


KANNUR UNIVERSITY

(Abstract)

M.Sc Zoology Programme – under Credit Based Semester System in Affiliated Colleges - Modified Scheme & Syllabus – Implemented with effect from 2016 admission - orders issued.

ACADEMIC C SECTION

U.O.No.Acad/C4/8008/2014

Dated, Civil Station (P.O), 03-05-2017

Read:-1.U.O of even No. dt:18/07/2014

2.U.O of even No.dt:03/01/2017

3. Minutes of the meeting of the BOS in Zoology (PG) held on 13/03/2017

ORDER

1 The Scheme , Syllabus & Model question papers for M.Sc Zoology Course under Credit Based Semester System in affiliated colleges were implemented in the university w.e.f. 2014 admission vide paper read (1) above and certain modifications were effected to the same vide paper read (2) w.e.f 2016 admission .

2. The meeting of the BOS in Zoology (PG) held on 13/03/2017 vide paper read (3) above recommended to incorporate certain Elective & Practical Courses and to modify the 'Introduction' part in the syllabus of M.Sc Zoology to be effected from 2016 admission as follows.

a) The Elective and Practical papers to be incorporated in the Scheme and Syllabus of 3rd and 4th semester of M.Sc Zoology Programme are **General Entomology (Z003E 01), Insect Physiology (Z004E 02), Agricultural Medical & Forensic Entomology (Z004 E 03) and Entomology (Zoo3&4P06).**

b)The wordings “ **The Elective courses offered for the programme are Parasitology at Sree Narayana College and Entomology at Govt.Brennen College**” needs to be incorporated in the second paragraph of the Introduction in the Syllabus.

3. The Vice-Chancellor, after considering the matter in detail, and in exercise of the powers of the Academic Council, conferred under Section 11 (1) of Kannur University Act, 1996 and all other enabling provisions read together with, has accorded sanction to incorporate **General Entomology (Z003E 01), Insect Physiology (Z004E 02), Agricultural Medical & Forensic Entomology (Z004 E 03) and Entomology (Zoo3&4P 06) as the Elective & Practical papers** and the wordings ““ **The Elective courses offered for the programme are Parasitology at Sree Narayana College and Entomology at Govt.Brennen College.**”to be incorporated in the introduction page of the Syllabus of M.Sc Zoology Programme as recommended by the BOS under Credit Based Semester System in affiliated colleges to be implemented w.e.f. 2016 admission, subject to report to the Academic Council.

4. The U.O as per paper (2) stands modified to this extent.

(P.T.O)

5. Orders are, therefore, issued accordingly.

6. The modified pages of the Scheme & Syllabus are appended h/w



Sd/-
JOINT REGISTRAR (ACADEMIC)
For REGISTRAR

To:

The Principals of Colleges offering M.Sc Zoology Programme.

Forwarded /By Order

Copy to:

1. The Examination Branch (through PA to CE)
2. The Chairman, BOS in Zoology(PG)
3. PS to VC/PA to PVC
4. PA to Registrar/PA to CE.
5. JR/AR-I (Academic).
6. Computer Programmer (for uploading in the website)
7. SF/DF/FC


SECTION OFFICER



POST GRADUATE PROGRAMME IN ZOOLOGY

Introduction

The syllabi of M.Sc. programme in Zoology offered in the affiliated colleges of the university under semester system has been revised in the light of the decision of the Board of studies meeting in zoology (PG). The grading system of evaluation was introduced in Kannur University at the under graduate level during the academic year 2008-09. This was followed by the implementation of Choice Based Credit Semester System in 2009-10. In continuation to the academic reforms at the undergraduate level, **Credit Based Semester System** is being introduced at the Postgraduate level with effect from 2014-'15, restructuring the entire M.S Zoology programme.. The revised syllabi are to be effective from 2014 admission onwards. In the revised curriculum, M.Sc. Zoology programme has 11 core theory courses, 3 elective theory courses and 6 practical courses, and one dissertation/project course. The total marks for the entire course shall be 1500 and total credit for the entire course shall be 80. 20% of marks shall be allocated for internal assessment of theory and practical papers each.

While framing the courses, due meaning has been given to the thrust areas in Zoology/Life sciences such as Molecular biology, Biotechnology, Environmental biology and Biodiversity, Systematic Zoology, Microbiology etc. Topics from the C.S.I.R. NET/JRF syllabus in Life sciences has also been incorporated in various courses considering the future prospects of the students. The Elective courses offered for the programme are **Parasitology at Sree Narayana College and Entomology at Govt.Brennen College** . Students are required to submit a collection of 20 specimens related to the elective subject as part of the practical course. An independent **project/dissertation** with 3 credits form an important component of the programme in-order to inculcate research aptitude among students . Students are required to undertake a compulsory study tour and a report of tour has to be presented.

