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Model Answer of AS-2982

B.Sc. (R.T.) III Sem.

RTZ-303: Anatomy and Physiology of Insects

Section - A'

Q.1. Objective Type Questions:

- (i) Mesothorax and Metathorax
- (ii) Siphoning
- (iii) Haemocoel
- (iv) None
- (v) Malpighian tubules
- (vi) Gizzard
- (vii) Ommatidia
- (viii) Proprioceptors
- (ix) Phytotoxemia
- (x) All

Section - B

Short answer type questions:

Q.2. Describe Segmentation and Tagmosis:

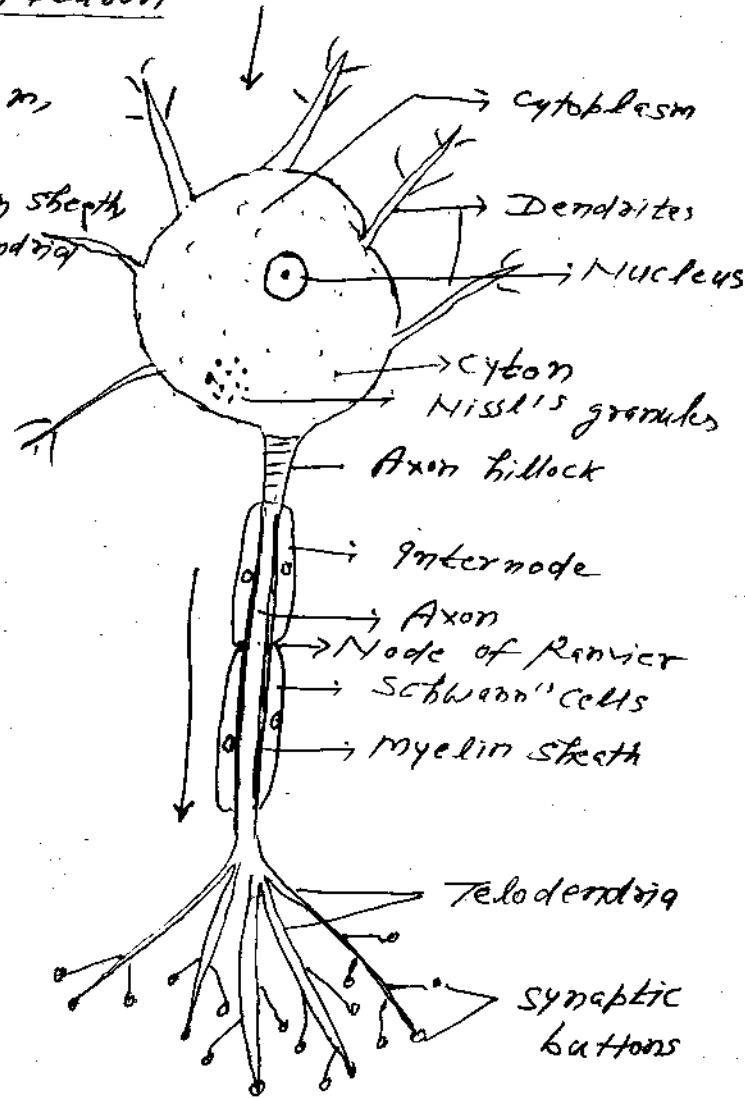
Segmentation → Division of the body into segments like head, thorax and abdomen.

Tagmosis → The grouping of segments into functional regions is known as tagmosis. e.g. Head, Thorax & Abdomen.

- (a) Head → Structure, Orientation, eyes, antennae, mouth parts
- (b) Thorax → Segmentation, wings, legs
- (c) Abdomen → Non-genital & genital appendages

Q.3. Describe structure of a Neuron

- (a) Cyton → Nucleus, Neuroplasm, Dendrites, Nissl's granules
- (b) Axon → Schwann cells, Myelin sheath, Node of Ranvier, Telodendria
- (c) Dendrites / Dendrites →



