Bee colony, Newton's bee hive, management of an apiary, uses of honey, Bee wax and Bee venom. Lac culture: Life history and rearing of lac insects and uses of lac.

**Unit-II: Sericulture**

Types of silkworm, Life cycle of silkworm, Rearing of silkworm, Silk glands, diseases of silkworm (Pebrine, Muscardine and Flacherie), Role of Central Silk Board.

**Unit-III: Poultry & Dairy farming**

Poultry: Breeds of poultry, Types of poultry house and Principles for construction of poultry house, Nutrition, Diseases and control. Dairyfarming: Economically important cattle, Nutritive value of milk, Livestock diseases: Mastitis, Foot and mouth diseases and Rinder pest.

**Unit-IV: Pisciculture & Vermiculture**

Pisciculture: Types of culturable fishes (fin fishes and shell fishes), Polyculture of carps. Vermiculture: Species, methods of culture, vermiwash, uses of vermicompost.

**Unit-V: Edible & Pearl Oyster farming**

Edible oyster farming: Biology, spat collection, culture methods, harvesting, cleaning and preservation. Pearl Oysterfarming: pearl formation and culture of pearls. Seaweed culture: culture methods and uses of seaweeds.

**P.T.O.**

### **Books for Study**

1. Tomer B.S, 2011. *Economic Zoology*, Emkay publications, Delhi.
2. Arumugam N, Murugan S, Johnson Rajeshwar J and Ramprabha R, 2005. *Applied Zoology*, Saras publication, Nagercoil.
3. Johnson M and Kesary M, 2008. *Sericulture* IV<sup>th</sup> Edition, N.M.C. College, Marthandam.
4. Ganga G and Sulochanachetty J, 2000. *An Introduction to Sericulture*, Oxford & IBH Publishing Company Pvt. Ltd. New Delhi.
5. Arumugam N, 2000. *Aquaculture*, Saras publication, Nagercoil.
6. Mery Violet Chrity A, 2014. *Vermitechnology*, MJP Publishers, New Delhi.

### **Books for References**

1. Ravindranathan K.R, 2005. *A text book of economic zoology*, Dominant publishers and distributors, New Delhi.
2. Vasantharaj David B and Kumaraswamy T, 1996. *Elements of Economic Entomology*, Popular book depot, Chennai.
3. Venkatanarasaiah P, 2013. *Sericulture*, APH Publishing Corporation, New Delhi.

### **Resources**

1. [http://agritech.tnau.ac.in/farm\\_enterprises/fe\\_apiculture\\_home.html](http://agritech.tnau.ac.in/farm_enterprises/fe_apiculture_home.html)
2. [http://agritech.tnau.ac.in/sericulture/seri\\_index.html](http://agritech.tnau.ac.in/sericulture/seri_index.html)
3. [http://www.agritech.tnau.ac.in/expert\\_system/poultry/index.html](http://www.agritech.tnau.ac.in/expert_system/poultry/index.html)
4. [http://agritech.tnau.ac.in/animal\\_husbandry/animhus\\_cattle%20index\\_page.html](http://agritech.tnau.ac.in/animal_husbandry/animhus_cattle%20index_page.html)
5. [http://agritech.tnau.ac.in/fishery/fish\\_index.html](http://agritech.tnau.ac.in/fishery/fish_index.html)
6. [http://agritech.tnau.ac.in/org\\_farm/orgfarm\\_vermicompost.html](http://agritech.tnau.ac.in/org_farm/orgfarm_vermicompost.html)

### **Pedagogy**

Chalk and Talk, PPT, group discussion, seminar, interaction, quiz, tutorial and virtual labs.

**P.T.O.**

**Course Learning Outcomes:**

CLOs	CLO Statement	Knowledge level
<b>CLO-1</b>	Relate the economic importance of Zoology in human welfare.	K1
<b>CLO-2</b>	Understand the insect and animal types, rearing techniques and it uses.	K2
<b>CLO-3</b>	Apply the knowledge to execute the methodology for field practice.	K3
<b>CLO-4</b>	Analyse the problem in culture practices and to rectify the same.	K4
<b>CLO-5</b>	Infer the biological importance of Apiculture, Lac culture, Sericulture, Poultry farming, Dairy farming, Pisciculture, Vermiculture, Edible oyster and Perl oyster culture.	K4

**Mapping with Programme Specific Outcomes of Chemistry:**

	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7	PSO-8
<b>CLO-1</b>	2		1			2		
<b>CLO-2</b>	2		1			2		
<b>CLO-3</b>	2		2			2	2	
<b>CLO-4</b>	2	1	2	1		2		
<b>CLO-5</b>	2					1		

3- Advance application; 2- Intermediate level; 1- Basic level

**Mapping with Programme Outcomes:**

	PO-1	PO-2	PO-3	PO-4	PO-5
<b>CLO-1</b>	2	2	2	3	3
<b>CLO-2</b>	1	2	2	3	2
<b>CLO-3</b>	2	2	2	3	3
<b>CLO-4</b>	2	3	2	3	3
<b>CLO-5</b>	2	3	2	3	3

3- Advance application; 2- Intermediate level; 1- Basic level

**P.T.O.**

**BLUE PRINT**  
**Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)**

Sl.No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K- Level	No. of Questions	K- Level		
1	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K 3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
3	CLO 3	Up to K 3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
4	CLO 4	Up to K 4	2	K1 & K2	1	K2	2 (K4&K4)	1(K4)
5	CLO 5	Up to K 4	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