The scheme, detailed syllabi and pattern of question papers are presented herewith.

KANNUR UNIVERSITY
Scheme of M.Sc. Zoology Programme
(2016 Admission onwards)

M.Sc. ZOOLOGY – SCHEME OF COURSES UNDER CBSS – 2016 Onwards.

Semester	Course code	Title of Courses	Marks			Credits	
			Internal	External	Total		
I	ZOO1C 01	Cell Biology and Genetics	15	60	75	4	
	ZOO1C02	Biological Chemistry	15	60	75	4	
	ZOO1C03	Systematic Zoology and Behavioral Science	15	60	75	4	
	ZOO1C04	Microbial Science	15	60	75	4	
	ZOO1 &2P 01	Cell Biology, Genetics & Molecular Biology	---	----	----	-	
	ZOO1 &2P 02	Biological Chemistry, Biophysics & Biometry	---	----	----	-	
	ZOO1 &2P 03	Environmental Biology& Systematic Zoology	--	---	---	-	
		Total for I Semester	60	240	300	16	
II	ZOO2C 05	Molecular Biology & Molecular Evolution	15	60	75	4	
	ZOO2C06	Biophysics and Biometry	15	60	75	4	
	ZOO2C07	Environmental Biology	15	60	75	4	
	ZOO2C08	Immunology	15	60	75	4	
	ZOO1 &2P 01	Cell Biology, Genetics & Molecular Biology	10	40	50	3	
	ZOO1 &2P 02	Biological chemistry, Biophysics & Biometry	10	40	50	3	
	ZOO1 &2P 03	Environmental Biology& Systematic Zoology	10	40	50	3	
	ZOO2C09	Viva-voce	5	20	25	1	
		Total for II Semester	95	380	475	26	
	III	ZOO3C 10	Animal Physiology	15	60	75	4
ZOO3C 11		Developmental Biology and Endocrinology	15	60	75	4	
ZOO3E 01		General Parasitology and Helminthology / General Entomology	15	60	75	4	
ZOO 3 &4P 04		Animal Physiology	...	...	...	..
ZOO3 &4P 05		Developmental Biology, Histology & Histochemistry	...	...	...	..
ZOO3 &4P 06		Parasitology / Entomology	...	...	...	..
ZOO3 &4 Pr.01		Project/Dissertation	...	...	...
		Total for III Semester	45	180	225	12	
IV		ZOO4C 12	Biotechnology and Bioinformatics	15	60	75	4
		ZOO4E 02	Protozoology, Medical and Veterinary Entomology / Insect Physiology	15	60	75	4
	ZOO4E 03	Physiology, Biochemistry and Genetics of parasites / Agricultural Medical & Forensic Entomology	15	60	75	4	
	ZOO 3 &4P 04	Animal Physiology	10	40	50	3	
	ZOO3 &4P 05	Developmental Biology. Histology & Histochemistry	10	40	50	3	
	ZOO3 &4P 06	Parasitology / Entomology	10	40	50	3	
	ZOO3 &4P07	Personnel Collections related to Elective Subject	5	20	25	1	
	ZOO3 &4 Pr.01	Project/Dissertation	15	60	75	3	
	ZOO4 C 13	Viva-voce	5	20	25	1	
		Total for IV Semester	100	400	500	26	
Total I, II, III & IV Semester			300	1200	1500	80	

Syllabus

M.Sc. Zoology

Elective paper: Entomology

Semester III

ZOO 3E 01: GENERAL ENTOMOLOGY

(Theory-70 hrs- Credits-4)

(70 Hours)

1. External morphology

(25Hrs)

1.1. Segmentation and division of the body

1.2. General morphology of the head –

1.2.1. Opisthognathous, hypognathous and prognathous

1.2.2. Head segmentation- theories about the segmentation of the head

1.2.3. Head skeleton- different sutures and sclerites

1.2.4. Tentorium

1.2.5. Modification in head capsules

1.2.6. Cephalic appendages

1.2.6.1. Antenna: structure, function & types

1.2.6.2. Gnathal appendages: types, structure & function

1.2.6.3. Mouth parts of insects

1.2.7. Cervix

1.3. Thorax

1.3.1. Thoracic segmentation

1.3.2. Thoracic skeleton

1.3.3. Endothorax

1.3.4. Thoracic appendages

1.3.4.1. Modifications of thoracic legs

1.3.4.2. Wings: origin and evolution of wings, structure, venation, wing coupling apparatus, morphological variations

1.4. Abdomen

- 1.4.1. Segmentation
- 1.4.2. Skeletal composition
- 1.4.3. Pregenital and post genital segments
- 1.4.4. Abdominal appendages
- 1.4.5. External genitalia: male and female

2. Insect classification

(30hrs)

2.1. Introduction to classification of insects.

Mention Apterygota, Exopterygota, Endopterygota, Hemimetaboly and Holometaboly.

