EXTENDED LECTURE OUTLINE

ENT6 121 Fundamentals of Entomology (2+1)

1. Position of the insect in Animal kingdom.
2. Dominance of insects in the Animal Kingdom: Factors responsible for dominance.
3. Classification of phylum Arthropoda up to classes.
4. General morphology of insects: Body division and segmentation *viz*., Primary segmentation and Secondary segmentation. (Grasshopper and Cockroach)
5. Structure and functions of body wall and its appendages.
6. Definition of molting and steps in molting process.
7. Structure of Insect Head: Areas and sutures, appendages of the head (antenna, mouth parts and eyes).
8. Structure of typical antenna, types of antenna: Modifications of insect antennae with examples.
9. Classification of mouth parts: General structure of a typical biting and chewing type of insect mouth parts (Grasshopper/Cockroach).
10. Types of mouth parts- piercing and sucking type (true bugs, female mosquito, headlouse and flea), lacerating and sucking type (Thrips), chewing and lapping (honey bee), sponging and lapping type (house fly) and Siphoning type (moths & butterflies).
11. Structure of Thorax and its appendages, structure of typical leg and its modification with suitable examples.
12. Wings: Structure of typical wing, wing venation, wing modifications and wing coupling mechanisms.
13. Structure of abdomen and its appendages, modifications of abdomen. Pre-genital, genital and post-genital appendages; structure of male and female genitalia.
14. Sensory organs in insects: Structure and function of Mechanoreceptors, Auditory receptors, Chemo receptors, Thermo receptors, Photo receptors.
15. Metamorphosis in insects – definition, types of metamorphosis with examples. Diapause in insects.
16. Internal anatomy- Digestive, Circulatory, Respiratory, Nervous, Excretory, Reproductive and Glandular systems.

17. Systematics: Taxonomy-definition, importance, classification, objectives of classification, guidelines, binomial nomenclature as per ICZN, Type concept in nomenclature.
18. Definitions of Species, Sub species, Genus, Tribe, Family, Order.
19. Classification of insects as per Kristensen's classification.
20. Study of Major Orders of Agriculturally Important Insects:
    Study of insect orders Odonata, Blattodea (including Isoptera) and Mantodea
    a. Identification characters of the order
    b. Economic importance of the order
21. Study of the order Orthoptera
    a. Identification characters of the order
    b. Classification & study of agriculturally important families viz.,Tettigonidae, Acrididae, Gryllidae and Gryllotalpidae
    c. Economic importance of the Order and Important Families of the order Orthoptera
22. Order Hemiptera:
    a. Identification characters of the order
    b. Economic importance
    c. Classification
23. Suborder Heteroptera: study of agriculturally important families
    i. Pentatomidae
    ii. Coreidae
    iii. Cimicidae
    iv. Pyrrhocoridae
    v. Lygaeidae
    vi. Miridae
    vii. Reduviidae
24. Suborder Homoptera: study of agriculturally important families
    i. Cicadellidae
    ii. Cicadidae
    iii. Delphacidae
    iv. Membracidae
    v. Lophopidae
    vi. Aphididae
    vii. Psyllidae

viii. Aleyrodidae

ix. Coccidae

x. Pseudococcidae

xi. Diaspididae

25. Study of the order Thysanoptera (Thripidae)

a. Identification characters of the order

b. Classification & Economic importance of the order Thysanoptera

Study of the order Neuroptera

a. Identification characters of the order and agriculturally important families viz., Chrysopidae, Hemerobiidae

b. Economic importance

26. Study of the order Coleoptera:

a. Identification characters of the order

b. Economic importance and

c. Classification of the order

Major agriculturally important Families

i. Carabidae
ii. Scarabaeidae
iii. Coccinellidae
iv. Cerambycidae
v. Bruchidae
vi. Chrysomellidae
vii. Curculionidae
viii. Buprestidae

27. Study of the order Lepidoptera:

a. Identification characters

b. Economic importance

c. Classification of the order

d. Characters of major agriculturally important families

i. Nymphalidae
ii. Peiridae

iii. Papilionidae
iv. Lycaenidae
v. Hesperidae
vi. Gelechiidae
vii. Pyralidae
viii. Saturniidae
ix. Bombycidae
x. Sphingidae
xi. Arctiidae
xii. Noctuidae
xiii. Crambidae

28. Study of the order Diptera:
    a. Identification characters
    b. Economic importance and
    c. Classification of the order
    d. Characters of major agriculturally important families
    i. Culicidae
    ii. Cecidomyiidae
    iii. Tabanidae
    iv. Asilidae
    v. Syrphidae
    vi. Tephritidae
    vii. Agromyzidae
    viii. Tachinidae
    ix. Sarcophagidae
    x. Muscidae
29. Study of the order Hymenoptera:
    a. Identification characters
    b. Economic importance;
    c. Classification and
    d. Characters of major agriculturally important families
    i. Tenthredinidae
    ii. Ichneumonidae

iii. Braconidae
iv. Trichrogrammatidae
v. Chalcididae
vi. Bethylidae
vii. Formicidae
viii. Vespidae
ix. Apidae

30. **INSECT ECOLOGY:** Definition, Types of Ecology (Autecology and Synecology), importance of insect ecological studies in IPM.

. Terminologies used in Ecology: Agro Ecosystem, Population, Community, Habitat, Niche, Ecosystem, Biosphere, Symbiosis, Mutualism, Phoresy and Crypsis.

31. Environment and its components: Effect of Abiotic factors such as temperature, Relative humidity, Rain fall, Light, wind, soil and topography on insect growth and development.

32. Effect of Biotic factors – food, natural enemies and their interactions.

Food: Intra and interspecific interactions

33. Categories of pests

Classification of pests

- ✓ Based on the occurrence: Regular, Occasional, Seasonal, Persistent and sporadic pests with examples.
- ✓ Based on extent of infestation/level of infestation: Epidemic and Endemic pests with examples.
- ✓ Based on the economic importance: Major, Minor and negligible pests with examples.

Causes for outbreak of insect pests

34. Insecticides and their formulations:

Insecticides classification: Based on mode of entry, mode of action and Chemical nature.

35. Insecticides formulations: Solid formulations - Dusts, Granules, Wettable powders, Wettable granules, Soluble powders, Soluble granules; Liquid formulations- Emulsifiable concentrates, Soluble concentrates, Soluble liquids, Flowables; Gaseous formulations- Aerosols, Fumigant

Practical:

1. Methods of collection and preservation of insects including immature stages
2. External features of Grasshopper/Cockroach
3. Types of insect mouth parts
4. Types of insect antennae and legs
5. Wing venation, types of wings and wing coupling apparatus.
6. Types of insect larvae and pupae
7. Dissection of digestive system of insects (Cockroach)
8. Study of characters of the orders Odonata, Blattodea, Mantodea, Orthoptera
9. Study of characters of the orders Hemiptera and its economically important families
10. Study of characters of the orders Thysanoptera, Neuroptera and their economically important families
11. Study of characters of the order Coleoptera and its economically important families
12. Study of characters of the order Lepidoptera and its economically important families
13. Study of characters of the order Diptera and its economically important families
14. Study of characters of the order Hymenoptera and its economically important families
15. Insecticides classification: Chemical nature

    Insecticides formulations: Solid formulations, Liquid formulations, Gaseous formulations
16. Pesticide appliances and their maintenance- Sprayers and dusters

Classification of sprayers – High volume, Low volume, Ultra-low volume sprayers with examples

17. Sampling techniques for estimation of insect population and damage