**Distribution of Section-wise Marks with K Levels**

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	2	10	--	<b>17</b>	14.17	<b>42%</b>
K2	5	8	10	10	<b>33</b>	27.5	
K3	-	-	10	30	<b>40</b>	33.33	<b>33%</b>
K4	-	-	20	10	<b>30</b>	25	<b>25%</b>
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

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**THE MADURA COLLEGE (Autonomous), MADURAI – 625 011**  
(AFFILIATED TO MADURAI KAMARAJ UNIVERSITY)  
RE-ACCREDITED (3<sup>rd</sup> Cycle) WITH “A” GRADE BY NAAC

**PROGRAMME : B.Sc., Zoology**

**COURSE CODE : 20U3ZMC5**

**COURSE TITLE : Cell Biology &  
Biochemistry**

**QN.NO : 1111**

**TIME : 3 Hours**

**MAX.MARKS :75**

**Course Objectives**

By the end of the course, students will be able:

1. To understand the cell theory, types of cells and techniques used in cell biology
2. To describe ultrastructure and functions of the cell organelles.
3. To appraise the cell cycle and biochemistry of metabolism in cells.
4. To understand the types and role of RNA and protein synthesis.
5. To give an idea about enzymes and their role in cell metabolism.

Unit	Description	Hours	K-level	CLO
<b>I</b>	<b>Introductory Cytology</b> Cell theory - Prokaryotic and Eukaryotic cells. Cytological techniques: Fixation– Sectioning & Staining. Principle & uses of compound microscope, confocal microscope and electron microscope. Cell Junctions - Ultrastructure and functions of plasma membrane.	<b>15</b>	Up to K2	<b>1</b>
<b>II</b>	<b>Cell Organelles</b> Nucleus & Nucleolus. DNA structure and function - DNA Replication - Chromatin – Nucleosome. Chromosomes: – Structure, types, Giant chromosomes. Ultrastructure and functions of Endoplasmic reticulum & Golgi body.	<b>15</b>	Up to K3	<b>2</b>
<b>III</b>	<b>Biochemistry &amp; Cell cycle</b> Ultrastructure and functions of Lysosomes, Centrosomes, Mitochondria. Glycolysis and Krebs cycle. Electron transport chain and formation of ATP. Cell cycle - Mitosis, Meiosis & interphase its regulation. Apoptosis & Cancer.	<b>15</b>	Up to K3	<b>3</b>
<b>IV</b>	<b>Protein Synthesis</b> Types & role of RNA- Structure of t-RNA. Ultra structure, function and types of ribosome. Properties of Genetic code - Detailed study of Protein synthesis – Polysome – differences in eukaryotes – Short outline of post transcriptional modifications.	<b>15</b>	Up to K4	<b>4</b>
<b>V</b>	<b>Enzymes &amp; Metabolism</b> Structure and Classification of Carbohydrates, Protein and lipids. Enzymes: mechanism of action – classification and factors influencing enzyme action – Enzyme Inhibition. Glycogenesis –Glycogenolysis, Gluconeogenesis and HMP shunt. Deamination & Transamination. Beta oxidation of fats.	<b>15</b>	Up to K4	<b>5</b>

**Books for Study**

1. Arumugam, N. 2020. *Cell Biology & Molecular Biology*, Saras Publications, Nagercoil.
2. Arumugam, N. 2014. *Cell Biology*, Saras Publications, Nagercoil.
3. Fatima, D., Narayanan, LM., Meyyan, RP., Nallasingam, K., Prasanna Kumar, S. & Arumugam, N. 2014. *Biochemistry*, Saras Publications, Nagercoil.
4. Verma, PS. & Aggarwal, VK. 2015. *Cell Biology (Cytology, Biomolecules and Molecular Biology)*, S. Chand Publishers, New Delhi.

**Books for References**

1. De Robertis, EDP. & De Robertis, EMF. 2010. *Cell and Molecular Biology*, Lippincott Williams & Wilkins.
2. Gupta, PK. 2018. *Cell Biology*, Rastogi Publications, Meerut.

3. Jain, J.L., Jain, N. & Jain, S. 2016. *Fundamentals of Biochemistry*, S. Chand Publications, New Delhi.
4. Pawar, C.B. 2019. *Cell Biology*, Himalaya Publications.
5. Ramadevi, K. 2016. *Ambika Shanmugam's Fundamentals of Biochemistry for Medical Students*, Wolters Kluwer India Pvt Ltd.
6. David L. Nelson & Michael M. Cox, 2017. *Lehninger Principles of Biochemistry*, Macmillan.

#### Web resources

- <https://www.shomusbiology.com/cell-biology.html>  
<https://biolympiads.com/notes-of-molecular-biology-of-the-cell-by-alberts/>  
<https://www.biologyjunction.com/cell++notes+bi.htm>

#### Rationale for Nature of the course

This course will enable the students to comprehend the knowledge on concepts of cell theory, ultrastructure and types of cells, advanced techniques used in cell biology, role of cell organelles, phases of cell cycle, biochemistry of metabolism in cells, types and role of RNA, protein synthesis, enzymes and their role in cell metabolism.

#### Activities having direct bearing on Skill development/Employability/Entrepreneurship

The acquired knowledge on the working principles of advanced instruments used in cytology will help the students for developing their skills in cytological techniques, which further paves the way for their employability.

#### Pedagogy

Chalk and Talk, PPT, group discussion, seminar, interaction, quiz, tutorial and virtual labs.