- Types of Neurons

- (a) Apolar
- (b) Unipolar
- (c) Pseudobipolar
- (d) Bipolar
- (e) Multipolar

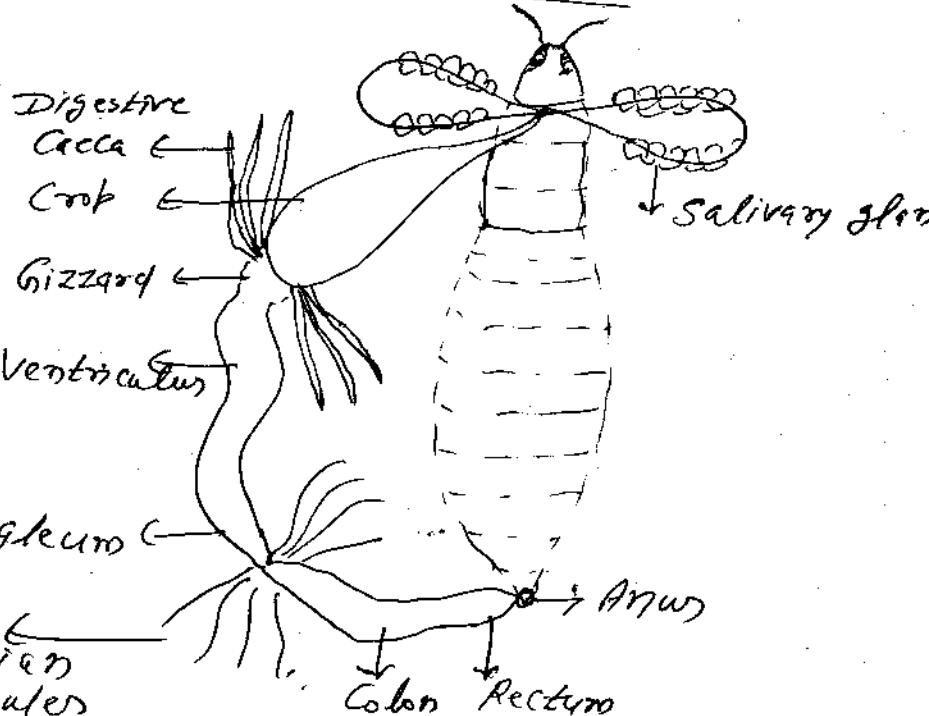
- Sensory Neuron
- Motor Neuron
- Mixed Neuron
- Internuron

(Multipolar Neuron)

Q.4. Describe digestion of food in an insect.

- Ingestion of food
- Digestion of food
- (a) Digestion of Carbohydrates:

- Starch $\xrightarrow{\text{Amylase}}$ Maltose
- Cellulose $\xrightarrow{\text{Cellulase}}$ Glucose
- Chitin $\xrightarrow{\text{Chitinase}}$ Glucose + Glucosamine
- Maltose $\xrightarrow{\text{Maltase}}$ Glucose
- Sucrose $\xrightarrow{\text{Sucrase}}$ Glucose + Fructose
- Lactose $\xrightarrow{\text{Lactase}}$ Galactose + Glucose



⑥ Digestion of Proteins:

Protein $\xrightarrow{\text{Protease}}$ Peptides + Proteases

Polypeptides $\xrightarrow{\text{Carboxypeptidase}}$

Polypeptides $\xrightarrow{\text{Aminopeptidase}}$ Amino acids

Amino acids

- certain insects can digest keratin and Fibroin, etc.

⑦ Digestion of Lipids:

Lipids $\xrightarrow{\text{Lipase}}$ Fatty acids and glycerol.

- Absorption of Digested food -

- chiefly in mid gut
- mainly by microvilli
- Absorption may be active or passive
- Glucose and Fructose \rightarrow by simple diffusion
- Amino acids \rightarrow in mid gut and caeca
- Lipids \rightarrow may be absorbed as such
- Water \rightarrow mainly in hind gut
- Minerals \rightarrow mainly in hind gut.

Q.5. Describe structure and functions of fat body:

- These are white, large tissue masses lying in the perivisceral sinus around the alimentary canal and the body wall. (Urate cells (mesodermal in origin))

- Covered by lobed membranous connective tissue.

- Each lobe contains trophocytes, Mycetocytes, oenocytes and urate cells.

- Trophocytes \rightarrow abundant, store

fat, proteins and glycogen and Trophocyte release food into the blood whenever needed.