2.2. Apterygota

Diagnostic characteristics, biology and economic importance of the following Orders: Collembola, Protura, Diplura, Archeognata (Microcoryphia) and Thysanura. Locomotion in Collembola.

2.3. Exopterygota: Diagnostic characteristics, biology and economic importance of the following Orders and families mentioned under each order.

1. Ephemeroptera.
2. Odonata-mention dragon flies and damsel flies, mouthparts of naiads, mating behavior.
3. Isoptera- Castes, Termitarium, economic importance.
4. Phasmida.
5. Blattaria- mention economic importance and important species.
6. Mantodea & Mantophasmatodea.

7. Orthoptera- Families: Acrididae, Tetrigidae, Tettigonidae, Gryllidae, Gryllotalpidae. Stridulatory organs in Orthoptera; Locusts.
8. Thysanoptera.
9. Hemiptera; Families- Cicadidae, Jassidae, Cercopidae, Membracidae, Aphididae, Nepidae, Gerridae, Pentatomidae, Reduviidae. Medical importance Of Reduviidae; Polymorphism in Aphids; Stridulation in Cicada.
10. Psocoptera.
11. Phthiraptera- mention *Pediculus humanus* and its parasitic adaptations.
12. Dermaptera- Sexual dimorphism and parental care.
13. Plecoptera.
14. Embioptera.
15. Zoraptera.

2.4. Endopterygota : Diagnostic characteristics, biology and economic importance of the following Orders and families mentioned under each order.

1. Coleoptera- Families: Curculionidae, Scarabaeidae, Carabidae, Cerambycidae, Lampyridae, Chrysomelidae, Elateridae, Meloidae. Mention cantharidin and bioluminescence.
2. Lepidoptera. Butterflies and Moths. Families: Noctuidae, Sphingidae, Saturniidae, Pyralidae, Papilionidae, Nymphalidae, Hesperidae, Pieridae, Lycaenidae, Geometridae .
3. Hymenoptera: Families: Vespidae, Sphecidae, Megachilidae, Apidae, Eumenidae, Xylocopidae, Formicidae, Evanidae, Braconidae, Ichneumonidae, Chalcididae, Eulophidae, Eurytomidae, Pteromalidae. Parasitic hymenoptera and biological control.
4. Diptera: Suborders: Nematocera and Brachycera. Families: Muscidae, Culicidae, Calliphoridae, Sarcophagidae, Simuliidae, Tipulidae, Glossinidae, Drosophilidae, Psychodidae.
5. Siphonoptera.
6. Strepsiptera.
7. Neuroptera.
8. Mecoptera.
9. Megaloptera.