#### Lecture Schedule (Total hours: 75)

Unit	Description	Staff Name	Hrs	Mode
I	Cell theory – Prokaryotic & Eukaryotic cells		3	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Cytological techniques: Fixation– Sectioning & Staining		3	
	Principle & uses of compound microscope, confocal microscope and electron microscope		4	
	Cell Junctions		2	
	Ultrastructure and functions of plasma membrane		3	
			<b>15</b>	
II	Nucleus & Nucleolus		2	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	DNA structure and function		2	
	DNA Replication, Chromatin, Nucleosome.		3	
	Structure & types of Chromosomes		2	
	Giant chromosomes		2	
	Ultrastructure and functions of Endoplasmic reticulum & Golgi body		4	
			<b>15</b>	
III	Ultrastructure and functions of Lysosomes, centrosomes, Mitochondria		4	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Glycolysis & Krebs cycle		4	
	Electron transport chain and formation of ATP		2	
	Cell cycle -Mitosis, Meiosis & Interphase its regulation		3	
	Apoptosis & Cancer		2	
			<b>15</b>	
IV	Types & role of RNA, Structure of t-RNA		3	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Ultra structure, function and types of ribosome		3	
	Properties of Genetic code		3	
	Detailed study of Protein synthesis		3	
	Polysome – differences in eukaryotes		2	
	Short outline of post transcriptional modifications		1	
			<b>15</b>	

V	Structure and Classification of Carbohydrates, Protein & Lipids		4	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Enzymes: mechanism of action, classification and factors influencing enzyme action - Enzyme Inhibition.		4	
	Glycogenesis –Glycogenolysis, Gluconeogenesis and HMP shunt		3	
	Deamination & Transamination		2	
	Beta oxidation of fats		2	
			<b>15</b>	

### Course Learning Outcomes:

On successful completion of the course, the student will able to:

CLOs	CLO Statements	Knowledge level
<b>CLO-1</b>	Describe the cell theory, widely used cytological techniques and ultrastructure & functions of plasma membrane.	Up to K2
<b>CLO-2</b>	Discuss the ultrastructure and functions of cell organelles.	Up to K3
<b>CLO-3</b>	Examine the stages of cell cycle and metabolic cycles in mitochondria	Up to K3
<b>CLO-4</b>	Investigate the mechanism of protein synthesis.	Up to K4
<b>CLO-5</b>	Analyze the role of cellular components and enzymes in cell metabolism	Up to K4

### Mapping with Programme Specific Outcomes

	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7	PSO-8
<b>CLO-1</b>	1	1	2		2		2	
<b>CLO-2</b>	2	2	3				2	
<b>CLO-3</b>	1	1	2				2	
<b>CLO-4</b>	2	1	3			2	2	
<b>CLO-5</b>	3	2	3	2	2	3	3	

3- Advance application; 2- Intermediate level; 1- Basic level

### Mapping with Programme Outcomes

	PO-1	PO-2	PO-3	PO-4	PO-5
<b>CLO-1</b>	1	1	2	2	3
<b>CLO-2</b>	2	1	2	1	2
<b>CLO-3</b>	2	1	2	1	2
<b>CLO-4</b>	2	2	1	2	2
<b>CLO-5</b>	1	1	3	2	3

3- Advance application; 2- Intermediate level; 1- Basic level

### BLUE PRINT FOR INTERNAL ASSESSMENT - I Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K- Level	No. of Questions	K- Level			
1	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K2&K2)	1(K2)	
2	CLO 2	Up to K 3	2	K1 & K2	2	K2	2 (K3&K3)	2(K2/K3)	
No. of Questions to be asked			4		3		4	3	14
No. of Questions to be answered			4		3		2	2	10
Marks for each question			1		2		5	10	
Total Marks for each section			4		6		10	20	40

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

**BLUE PRINT FOR INTERNAL ASSESSMENT - II**  
**Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)**

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K- Level	No. of Questions	K- Level			
1	CLO 3	Up to K 3	2	K1& K2	1	K1	2 (K2&K2)	2(K2/K3)	
2	CLO 4	Up to K 4	2	K1& K2	2	K2	2 (K3&K3)	1(K4)	
No. of Questions to be asked			4		3		4	3	14
No. of Questions to be answered			4		3		2	2	10
Marks for each question			1		2		5	10	
Total Marks for each section			4		6		10	20	40

**BLUE PRINT FOR EXTERNAL**  
**Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)**

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K- Level	No. of Questions	K- Level		
1	CLO 1	Up to K2	2	K1& K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K3	2	K1& K2	1	K1	2 (K2&K2)	1(K3)
3	CLO 3	Up to K3	2	K1& K2	1	K2	2 (K3&K3)	1(K3)
4	CLO 4	Up to K4	2	K1& K2	1	K2	2 (K4&K4)	1(K4)
5	CLO 5	Up to K4	2	K1& K2	1	K2	2 (K3&K3)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

**Distribution of Section-wise Marks with K Levels**

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	2	10	--	<b>17</b>	14.16	<b>42%</b>
K2	5	8	10	10	<b>33</b>	27.5	
K3	-	-	20	30	<b>50</b>	41.67	<b>42%</b>
K4	-	-	10	10	<b>20</b>	16.67	<b>16%</b>
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

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**THE MADURA COLLEGE (Autonomous), MADURAI – 625 011**  
(AFFILIATED TO MADURAI KAMARAJ UNIVERSITY)  
RE-ACCREDITED (3<sup>rd</sup> Cycle) WITH “A” GRADE BY NAAC

**PROGRAMME : B.Sc., Zoology**  
**COURSE TITLE : Applied Entomology**  
**TIME : 3 Hours**

**COURSE CODE : 20U3ZSM1**  
**QN.NO : 11113**  
**MAX.MARKS :75**

### Course Objectives

By the end of the course, students will be able:

1. To understand the economic and medical importance of insects.
2. To create awareness among the students about the applied aspects of Zoology.
3. To gain knowledge on various techniques employed in rearing of economically important insects.
4. To apply efficiently and execute the methodology for field practice.
5. To restate the role of insects in Forensic investigation.