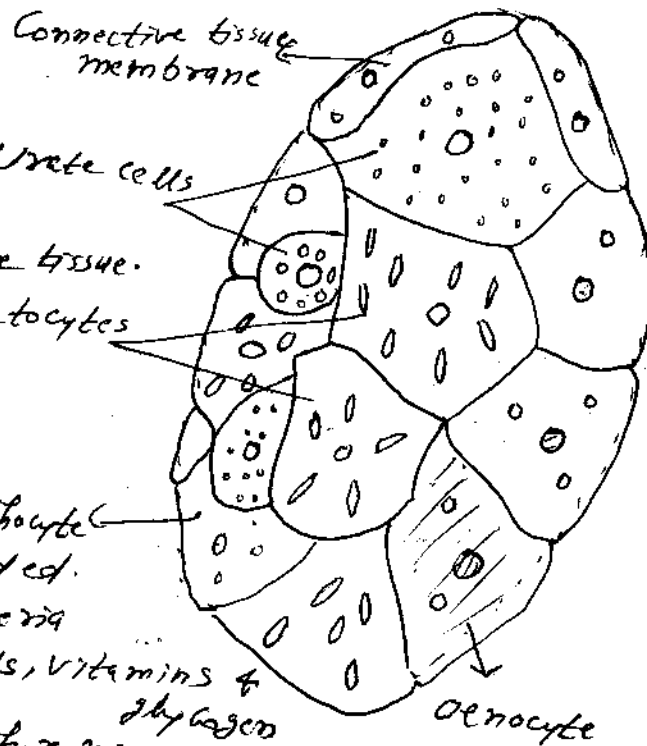
- Mycetocytes \rightarrow Harbour symbiotic bacteria

which helps in the synthesis of amino acids, vitamins & glycogen

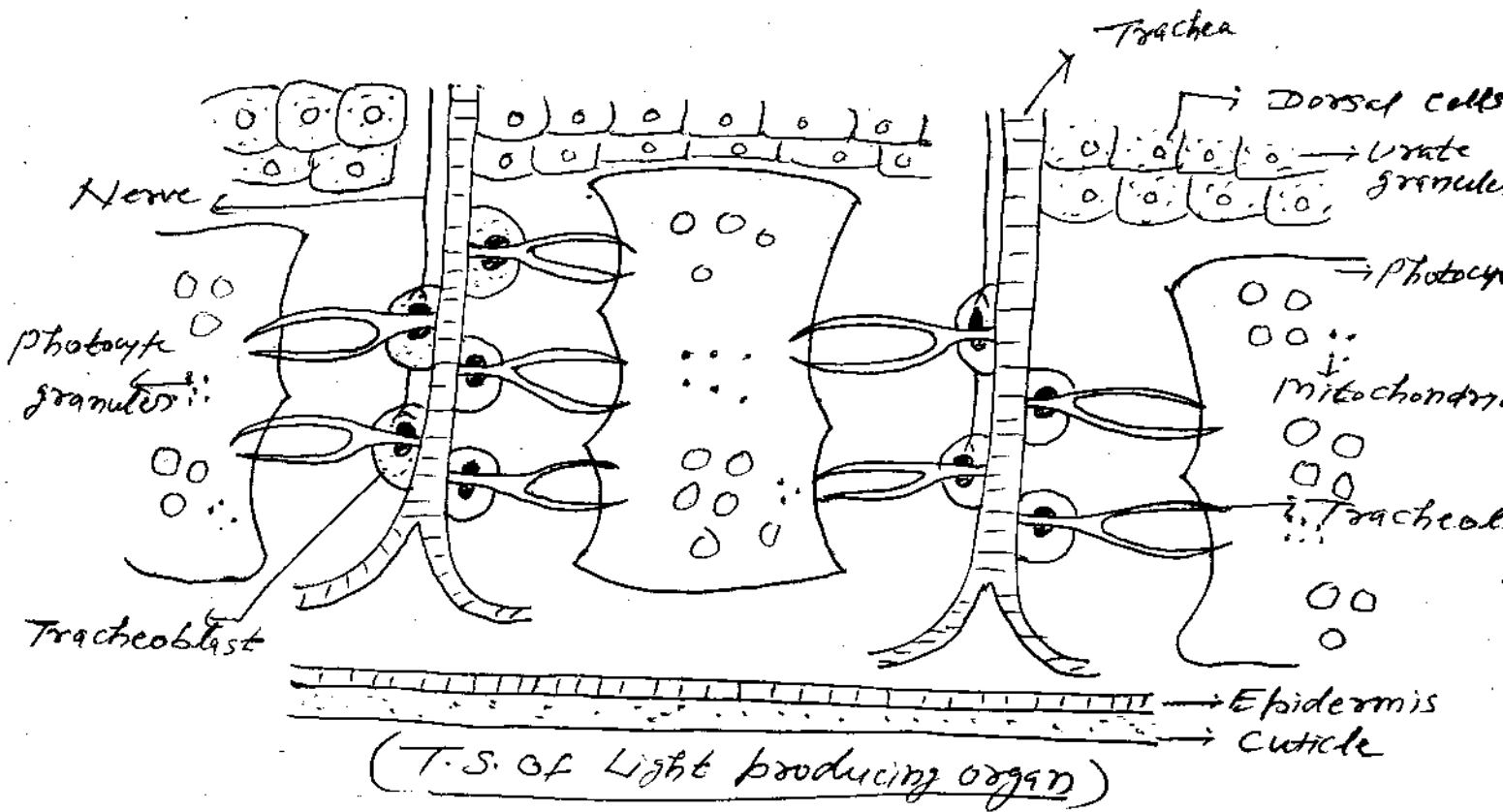
- Oenocytes \rightarrow Synthesize lipoproteins for new epicuticle