10. Raphidioptera.

11. Trichoptera.

3. Ecology and Behaviour(15hrs)

3.1. Aquatic insects

3.1.1. Factors influencing the aquatic life

3.1.2. Food capture; modifications

3.1.3. Respiration in semi-aquatic and in truly aquatic insects

3.1.4. Oviposition methods

3.1.5. Anchorage, locomotion

3.1.6. Adaptations of swimming forms

3.2. Gall forming insects

3.2.1. Definition and features

3.2.2. Formation, economic importance

3.2.3. Common gall pests

3.2.4. Extent of gall making habits

3.2.5. Gall as dwelling place, the position of gall

3.2.6. Classification of galls by Orders

3.2.7. Adaptation for the gall making habits

3.2.8. Origin and types of galls (open & closed)

3.2.9. Physiology of gall formation

3.3. Leaf mining insects

3.3.1. Definition and identification

3.3.2. Forms of leaf mines, economic importance

3.3.3. Extent of the leaf mining habits

3.3.4. Feeding habits and frass disposal

3.3.5. Ecological aspects of leaf mining

3.4. Insect-plant interdependence(co-evolution)

3.5. Social insects – social organisation

3.5.1 Caste differentiation

3.5.2 Aspects of social behaviour with reference to honey bee, termite and ant

3.6. Communication – acoustic, visual, tactile and chemical method (pheromones)

3.7. Adaptations of parasitic and predatory insects

References

1. Ananthakrishnan, T.N. (1992): Dimensions of Insect-Plant Interactions, Oxford & IBH Publishing Co. Pvt. LTD.
2. Aswathy, V.B. (1998) Introduction to General and Applied Entomology.ISBN.
3. Borror, D.J. and DeLong,D.M.(1964). An Introduction to the study of Insects. Holt Reineheart and Winston, New York.
4. Carde, R, T. and Bell, W.J. (1995): Chemical Ecology of Insects-2.Chapman and Hall, New York
5. Essig, E. O. (1974): College Entomology. Mac Millon Co. London
6. Richard, W.and Davies, R.G.G.(1977). Imm's general text book of Entomology, 10th edition,Chapman & Hall.
7. Mani,M,S.(1974): Modern classification of Insects. Satish Book Enterprise., Agra.
8. Mani, M.S. (1982): A general text book of entomology, Oxford & IBH, New Delhi.
9. Nayar, K.K., Ananthakrishnan, T.N., & David, B.V. (1976).General and Applied Entomology, Tata Mac Grew Hill. New Delhi.
10. Ross, H.H. et al., A general text book of entomology, John Wiley Sons NY. Scientific Publishers,Jodhpur.
11. Snodgrass, R, E. (1935): Principles of Insect Morphology.MacGrawHillBook.
12. Tembhare, D.B., Modern Entomology, Himalaya publishing House
13. Wilson, E.O. (1972): The Insect societies. Belknap, Harward University Press.
- 14.Gillot, C.(2005).Entomology. 3rded. Springer.
15. Romoser, W.S. and Stoffolano, J.G.(1994). The Science of Entomology.3rded.WCB Publishers, Oxford, England.
- 16.Wigglesworth, V.B. (1964).The life of Insects.Heindenfield and Necolson, London.

Semester IV

ZOO4E02:INSECT PHYSIOLOGY (70 Hours) (Theory-70 hrs- Credits-4)

70 hrs

1. The Integument (6 hrs)

- 1.1. Histology-basic components
- 1.2. Chemical and physical properties
- 1.3. Moulting and sclerotisation
- 1.4. Hormonal control and function

2. Digestion and Assimilation (7hrs)

- 2.1. General structure of alimentary canal: foregut, midgut, hindgut and their modifications
- 2.2. Digestive enzymes and physiology of digestion
- 2.3. Specialized digestion: Digestion of wood, keratin wax and silk, Extra-intestinal digestion
- 2.4. Role of micro flora/ fauna in insect digestion
- 2.5. Assimilation.

3. Respiratory system (6 hrs)

- 3.1. Structure and modification of respiratory system
- 3.2. Closed and open tracheal system
- 3.3. Physical gill and plastron respiration
- 3.4. Diffusion, ventilation, control of ventilation, cyclic release of carbon dioxide

4. Circulatory system (7hrs)

- 4.1. Cellular elements in haemolymph
- 4.2. Composition of haemolymph
- 4.3. Dorsal vessels, accessory pumping sinuses and diaphragm
- 4.4. Heart beat rate and control of heart beat
- 4.5. Course of circulation of haemolymph

5. Excretory system (6 hrs)

- 5.1. Malpighian tubules, Nephrorectal complex and labial glands

5.2. Physiology of excretion

5.3. Synthesis of uric acid and formation of excreta

6. Nervous system (12hrs)

6.1. General structure and organization of central and peripheral nervous system

6.2. Anatomy and histology of brain, ganglia and nerves

6.3. Reception of stimuli and transmission of nerve impulses, transmission at synapse

6.4. Sense organs – anatomy, histology and physiology of mechanoreceptors, chemoreceptors and photoreceptors.

7. Muscular system (5hrs)

7.1 Histomorphology of insect muscles

7.2 Neuromuscular junctions

7.3 Excitation of muscle fibres, activation of muscle fibres, role of fast and slow axons

8. Endocrine and exocrine glands (7hrs)

8.1. Histomorphology of neurosecretory cells and endocrine glands (corpora cardiaca, corpora allata and Prothoracic glands)