Unit	Description	Hours	K-level	CLO
I	<b>Sericulture</b> Types of silk worm, Life history of mulberry silk worm <i>Bombyx mori</i> , Mountage, Diseases of silk worm: pebrine, muscardine and flacherie.	6	Up to K2	1
II	<b>Moriculture</b> Cultivation of mulberry plant, Methods of harvesting and preservation. Role of Central Silk Board in Sericulture.	6	Up to K3	2
III	<b>Apiculture</b> Different species of honey bees, Life history of bees, Newton's bee hive, Uses of honey.	6	Up to K3	3
IV	<b>Lac culture</b> Lac insect classification, Life history of lac insects, Cultivation of lac, Harvesting and processing of lac, Composition and uses of lac.	6	Up to K4	4
V	<b>Forensic Entomology</b> Insects of forensic importance, Corpse feeders, Maggots, Life cycle analysis, Role of insects in crime investigation.	6	Up to K4	5

### Books for Study

1. Tomer, BS. 2011. *Economic Zoology*, Emkay publications, Delhi.
2. Arumugam, N., Murugan, S., Johnson Rajeshwar, J. & Ramprabha, R. 2005. *Applied Zoology*, Saras publication, Nagercoil.
3. Johnson, M. & Kesary, M. 2008. *Sericulture* IV<sup>th</sup> Edition, N.M.C. College, Marthandam.
4. Ganga, G. & Sulochanachetty, J. 2000. *An Introduction to Sericulture*, Oxford & IBH Publishing Company Pvt. Ltd. New Delhi.

### Books for References

1. Ravindranathan, KR. 2005. *A text book of economic zoology*, Dominant publishers and distributors, New Delhi.
2. Vasantharaj David, B. & Kumaraswamy, T. 1996. *Elements of Economic Entomology*, Popular book depot, Chennai.
3. Venkatanarasaiah, P. 2013. *Sericulture*, APH Publishing Corporation, New Delhi.

### Web Resources

[http://agritech.tnau.ac.in/farm\\_enterprises/fe\\_apiculture\\_home.html](http://agritech.tnau.ac.in/farm_enterprises/fe_apiculture_home.html)  
[http://agritech.tnau.ac.in/sericulture/seri\\_index.html](http://agritech.tnau.ac.in/sericulture/seri_index.html)

### Rationale for Nature of the course

This course represents an attractive means of combining state-of-the-art transition on various techniques employed in rearing of economically important insects. It also highlights the use of insects in forensic investigations.

### Activities having direct bearing on Skill development/Employability/Entrepreneurship

The acquired knowledge on applied entomology will help the students to develop their entrepreneurial skills that enable the students to become a successful entrepreneur. The knowledge on forensic entomology will help them to get through their employability in forensic department.

### Pedagogy

Chalk and Talk, PPT, group discussion, seminar, interaction, quiz, tutorial and virtual labs.

### LESSON PLAN (Total hours: 30)

Unit	Description	Staff Name	Hrs	Mode
I	Types of silkworm		1	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Life history of mulberry silk worm <i>Bombyx mori</i>		1	
	Mountage		1	
	Diseases of silkworm (Pebrine, Muscardine & Flacherie)		3	
			<b>6</b>	
II	Cultivation of mulberry plant		2	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Methods of harvesting		1	
	Methods of preservation		1	
	Role of Central Silk Board in Sericulture		2	
			<b>6</b>	
III	Different species of honey bees		2	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Life history of bees		1	
	Newton's bee hive		2	
	Uses of honey		1	
			<b>6</b>	
IV	Lac insect classification		1	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Life history of lac insects		1	
	Cultivation of lac		1	
	Harvesting and processing of lac		1	
	Composition and uses of lac		2	
			<b>6</b>	
V	Insects of forensic importance		2	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Corpse feeders		1	
	Maggots		1	
	Life cycle analysis		1	
	Role of insects in crime investigation		1	
			<b>6</b>	

### Course Learning Outcomes:

On successful completion of the course, the student will be able to:

CLOs	CLO Statements	Knowledge level
CLO-1	Describe the life cycle silkworm, honey bee and lac insects	Up to K2
CLO-2	Outline the rearing techniques of economically important insects.	Up to K3
CLO-3	Examine the rearing and cultivation methods for mulberry	Up to K3
CLO-4	Analyse the uses of products derived from the culture of insects	Up to K4
CLO-5	Investigate the role of insects in Forensic investigation	Up to K4

### Mapping with Programme Specific Outcomes of Chemistry

	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7	PSO-8
CLO-1	2	2	1		2	2		1
CLO-2	2		3	1	2	3	2	1
CLO-3	2	1	1	3	1	3	1	
CLO-4	2		2	1		1	1	
CLO-5	2	1	2	2	3	3	2	2