- Urate cells \rightarrow store urate granules.

- fat bodies are analogous to vertebrate liver.



Q.6. Draw a well labelled diagram of Light producing organ:



Q.7. Write about beneficial insects of man:

- Introduction
- ① Honey bees → Wax, Honey, Propolis, Pollination, etc.
- ② Silk moth → Silk and its types
- ③ Lac insect → Lac
- ④ Scale insects → Dyes
- ⑤ Blister beetle → Cantharidine oil
- ⑥ Pollinating insects → Bees, Wasps, beetles, flies, etc.
- ⑦ Insects as food →
- ⑧ Insects as ornaments → Beetles, flies etc.
- ⑨ Singing insects → Crickets, Cicadas, etc.
- ⑩ Insects in medicines → Bee venom, silkworm cocoon, Bee wax, Lytta beetle, etc.

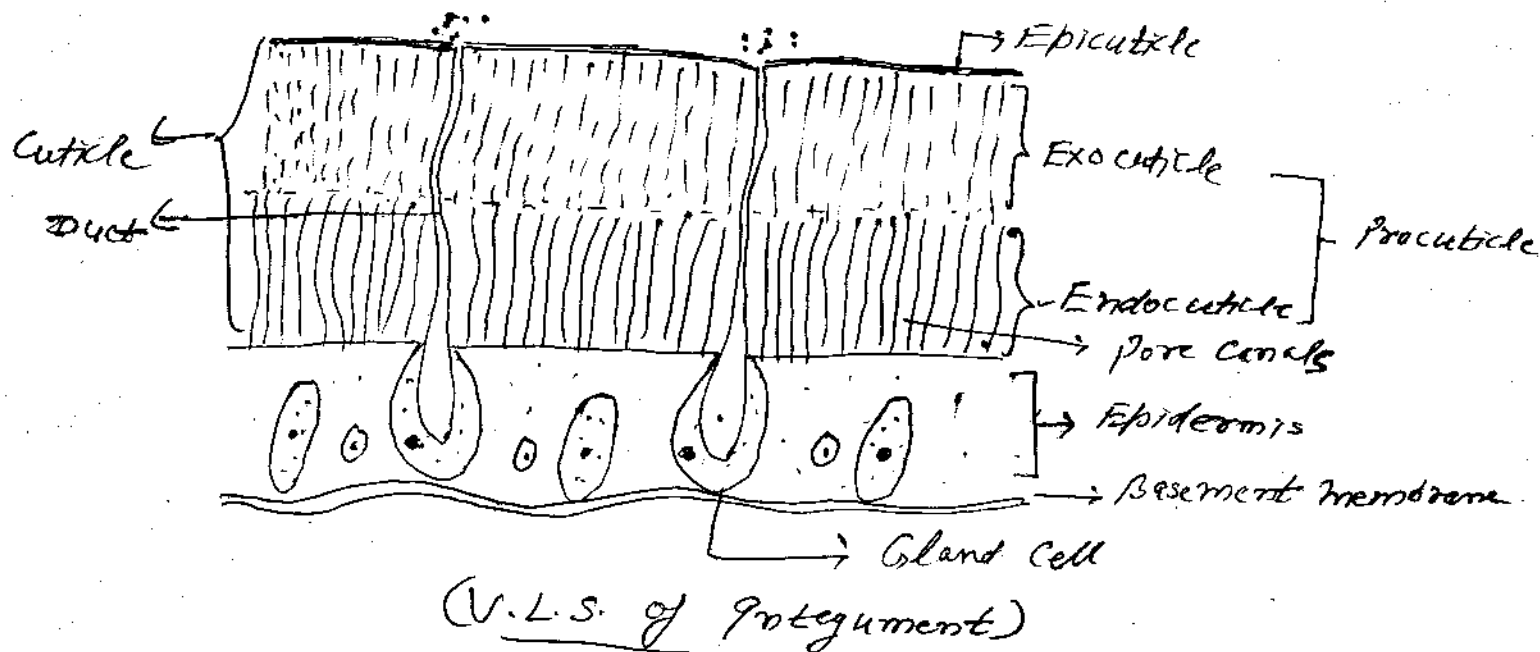
Section - C

Long Answer type Questions:

Q.8. What is integument? & Describe structure and functions of Cuticle.

- Introduction →
- Definition →
- Histology →

(a) Epidermis (b) Basement memb. (c) cuticle



- Histology of cuticle:

- Epicuticle → Cement layer, Wax layer, Cuticular layer & inner epicuticle
- Procuticle → Hardest part, two layers
 - Exocuticle → pigmented layer, resistant to fluid.
 - Endocuticle →

- Chemical Composition of Cuticle: chitin & proteins, quinones

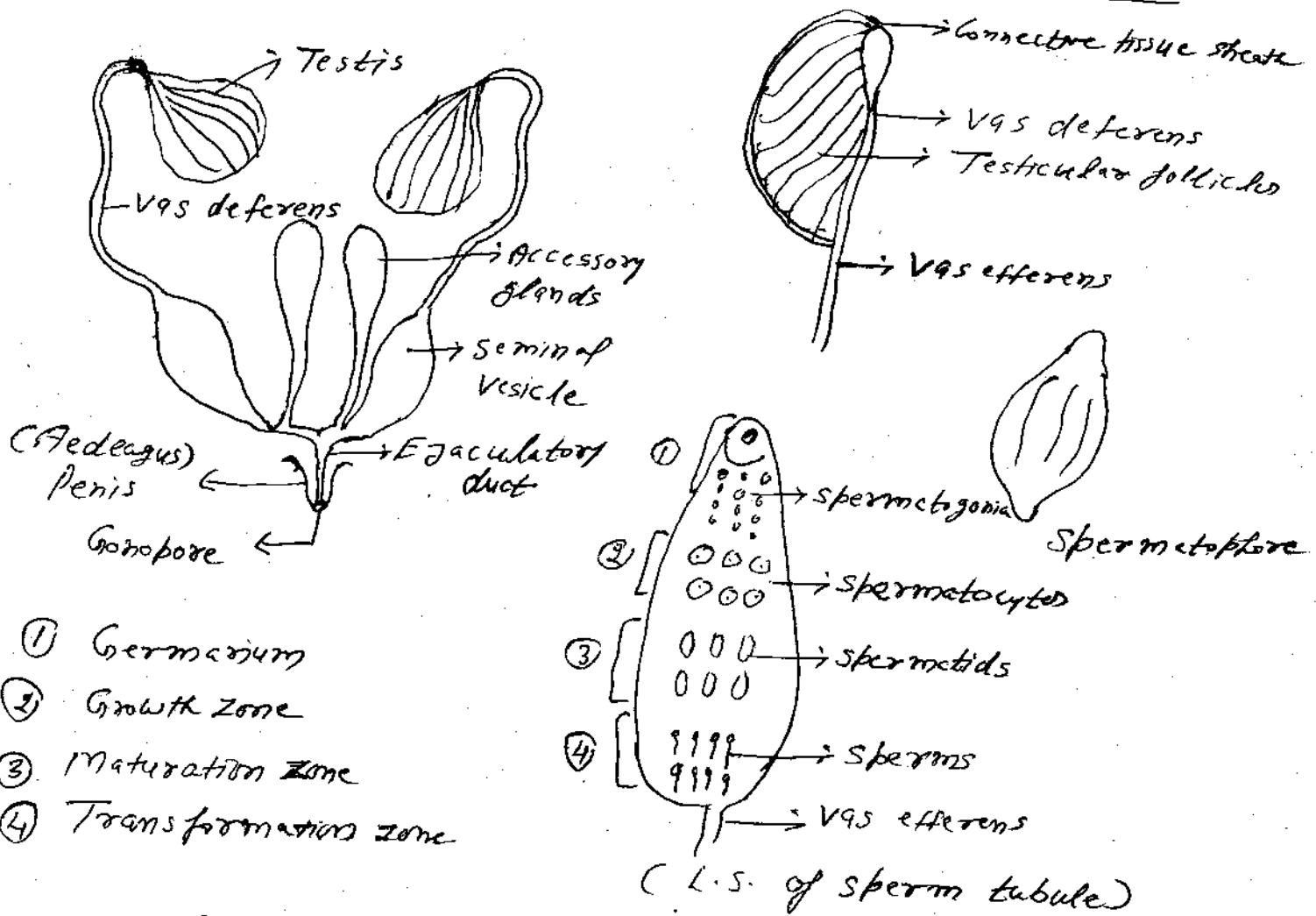
- Proteins → Arthropodins, Resilin, sclerotin & polyhydric alcohols.
- Quinones play a role in sclerotisation and melanisation.