8.2. Hormones and their functions

8.3. Mechanism of hormone action

8.4. Pheromones and their function

9. Reproductive system and morphogenesis (8hrs)

9.1. Development of primordial germ cells

9.2. Reproductive system- structure-male and female

9.3 Fertilization and oviposition

9.4 Formation of blastoderm and extraembryonic membranes

9.5. Sex determination and parthenogenesis

10. Embryogenesis (6 hrs)

10.1. Differentiation of germ layers

10.2. Segmentation, appendage formation, organogenesis

10.3. Polyembryony, paedogenesis, viviparity, oviparity, eclosion,

10.4. Postembryonic development-hatching, larval development and control, polyphenism, diapause.

References

1. Beament, J.W.L., Treherne, J. E. and Wigglesworth, V.B.(1972). *Advances in Insect Physiology*, Academic press, London
2. Bursell, E (1970): *An Introduction to Insect physiology*, Academic Press
3. Chapman. R.F.(1998): *The Insects: Structure and Function*.4thed.ELBS ,London.
4. Gilbert, L.I. &Kerkut. G.A. (1985): *Comprehensive Insect Physiology, Biochemistry and Physiology*, Vol. 1-12
5. Pathak, S.C. (Ed) (1986): *Recent advances in Insect Physiology, Morphology And Ecology*. Today and Tomorrow Publishers, New Delhi.
6. Patton, R. (1963): *Introductory Insect Physiology*, Saunders, USA.
7. Richards, O.W. and Davis, R.G. (1977): *Imms General Text Book of Entomology*. Vol.I. Chapman & Hall, London
8. Rockestein, M. (Ed) (1974): *Physiology of Insecta*Vol 1.VI. Academic press, New York
9. Roeder, K. D. (1953): *Insect Physiology*, Wiley, New York.
10. Simpson Stephen (2005): *Advances in Insect Physiology*. Elsevier
11. Tembhare, D.B., *Modern Entomology*, Himalaya publishing House
12. Wigglesworth, V.B. (1972): *Principles of Insect Physiology*, Methue.
13. James, L.N.(2001). *Insect Physiology and Biochemistry*.CRC Press, London. .
14. Romoser, W.S. and Stoffolano, J.G.(1994). *The Science of Entomology*.3rd ed. WCB Publishers, Oxford, England

Semester IV

ZOO 4E 03: AGRICULTURAL, MEDICAL & FORENSIC ENTOMOLOGY

(Theory-70 hrs- Credits-4)

(70 Hours)

1: Insect Pests

(8Hrs)

1.1. Types of damage to plants by insects

(Injury by chewing insects, piercing and sucking insects, internal feeders, subterranean insects, to stored products and indirect effect of feeding)

1.2. Classification of insect pests

(Regular pests, Occasional pests, Seasonal pests, persistent pests, sporadic pests, major pests, minor pests, potential pests, key pests)

1.3. Causes for insect assuming pest status

1.4. Concepts of Economic levels, Economic injury levels, Economic threshold level

1.5. Pest surveillance and forecasting pest outbreak

1.6. Estimation of damage caused by insects to crops

2: Insect pests of crops

(20Hrs)

2.1. Identification, life history, damage and control of major pests of:

2.1.1. Paddy (15 major pests including stem borers, army worm, rice thrips, gallmidge, mealy bug, BPH, green & white leaf hoppers, rice caseworm, rice leaf roller, rice hispa, rice earhead bug, root weevil, rice grass hoppers)

2.1.2. Sugarcane (Major pests including shoot, internode & top borers, white grub, leaf hopper, sugarcane scale, mealy bug, whiteflies)

2.1.3. Cotton (Major pests - Aphid, leaf hopper, thrips, whitefly, Pink spotted and American boll worms, stem weevil, leaf roller)

2.1.4. Coconut (7 pests - Rhinoceros beetle, red palm weevil, black-headed caterpillar, white grub, Scale insect, Lace wing bug, coconut skipper)

2.1.5. Pulses (8 pests - Gram pod borer, plume moth, red gram pod fly, pod borer, spotted pod borer, Blue butterflies, bean aphid, white fly)

2.1.6. Common vegetables

2.1.6.1. Brinjal (shoot & fruit borer, stem borer, spotted leaf beetle, grey weevil, Pumpkin beetle)

2.1.6.2. Tomato (serpentine leaf miner, fruit borer)

2.1.6.3. Gourds (fruitflies, snake gourd semilooper, spotted beetle, Pumpkin beetle)

2.1.6.4. Bhendi (Earias, leaf hopper, Red cotton bug, Grampod borer)

2.1.6.5. Cruciferous vegetables (diamond black moth, cabbage borer, leaf webber, Cabbage green semilooper, Cabbage aphid)

2.1.7. Fruit trees

2.1.7.1. Mango (hopper, flower webber, Leaf webber, gall midges, Nut weevil, stem borer, red tree ant)

2.1.7.2. Cashew (tree borers, Hairy caterpillar, Tea mosquito bug, Apoderus, Leaf miner)

2.1.7.3. Banana (rhizome weevil, banana aphid, spittle bug)

2.1.7.4. Citrus (Fruit sucking moth, citrus butterfly)

2.1.8. Spices

2.1.8.1. Pepper (pollu beetle, shoot borer, Marginal gall thrips)

2.1.8.2. Cardamom (cardamom thrips, rhizome borer, cardamom whitefly, hairy caterpillars, Eupterote and Pericallia)

2.1.8.3. Turmeric and Ginger (Leaf roller, shoot borer)

2.2. Identification, nature of damage & control of Insect pests of Stored Products: rice weevil, sweet potato weevil, tobacco beetle, drug store beetle, pulse beetle, Angoumois grain moth, potato tuber moth, Red flour beetle, rice moth)

3: Principles of Insect pest management

(15 Hrs)

3.1. Prophylactic methods

3.2. Curative or direct methods

3. 2.1. Cultural methods

3. 2.2. Mechanical methods

3. 2.3. Physical methods

3. 2.4. Legal methods

3. 3. Biological control-

3. 3.1. History of biological control, Ecological basis of biological control.