3- Advance application; 2- Intermediate level; 1- Basic level

### Mapping with Programme Outcomes

	PO-1	PO-2	PO-3	PO-4	PO-5
CLO-1	1	1	1	1	2
CLO-2	2	2	1	1	3
CLO-3	2	2	1	1	3
CLO-4	2	3	1	1	3
CLO-5	2	3	1	2	2

3- Advance application; 2- Intermediate level; 1- Basic level

### BLUE PRINT FOR INTERNAL ASSESSMENT - I Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K- Level	No. of Questions	K- Level			
1	CLO 1	Up to K2	2	K1& K2	1	K1	2 (K2&K2)	1(K2)	
2	CLO 2	Up to K3	2	K1& K2	2	K2	2 (K3&K3)	2(K2/K3)	
No. of Questions to be asked			4		3		4	3	14
No. of Questions to be answered			4		3		2	2	10
Marks for each question			1		2		5	10	
Total Marks for each section			4		6		10	20	40

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

### BLUE PRINT FOR INTERNAL ASSESSMENT - II Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K- Level	No. of Questions	K- Level			
1	CLO 3	Up to K3	2	K1& K2	1	K1	2 (K2&K2)	2(K2/K3)	
2	CLO 4	Up to K4	2	K1& K2	2	K2	2 (K3&K3)	1(K4)	
No. of Questions to be asked			4		3		4	3	14
No. of Questions to be answered			4		3		2	2	10
Marks for each question			1		2		5	10	
Total Marks for each section			4		6		10	20	40

### BLUE PRINT FOR EXTERNAL Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K- Level	No. of Questions	K- Level		
1	CLO 1	Up to K2	2	K1& K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K3	2	K1& K2	1	K1	2 (K2&K2)	1(K3)
3	CLO 3	Up to K3	2	K1& K2	1	K2	2 (K3&K3)	1(K3)
4	CLO 4	Up to K4	2	K1& K2	1	K2	2 (K4&K4)	1(K4)
5	CLO 5	Up to K4	2	K1& K2	1	K2	2 (K3&K3)	1(K3)

No. of Questions to be asked	10		5		10	5
No. of Questions to be answered	10		5		5	3
Marks for each question	1		2		5	10
Total Marks for each section	10		10		25	30

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

#### Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	2	10	--	<b>17</b>	14.16	<b>42%</b>
K2	5	8	10	10	<b>33</b>	27.5	
K3	-	-	20	30	<b>50</b>	41.67	<b>42%</b>
K4	-	-	10	10	<b>20</b>	16.67	<b>16%</b>
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

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**THE MADURA COLLEGE (Autonomous), MADURAI – 625 011**  
(AFFILIATED TO MADURAI KAMARAJ UNIVERSITY)  
RE-ACCREDITED (3<sup>rd</sup> Cycle) WITH “A” GRADE BY NAAC

**PROGRAMME : B.Sc.,**  
**COURSE TITLE : Allied Zoology**  
**TIME : 3 Hours**

**COURSE CODE : 20U3ZAC1(B)**  
**QN.NO : 11114**  
**MAX.MARKS : 75**

**Course Objectives**

By the end of the course, students will be able:

1. To describe the general characters and outline classification of Invertebrate and Chordate.
2. To identify the animals and recognize their distinguishing features.
3. To appraise the specific features of animal and their life cycle.
4. To understand the morphology and adaptations of animals in the context of evolution.
5. To learn how different body designs solve biological problems related to physiological and environmental challenges.

Unit	Description	Hours	K-level	CLO
I	<b>Classification, Protista &amp; Porifera</b> Systems of classification and nomenclature, Levels of organization, Types of symmetry. General characters and outline classification of invertebrates (up to phylum) with examples. Life cycle of <i>Plasmodium</i> , Canal system in sponges, Corals and coral reefs.	12	Up to K2	1
II	<b>Platyhelminthes, Annelida &amp; Arthropoda</b> Parasitic adaptation in helminthic worms, Metamerism in Annelida, Metamorphosis in insects, Mouth parts in insects, Affinities of Peripatus.	12	Up to K3	2
III	<b>Mollusca, Echinodermata &amp; Chordata</b> Torsion in Mollusca, Economic importance of Mollusca, Water vascular system in starfish. General characters and outline classification of Chordates (up to class) with examples.	12	Up to K3	3
IV	<b>Prochordates &amp; Fishes</b> General characters and classification of Urochordates, Cephalochordates and Hemichordates (up to class) with examples, Parental care in fishes, Migration of fishes.	12	Up to K4	4
V	<b>Amphibia, Reptilia, Birds &amp; Mammals</b> Neoteny in Amphibians, Poisonous snakes of south India (Cobra and krait), Identification of poisonous and non poisonous snakes, Flight adaptations in birds, Egg laying and pouched mammals, Adaptive radiation in mammals.	12	Up to K4	5

**Books for Study**

1. Nair NC, Leelavathy S, Soundara Pandian N, Murugan T and Arumugam N, 2017. *A Text Book of Invertebrates*, Saras Publication, Nagercoil.
2. Thangamani A, Prasannakumar, S, Narayanan L.M and Arumugam N, 2017. *A Text Book of Chordates*, Saras Publication, Nagercoil.
3. Nair N.C, Thangamani A, Leelavathy S, Prasanakumar S, Soundrapandian N, Murugan T, Narayanan L.M and Arumugam N, 2017. *Animal diversity (Invertebrata & Chordata)*, Saras Publication, Nagercoil.
4. Kotpal R.L, 2017. *Modern Text Book of Zoology: Invertebrate*, Rastogi Publications, Meerut.
5. Kotpal R.L, 2017. *Modern text book of Zoology: Vertebrates*, Rastogi Publications, Meerut.