- Characteristics & functions:

- (i) Rigid, elastic, permeable and impermeable

- ② Periodically changeable structure
- ③ Reduces the water loss.
- ④ Protective covering for the internal organs.
- ⑤ Outgrowths act as sensory, feeding, filtering and copulatory and locomotory organs.

Q.9. Describe male reproductive system of an insect:



- ① Germarium
- ② Growth zone
- ③ Maturation zone
- ④ Transformation zone

— Consists of following organs:

- ① Testis → 1 pair, contains sperm tubules, produce sperms by spermatogenesis. sperms are grouped inside spermatophore.
- ② Vas deferens → 1 pair, tube like, conduct sperms, open into Seminal vesicle.
- ③ Seminal vesicle → swollen distal end of vas deferens, store sperms temporarily.

- ④ Ejaculatory duct: Ducts of Seminal Vesicles unite to form an ejaculatory duct which passes through penis open outside through gonopore.
- ⑤ Accessory glands → 1 pair, contains seminal fluid, activates sperms, produces spermatophore, stimulates female for oviposition.
- Spermatophores → Gelatinous capsule, sperms are held together by secretions of the male accessory glands.

Q.10. Describe various methods of sound production in insects

- Sound is produced by using varieties of mechanisms:
- ① Sound produced as a by product of some usual activity of insects:
- When insects busy in feeding, cleaning, courtship flying, etc.
 - Wings in flight produce sound. (eg. Mosquitoes)
 - During collection of pollen grains (eg. Bumble bee)
- ② Sound produced by the impact of some part of the body against the substratum:
- Tapping of head against floor eg. Death watch beetle
 - Drums on the ground with its hind tibia. eg. Grasshoppers
 - By head against roof and by mandibles against floor. eg. Soldiers of termites.
- ③ Sound Produced by stridulation:
- Two surfaces are rubbed together (Two wings, one leg & one wing, etc.) eg. Elytral stridulation → Friction between two wings eg. Crickets
 - Femoro-elytral stridulation → Friction between a leg and wing eg. Grasshoppers
- ④ Sound Production by Tymbal organs → Tymbal organs are associated with air sac eg. Cicada, Bugs
- ⑤ Sound production by a pulsed air stream:
- Air is sucked through the proboscis by dilation of Pharynx causing the epipharynx to vibrate and create a pulsed air

Stream eg. Deer's head hawk moth.

Significance: ① For intra or interspecific communication

- ② For defense and warning ③ Disrupt the echolocation system of bat ④ In courtship ⑤ Isolation of species ⑥ For aggregation ⑦ Transmission of information.

Q. 11. Write about insects as vectors of diseases and their control

- Introduction →

- Vectors →

- ① Anopheles → Female, Malaria by Plasmodium, Control
- ② Aedes → Dengue and Yellow fever by virus, Control
- ③ Culex → Filariasis by Wuchereria, Control
- ④ Tse-Tse fly → African sleeping sickness by Trypanosoma gambiense, Control.
- ⑤ Triatoma bug → Chagas disease specially to children by Trypanosoma cruzi, Control.
- ⑥ Sand fly → Kala-Azar disease by Leishmania donovani, Control
- ⑦ Xenopsylla → Bubonic plague by Pasteurella pestis, Control.
- ⑧ Pediculus → Typhus fever by Rickettsia, Control
- ⑨ Musca → - Cholera by Vibrio cholerae, Control
+ Diarrhoea by Giardia intestinalis
- ⑩ Cimex → Typhoid, Plague, Leprosy, etc. by Salmonella typhae, Salmonella enterica, etc. Control
- ⑪ Annoying insects → Cockroach, ants, crickets
- ⑫ Venomous insects → Wasps, bees, ants, mosquitoes, blister beetle, etc.