3. 3. 2.Natural enemies (Parasites, Parasitoids, Predators), Feasibility of biocontrol.

3. 3. 3.Applied biological control (Conservation and Enhancement, Importation and Colonization, Mass culture and release).

3.3.4. Importance of systematics, Advantages and disadvantages of biological control.

3. 3.5. Important biocontrol projects undertaken in India by employing parasites and predators.

3. 4. Autocidal control- Sterile male technique and other methods, Chemosterilants, Methods of sterilization, Application, Dynamics, Advantages and disadvantages Examples of autocidal control.

3.5. Insect growth regulators (IGRs) – Brief note on Insect growth hormones and mimics (JH mimic & ecdysone agonists) and chitin synthesis inhibitors as insect control agents.

3.6. Behavioural (pheromonal) control- (Brief note on Trail, Alarm, Aggregation and sex pheromones and the behaviour produced, Mode of application, Pest management with pheromones, Advantages and disadvantages, Examples).

3. 7. Insect attractants: definition, types of attractants, applications in insect pest management, examples, advantages and disadvantages.

3.8. Insect repellents: definition, desirable features of good repellent, types of repellents, applications in insect pest management, examples, advantages and disadvantages.

3.9. Insect antifeedants: definition, examples, applications in insect pest management, advantages and disadvantages

3.10. Microbial control of crop pests by employing Bacteria, Virus and Fungi

Classification of entomophagous Bacteria, Virus, Fungi, Mode of action, formulation, Application, Examples

3.11. Integrated Pest Management- Definition, IPM in Agroecosystem, Kinds of pest,

(Key pests, Occasional pests, Potential pests, Migrant pests) Establishing the need to take action, Guidelines for developing IPM, Tactics in IPM, IPM of Rice.

4. Chemical Control of Insect Pests

(12Hrs)

4.1. Insecticide formulation (Brief note on Emulsifiable concentrates, Water-miscible liquids, Wettable powders, Water soluble powders, Oil solutions, Flowable powders, Aerosoles, Granulars, Fumigants, Ultra-low volume concentrates, Fogging concentrates, Dusts, Poison baits and Slow release insecticides)

4.2. Classification of insecticides.

4.2.1. Based on mode of entry.

4.2.2. Based on mode of action.

4.2.3. Based on chemical nature

4.3. Chemistry, toxicology & mode of action of following class of insecticides;

mention examples for each class.

4.3.1. Synthetic Organic compounds.

4.3.1.1. Organochlorine insecticides.

4.3.1.1.1. DDT.

4.3.1.1.2. BHC.

4.3.1.1.3. Cyclodiene group

4.3.1.2. Organophosphorous insecticides (examples: TEPP, Dichloros, monocrotophos, parathion).

4.3.1.3. Carbamates (special mention of carbofuran; examples: Carbaryl, aprocarb)

4.4. Inorganic compounds as insecticides - arsenic compounds, fluorides,

sulphur compounds

- 4.5. Fumigants – definition, examples, methods of fumigation, hazards of fumigation, advantages and precautions
- 4.6. Botanical insecticides- chemical properties, mode of action and toxicity of the following: Nicotine, Rotenone, Pyrethrum and Neem
- 4.7. Synthetic pyrethroids – definition, uses as insecticides, mode of action (examples: Pyrethrin, allethrin)
- 4.8. Insecticide synergists – definition, types of synergism, mode of action & examples
- 4.9. Insecticide resistance -Genetic, Physiological and biochemical mechanism

6. Medical entomology

(10 hrs)

- 6.1. Insect vectors of human diseases and their biology: (Malaria, Lymphatic filariasis, Dengue, Chikungunya, Zika, Yellow fever, West Nile virus, River Blindness, African sleeping sickness, American sleeping sickness, Kala Azar, Plague, Typhus): Mosquitoes (Anopheles, Aedes, Culex, Mansonia); Sand fly, Flea, Assassin bug, Black fly, Tsetse fly, Head louse.
- 6.2. Mosquito control- Larval and adult control - Chemical, Biological and environmental.
- 6.3. Insects related to Myiasis
- 6.4. Poisonous insects: Bees, wasps and ants- Anaphylaxis.
- 6.5. Maggot therapy (Use of maggots in treatment).

7. Forensic Entomology

(5 hrs)

- 7.1: Introduction to Forensic entomology
- 7.2: Insects used in forensic entomology (Dipterans and coleopterans)
- 7.3: Succession of insect fauna on a cadaver.
- 7.4. Methods of forensic entomology: Detection of time of death, mode of death and place of death. Case histories (At least 3).