**Books for References**

1. Barnes R.D. 2006. *Invertebrate Zoology* (1982) VII<sup>th</sup> Edition, Holt Saunders International Edition.
2. Ekambaranatha Ayyar and Ananthkrishnan T.N, 1992. *Manual of Zoology Vol – I, Part I & II*, S.Viswanathan Pvt. Ltd. Chennai.
3. Kotpal R.L, Agarwal S.K and Khetarpal R.P, 1990. *Invertebrates*, Rastogi Publications, Meerut.
4. Anderson D.T, 2001. *Invertebrate Zoology*, Oxford University Press, New Delhi.
5. Verma P.S, 2010. *Chordate Zoology*, S Chand Publishers, New Delhi.

## Web resources

- <https://www.nwf.org/Educational-Resources/Wildlife-Guide/Invertebrates>  
<https://biologydictionary.net/invertebrate/>  
<https://basicbiology.net/animal/invertebrates>  
<https://www.khanacademy.org/science/biology/crash-course-bio-ecology/crash-course-biology-science/v/crash-course-biology-121>  
<https://www.khanacademy.org/science/biology/crash-course-bio-ecology/crash-course-biology-science/v/crash-course-biology-122>  
<https://www.khanacademy.org/science/biology/crash-course-bio-ecology/crash-course-biology-science/v/crash-course-biology-123>

## Pedagogy

Chalk and Talk, PPT, group discussion, seminar, interaction, quiz, tutorial and virtual labs.

## Rationale for Nature of the course

This course will enable the students to comprehend the general characters and outline classification of Invertebrates and Chordates. It augments the students' knowledge on morphology and adaptations of animals to meet challenges in their living environment.

## Activities having direct bearing on Skill development/Employability/Entrepreneurship

The acquiring of knowledge on body designs of Invertebrates & Chordates, their role to solve physiological and environmental challenges, could enrich the students' knowledge on biology in an evolutionary perspective. It could pave the way for their holistic understanding on biology.

## LESSON PLAN (Total hours: 60)

Unit	Description	Staff Name	Hrs	Mode
I	Systems of classification & nomenclature		1	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Levels of organization		1	
	Types of symmetry		1	
	General characters of Invertebrates		1	
	Classification of Invertebrates (up to phylum) with examples		2	
	Life cycle of <i>Plasmodium</i>		2	
	Canal system in sponges		2	
	Corals and coral reefs		2	
			<b>12</b>	
II	Parasitic adaptation in helminthic worms		3	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Metamerism in Annelida		2	
	Metamorphosis in insects		2	
	Mouth parts in insects		3	
	Affinities of Peripatus		2	
			<b>12</b>	
III	Torsion in Mollusca		3	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Economic importance of Mollusca		3	
	Water vascular system in starfish		2	
	General characters of Chordates		2	
	Classification of Chordates (up to class) with examples		2	
			<b>12</b>	
IV	General characters and classification of Urochordates (up to class) with examples		2	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	General characters and classification Cephalochordates (up to class) with examples		2	
	General characters and classification of Hemichordates (up to class) with examples		2	
	Parental care in fishes		3	
	Migration of fishes		3	
			<b>12</b>	

V	Neoteny in Amphibians		2	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Poisonous snakes of south India (Cobra and krait)		2	
	Identification of poisonous and non poisonous snakes		2	
	Flight adaptations in birds		2	
	Egg laying and pouched mammals		2	
	Adaptive radiation in mammals		2	
			<b>12</b>	

### Course Learning Outcomes:

On successful completion of the course, the student will able to:

CLOs	CLO Statements	Knowledge level
CLO-1	Understand the systems of classification and nomenclature for animals.	Up to K2
CLO-2	Predict the adaptations of animals with their mode of life.	Up to K3
CLO-3	Apply the knowledge to identify evolutionary relationship among Invertebrates and Chordates.	Up to K3
CLO-4	Investigate the relations between unique behaviours of animals with their habitat.	Up to K4
CLO-5	Examine the role of Invertebrate and Chordates in biological communities and ecological interactions.	Up to K4

### Mapping with Programme Specific Outcomes of Botany

	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7	PSO-8
CO-1	2	2	1	1				
CO-2	2	2	3	1				2
CO-3	1	2	1	2				
CO-4	2	1	3	3				1
CO-5	2	2	2	1	2		3	2

3- Advance application; 2- Intermediate level; 1- Basic level

### Mapping with Programme Outcomes

	PO-1	PO-2	PO-3	PO-4	PO-5
CO-1	2	2	1	2	2
CO-2	2	2	2	3	
CO-3	3	3	2	2	2
CO-4	1	3	2	3	3
CO-5	2	2	3	3	2

3- Advance application; 2- Intermediate level; 1- Basic level

### BLUE PRINT FOR INTERNAL ASSESSMENT - I

#### Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K- Level	No. of Questions	K- Level			
1	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K2&K2)	1(K2)	
2	CLO 2	Up to K 3	2	K1 & K2	2	K2	2 (K3&K3)	2(K2/K3)	
No. of Questions to be asked			4		3		4	3	14
No. of Questions to be answered			4		3		2	2	10
Marks for each question			1		2		5	10	
Total Marks for each section			4		6		10	20	40

- K1- Remembering and recalling facts with specific answers  
 K2- Basic understanding of facts and stating main ideas with general answers  
 K3- Application oriented- Solving Problems  
 K4- Examining, analyzing, presentation and make inferences with evidences

**BLUE PRINT FOR INTERNAL ASSESSMENT - II**  
**Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)**

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K- Level	No. of Questions	K- Level			
1	CLO 3	Up to K3	2	K1& K2	1	K1	2 (K2&K2)	2(K2/K3)	
2	CLO 4	Up to K4	2	K1& K2	2	K2	2 (K3&K3)	1(K4)	
No. of Questions to be asked			4		3		4	3	14
No. of Questions to be answered			4		3		2	2	10
Marks for each question			1		2		5	10	
Total Marks for each section			4		6		10	20	40

**BLUE PRINT FOR EXTERNAL**

**Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)**

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K- Level	No. of Questions	K- Level		
1	CLO 1	Up to K2	2	K1& K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K3	2	K1& K2	1	K1	2 (K2&K2)	1(K3)
3	CLO 3	Up to K3	2	K1& K2	1	K2	2 (K3&K3)	1(K3)
4	CLO 4	Up to K4	2	K1& K2	1	K2	2 (K4&K4)	1(K4)
5	CLO 5	Up to K4	2	K1& K2	1	K2	2 (K3&K3)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

- K1- Remembering and recalling facts with specific answers  
 K2- Basic understanding of facts and stating main ideas with general answers  
 K3- Application oriented- Solving Problems  
 K4- Examining, analyzing, presentation and make inferences with evidences

**Distribution of Section-wise Marks with K Levels**

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	2	10	--	<b>17</b>	14.16	<b>42%</b>
K2	5	8	10	10	<b>33</b>	27.5	
K3	-	-	20	30	<b>50</b>	41.67	<b>42%</b>
K4	-	-	10	10	<b>20</b>	16.67	<b>16%</b>
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

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# THE MADURA COLLEGE (Autonomous), MADURAI – 625 011

(AFFILIATED TO MADURAI KAMARAJ UNIVERSITY)

RE-ACCREDITED (3<sup>rd</sup> Cycle) WITH “A” GRADE BY NAAC

**PROGRAMME : NME - Zoology**

**COURSE TITLE : Essentials of Zoology**

**TIME : 3 Hours**

**COURSE CODE : 20U3ZNM1**

**QN.NO : 11116**

**MAX.MARKS :75**

## Course Objectives

By the end of the course, students will be able:

1. To understand the concept and systematic classification of animal kingdom.
2. To recognize the general characters and outline classification of Invertebrate and Chordate.
3. To analyze the structure and functions of nucleic acids.
4. To create an awareness about the various microbial diseases and the causative organisms.
5. To gain knowledge on blood and their components, groups and clotting mechanism.

Unit	Description	Hours	K-level	CLO
I	<b>Classification</b> Concept of five kingdom classification of life. Systems of classification & nomenclature - Levels of organization - Types of symmetry.	6	Up to K2	1
II	<b>Invertebrates &amp; Chordates</b> General characters and classification of Invertebrates (up to phylum) with example. General characters and classification of Chordates (up to class) with example.	6	Up to K2	2
III	<b>Nucleic acids</b> Nucleic acids. DNA structure – Watson and Crick model. Significance of DNA. RNA –structure, types of RNA –mRNA, tRNA and rRNA	6	Up to K2	3
IV	<b>Microbial Diseases</b> Communicable Diseases: AIDS, Rabbits – causative agent, mode of transmission, symptoms and treatment. Non-communicable Diseases: Cholera, Typhoid- causative agent, mode of transmission, symptoms.	6	Up to K2	4
V	<b>Immunology</b> Components of blood, blood groups- ABO blood grouping, Rh factor, blood pressure, blood clotting-mechanism.	6	Up to K2	5

## Books for Study

1. Arumugam, N. 2020. *Cell Biology & Molecular Biology*, Saras Publications, Nagercoil.
2. Arumugam N, Mani A, Narayanan LM, Fatima D, Selvaraj AM, &, 2015. *Immunology and Microbiology*, Saras Publication, Nagercoil.
3. Nair N.C, Thangamani A, Leelavathy S, Prasanakumar S, Soundrapandian N, Murugan T, Narayanan L.M and Arumugam N, 2017. *Animal diversity (Invertebrata & Chordata)*, Saras Publication, Nagercoil.
4. Dubey RC. & Maheswari DK, 2013. *A Textbook of Microbiology*, S. Chand Publishers, New Delhi.

## Books for References

1. Abul K Abbas, Andrew H. Lichtman, & Shiv Pillai, 2019. *Basic Immunology*, Elsevier.
2. Barnes R.D. 2006. *Invertebrate Zoology* (1982) VII<sup>th</sup> Edition, Holt Saunders International Edition.
3. De Robertis, EDP. & De Robertis, EMF. 2010. *Cell and Molecular Biology*, Lippincott Williams & Wilkins.
4. Pelczar MJ, Chan EC, Pelczar MF. 1981. *Elements of Microbiology*. McGraw-Hill International Book Company.
5. Peter J. Delves, Seamus J. Martin, Dennis R. Burton, Ivan M. Roitt, 2017. *Roitt's Essential immunology*, Wiley-Blackwell.
6. Ryan KJ & Ray CG, (Editors), 2004. *Sherris Medical Microbiology*. McGraw-Hill Education.
7. Willey J, Sherwood L. & Christopher J. Woolverton, 2017. *Prescott's Microbiology*, McGraw Hill.

## Web resources

<https://www.youtube.com/watch?v=hiQCCN5oisw>  
<https://www.youtube.com/watch?v=jAnch9ET-gg>  
<https://www.youtube.com/watch?v=MA-ouz1LtpM>  
<https://www.youtube.com/watch?v=ZVvjXuSmyZQ>  
<https://www.youtube.com/watch?v=H6w-BRSgfMg>

## Pedagogy

Chalk and Talk, PPT, group discussion, seminar, interaction, quiz, tutorial and virtual labs.