References:

1. Ananthkrishnan, T.N. (1977): Insect and Host Specificity, Mc Millan Co, India Ltd.
2. Ananthkrishnan, T.N.(1992).Emerging trends in Biological Control of Phytophagous Insects. Oxford and IBH Publishing Co. Pvt. Ltd.,New Delhi.
3. Atwal, A.S., Agricultural Pests of India and South East Asia. Kalyanai Publishing, New Delhi.
4. Brown, A.W.A. (1978): Ecology of Pesticides, John Wiley Sons, N.Y.
5. D'Brien, R.D. (1967): Insecticide- action and metabolism, Academic Press, N.Y.
6. Edwards, C.A. (1973): Persistent pesticides in the environment, C.R.C. Press
7. Dent.D.(1991). Insect Pest Management. CAB International,UK.
8. Harward, R.F. and James, M.T. (1979): Entomology in Human and Animal Health. 7th Edn. CtherMc Millan Publishing London
9. Hill, D.S. and Waller, Insect Pests of Agriculture and their Control
10. Hill, D.S., Agricultural Entomology
11. Hill, D.S., Agricultural Insect Pests of the Tropics and their control C.V.P.
12. Matsumura, F. (1975): Toxicology of Insecticides – Plenum
13. Metcalf. G.L.andFlint.W.P.(1962). Destructive and Useful Insects, their Habits and Control. Tata McGraw Hill Publishing.Co.Ltd. N.Y.
14. Metcalf, R.L. and Luckman, W.H., Introduction to Insect Pest management, 3rd Edn. John Wiley & Sons
14. Moriarty, F., (1975): Organochlorine insecticides persistent organic pollutants, Academic Press, INC, London
15. Nair, M.R.G.K. (1975): Insect and Mites of Crops in India, ICAR, New Delhi.
16. O'Brian, R.D. and Yamanots, I.(1970): Biochemical Toxicology of Insecticides, Academic Press INC, London
17. Pedigo, L.P. (1996): Entomology and Pest Management Practice. Hall India Pvt. Ltd. New Delhi.
18. Perry, A.S., Yamamoto, I., Ishaaya, I. and Perry, R. (1998): Insecticides in Agriculture and Environment – Retrospects and Prospects, Narosa Publishing House, New Delhi
19. Pradhan, S. (1969), Insect pests of Crops, National Book Trust, New Delhi. 20. Romoser, W.S. and Stoffalano, J.G. (1994). The Science of Entomology. 3rd Edn. Wm. C. Brown Publishing
20. Srivastava, K.P. (1996): A Text Book of applied Entomology. Vol.1&II, Kalyani publishers, Ludhiana.
21. Thacker, J.R.M.(2002).An Introduction to Arthropod Pest Control. Cambridge University Press,UK.
22. Vasantharaj David and Kumaraswami, Hand Book of Economic Zoology.
23. Walter,G. (2003). Insect Pest Management and Ecological Research,Cambridge University Press,U K.

Medical entomology

1. Kettle D.S. (1995). Medical and Veterinary Entomology. 2nd Ed. CAB international.
2. Jeremy Farrar et al (2015). Manson's Tropical Diseases, 23rd Edition. Elsevier. Pp. 1552
3. Sun, Xinjuan; Jiang, Kechun; Chen, Jingan; Wu, Liang; Lu, Hui; Wang, Aiping; Wang, Jianming (2014). A systematic review of maggot debridement therapy for chronically infected wounds and ulcers. International Journal of Infectious Diseases 25: 32–7
4. Mike Service (2008). Medical Entomology for students. 4th ed. Cambridge university Press. U.K.

Forensic Entomology

1. Kenneth G.V. Smith (1987). A manual of Forensic Entomology . Cornell Univ Pr. Pp.225.
2. Sumodan P.K. (2002). Insect Detectives. Resonance .
3. Gennard, D.E.(2007). Forensic Entomology.-An Introduction. John Wiley.
4. Wall, Richard and Shearer, David.(1998). Veterinary Entomology. Chapman & Hall, London.
5. Smith, K.V.G.(1986). A Manual of Forensic Entomology. British Museum Natural History.
6. David, B.V. and Ananthkrishnan, T.N.(2004). General and Applied Entomology. 2nd ed. Tata McGraw Hill publishing Co. Ltd. New Delhi.