## Rationale for Nature of the course

This course will enable the students to comprehend the principles of classification and general characters of Invertebrate and Chordate, structure and functions of nucleic acids, microbial diseases and the causative organisms and components of blood and blood groups.

## Activities having direct bearing on Skill development/Employability/Entrepreneurship

The acquiring of basic knowledge on diversity of animals, nucleic acids, microbial pathogens, and immunology could enable the students to understand the science in a holistic perspective. It could be helpful for the students in developing their multidisciplinary skills.

## LESSON PLAN (Total hours: 30)

Unit	Description	Staff Name	Hrs	Mode
I	Concept of five kingdom classification of life		2	Lecture, Chalk and
	Systems of classification & nomenclature		2	Talk, Interaction,
	Levels of organization		1	PPT & Group
	Types of symmetry		1	Discussion
				<b>6</b>
II	General characters of Invertebrate with examples		2	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Classification of Invertebrate (up to phylum) with examples		2	
	General characters and classification of Chordata (up to class) with examples		2	
			<b>6</b>	
III	Nucleic acids		2	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	DNA structure – Watson and Crick model, Significance of DNA.		2	
	RNA –structure, types of RNA –mRNA, tRNA and rRNA		2	
			<b>6</b>	
IV	AIDS & Rabbits – causative agent, mode of transmission, symptoms and treatment		2	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Cholera – causative agent, mode of transmission, symptoms		2	
	Typhoid – causative agent, mode of transmission, symptoms		2	
			<b>6</b>	
V	Components of blood		2	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Blood groups – ABO blood grouping, Rh factor		2	
	Blood pressure, blood clotting mechanism		2	
			<b>6</b>	

**Course Learning Outcomes:**

On successful completion of the course, the student will able to:

CLOs	CLO Statements	Knowledge level
<b>CLO-1</b>	Describe the concept and systematic classification of animal kingdom.	Up to K2
<b>CLO-2</b>	Explain the characters and outline classification of Invertebrate and Chordates.	Up to K2
<b>CLO-3</b>	Examine the structure and role of nucleic acids.	Up to K2
<b>CLO-4</b>	Compare and contrast various microbial diseases and the causative organisms, symptoms and their preventive measures.	Up to K2
<b>CLO-5</b>	Inspect the blood components, blood groups and clotting mechanism.	Up to K2

**Mapping with Programme Specific Outcomes**

	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7	PSO-8
<b>CLO-1</b>	2	1	2					
<b>CLO-2</b>	2	3	1					
<b>CLO-3</b>	1		3					
<b>CLO-4</b>	1				3		2	
<b>CLO-5</b>	1		3				2	

3- Advance application; 2- Intermediate level; 1- Basic level

**Mapping with Programme Outcomes**

	PO-1	PO-2	PO-3	PO-4	PO-5
<b>CLO-1</b>	2	2	1	3	2
<b>CLO-2</b>	2	2	1	2	1
<b>CLO-3</b>	2	3	2	2	2
<b>CLO-4</b>	2	3	2	3	2
<b>CLO-5</b>	3	3	2	3	3

3- Advance application; 2- Intermediate level; 1- Basic level

**Learning Outcome Based Education & Assessment (LOBE)****Blue Print –(CIA-I & II)****Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)**

CLOs	K- Level	Section A		Section B		Section C	
		Short Answers		(Either/or Choice)		(Open Choice)	
		No. of Questions	K- Level	No. of Questions	K- Level	No. of Questions	K- Level
CLO x	Up to K2	1	K1	1	K2/K2	1	K1
CLO y	Up to K2	2	K1	1	K2/K2	2	K1
No. of Questions to be asked		3		2		3	
No. of Questions to be answered		3		2		2	
Marks for each question		2		7		10	
Total Marks for each section		<b>6</b>		<b>14</b>		<b>20</b>	

**Distribution of Section-wise Marks with K Levels (CIA I & II)**

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Total Marks	% of Marks without choice	Consolidated %
K1	6	-	30	36	56.25	100
K2	-	28	-	28	43.75	
K3	-	-	-	-	-	-
K4	-	-	-	-	-	-
<b>Total Marks</b>	<b>6</b>	<b>14</b>	<b>30</b>	<b>64</b>	<b>100.00</b>	<b>100%</b>

**Learning Outcome Based Education & Assessment (LOBE)**

**Blue Print**

**Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)**

Units	CLOs	K-Level	Section – A		Section – B		Section – C	
			Short Answers		(Either / or Choice)		(Open Choice)	
			No. of Questions	K-Level	No. of Questions	K-Level	No. of Questions	K-Level
1	CLO 1	Up to K2	1	K1	1	K2/K2	1	K1
2	CLO 2	Up to K2	1	K1	1	K2/K2	1	K1
3	CLO 3	Up to K2	1	K1	1	K2/K2	1	K1
4	CLO 4	Up to K2	1	K1	1	K2/K2	1	K1
5	CLO 5	Up to K2	1	K1	1	K2/K2	1	K1
No. of Questions to be asked			5		5		5	
No. of Questions to be answered			5		5		3	
Marks for each question			2		7		10	
Total Marks for each section			10		35		30	

**Distribution of Section-Wise Marks with K Levels**

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (No Choice)	Total Marks	% of Marks (without choice)	Consolidated
K1	10	-	50	60	46.15	100
K2	-	70	-	70	53.85	
K3	-	-	-	-	-	-
K4	-	-	-	-	-	-
<b>Total Marks</b>	<b>10</b>	<b>35</b>	<b>50</b>	<b>130</b>	<b>100.00</b>	<b>100</b>

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

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