Semester IV

ZOO 3 & 4 P 06: ENTOMOLOGY

(Credits-3)

1. Dissection of different types of mouth parts.
2. Dissection and comparison of legs of different insects.
3. Study of the different types of antennae- prepare permanent slides of at least 5 types of antennae (To be submitted during practical examination)
4. Dissection of sound-producing organs of Orthopterans.
5. Mounting of stinging apparatus – Honeybee
6. Preparation of keys for identification of insects up to family level (common families of Orders Orthoptera, lepidoptera, Hemiptera and Coleoptera).
7. Use of Y-tube olfactometer to study responses to olfactory cues
8. Preparation of stained slides of insect haemolymph and identification of haemocytes.
9. Detection of digestive carbohydrases in the alimentary canal of insect.
10. Study of salient features of any 10 major insect pests.
11. Study of life histories of insect pests (at least two) and the damages caused by them.
12. Study of various insecticide appliances and their applications in the field.
13. Estimation of LD 50 values for some insect pests
14. Setting up and collection of insects with Malaise trap, Pitfall traps, Light trap, Sweep net, Yellow pan trap
15. Collection and identification of eggs/larvae of mosquitoes (Genus level).
16. Collection and preservation of insects. Students shall submit insects belonging 15 orders and 30 families (including 5 whole mounts) at the time of practical examination}.
17. Collection, identification and preservation of pests of local crops. The collection should include a minimum of 20 crop pests. The collection has to be submitted during the practical examination.

Question Papers

ZOO 3E 01: GENERAL ENTOMOLOGY

Time : 3 Hours

Maximum 60 Marks

1. Answer any TWO out of four questions - 2 x 12 = 24 Marks
2. Answer any TWO out of four questions -2 x 8 = 16 Marks
3. Answer any FOUR out of six questions -4 x 5 = 20 Marks

Model Question Paper

ZOO 3E 01: GENERAL ENTOMOLOGY

Time: 3 Hours

Maximum: 60 Marks

I. Answer any two of following;

1. Make a critical account on the various theories of head segmentation in insects.
2. Explain the structure, function and diversity of antennae in insects.
3. Substantiate the role of pheromones in insect communication.
4. Explain the social organization in termites. Add a note on their reproductive behaviour.

(2X12=24 Marks)

II. Answer any two of following:

5. Explain wing coupling mechanism in Lepidoptera
6. Describe the mouthparts of diptera.
7. Explain respiration in aquatic insects.
8. Describe the modifications of thoracic legs.

(2x8=16Marks)

III. Answer any four of following:

9. Distinguish between prognathous and hypognathous head
10. Comment on endothorax in insects.
11. Give an account of wingless insects
12. Give brief notes on feeding habit and frass disposal in leaf mining insects
13. Write an account of gall forming insects.
14. 'Locusts are gregarious phase of grass hoppers'. Explain.

(4X5= 20 Marks)

Zoo4E02 : INSECT PHYSIOLOGY

Time: 3Hours

Maximum 60 Marks

1. Answer any Two out of four questions – $2 \times 12 = 24$ Marks
2. Answer any Two out of four questions – $2 \times 8 = 16$
3. Answer any Four out of six questions – $4 \times 5 = 20$ Marks

Model Question Paper

ZOO4E02 : INSECT PHYSIOLOGY

Time: 3Hours

Maximum 60 Marks

I. Answer any two of following

1. Discuss the mechanism of respiration in insects.
2. Explain the structure, function and diversity of antennae in insects.
3. Discuss the role of hormones in insect metamorphosis.
4. Describe segmentation, appendage formation and organogenesis in insects...

(2x12=24)

II. Answer any two of following:

5. Explain the role of microbiota in digestion
6. Describe the control of heart beat in insects.
8. Describe the histomorphology of skeletal muscles in insects.

(2x8=16 Marks)

III. Answer any four of following:

9. Give an account of haemolymph composition
10. Explain nervous control of ventilation
11. Write an account of chemical and physical properties of insect integument
12. Give an account of polyembryony
13. Describe different types of ovaries in insects.
14. Explain mechanism of light production.

(4x5=20)

ZOO 4E 03: AGRICULTURAL, MEDICAL & FORENSIC ENTOMOLOGY

Time : 3 Hours

Maximum 60 Marks

1. Answer any TWO out of four questions - $2 \times 12 = 24$ Marks
2. Answer any TWO out of four questions - $2 \times 8 = 16$ Marks
3. Answer any FOUR out of six questions - $4 \times 5 = 20$ Marks

Model Question Paper

ZOO 4E 03: AGRICULTURAL, MEDICAL & FORENSIC ENTOMOLOGY

Time: 3 Hours

Maximum: 60 Marks

I. Answer any two of following;

1. Explain epidemiology, clinical aspects and treatment of malaria.
2. Methods in control of mosquitoes
3. Morphological adaptations of insect vector
4. DNA techniques in forensic entomology

(2X12=24 Marks)

II. Answer any two of following:

5. Treatment and preventive measures of Trypanosomiasis
6. Explain the use of insects as tools in forensic science
7. Insects of veterinary importance
8. Describe the taxonomy and biology of Tabanids

(2x8=16Marks)

III. Answer any four of following:

9. Mechanical and biological vectors
10. Microfilariae
11. Dengue fever
12. Pink eye disease
13. Sleeping sickness
14. Japanese encephalitis

(4X5= 20)

