Digestive system :

- In cockroach digestive system includes alimentary canal and digestive glands.
- Alimentary canal is elongated and coiled. It starts from mouth and ends with anus.
- Alimentary canal is divisible into 3 parts.

a) Foregut or stomodaeum
b) Midgut or mesenteron
c) Hindgut or proctodaeum

- Stomodaeum and proctodaeum arc ectodermal in origin, so they arc internally lined by chitin.
- Mescnteron is endodcrmal in origin, so it is nol internally lined by chitin.
- In cockroach stomodaeum includes pharynx, oesophagus, crop and gizzard. Mouth is present on the lower side of head.
- The small space present inftonlof the mouth is known as preoral cavity.
- Mouthparts ate arranged around the prcoralcavity.
- Mouth leads into a muscular tube called pharynx.
- Pharynx leads into a narrow and short tube known as oesophagus.
- Oesophagus opens into crop which is a sac like structure.
- Crop is the largest part in alimentary canal.
- Gizzard is highly muscular and bulb like structure.
- The inner wall of giz-zard produces 6 chitionus plates which bear the teeth.
- Below the chitinous plates soft pads and bristles are present. They form the **sieve** like structure which acts as a filtering apparatus.
- Gizzard acts as a grinding mill and filtering apparatus.
- A **stoniodeal valve** is present at the junction of gizzard and mescnteron.
- Stomodeal valve prevents the backward movement of food materials from mescnteron to gizzard.
- The food bolus in the mescnteron is enveloped by a porous, mesh like membrane called **peritrophic membrane** which is secreted by the glandular cells of anterior part of the mesenteron.
- **Peritrophic membrane** protects the wall of mescnteron from hard food particles.
- Hepatic caccac arc finger shaped structures present at the junction of gizzard and mesenteron. They are 6 to 8 in number.
- Hepatic caccac helpful in digestion and absorption of some digested food materials.
- Mesenteron is lined by the **endodermal** cclls.
- The anterior part of mesenteron is internally lined by glandular epithelium (mesentric glands) which secretes digestive juice.
- Mesenteron is the main site of enzyme production digestion and absorption.
- A muscular sphincter is present at the posterior part of mesenteron which prevents entry of undigested food and uric acid from hind gut into the mitgut.
- **Malpighian tubules** are thin, elongated and unbranched 6 bundles of tubules situated at the junction of mesenteron and ileum.
- Malpighian tubules are meant for excretion
- Proctodaeum includes ileum, colon and rectum.
- Ileum is a short and narrow tubue; colon is highly coiled and rectum bears **6 rectal papillae** in the inner side.
- Rectum opens out through anus which is present on the ventral side of 10th abdominal segment.

Digestive glands :

- Digestive glands include salivary glands, hepatic caccae and mesentric glands.

Salivary glands :

- These in cockroach are **a pair** of bilobed structures.
- They are attached to the ventrolateral side of the crop in the thorax region.
- The saliva secreting cells present in the **acini** arc called **zymogen cells.**
- The ductules of both the lobes units to form a common salivary duct on each side.
- The two common salivary ducts are joined to form the median salivary duct. Between the lobes of a salivary gland of each side lies a sac called salivary receptacle that stores saliva.
- It leads into a receptacular duct or reservoir duct.
- The receptacular ducts of the two receptacles are united to form a common receptacular duct or common receptor duct.
- The median salivary duct opens into the common receptacular duct.
- Later the two salivary duct opens at the base of the hypo- pharynx. Acinar cells secrete saliva, which contains starch digesting enzymes like **amylase.**
- Hepatic caeca: The hepatic caeca are also termed midgut caeca. They contain secretory and absorptive cells.
- Glandular cells of the mesentcron: The glandular cells of the mesenteron secrete enzymes such as **maltase, invertase, proteases and lipases.**

Physiology

(i) Ingestion :

- Cockroach is **omnivorous** animal as it ingests both plant and animal substances.
- Antennae, labial palps and maxillary palps helps in location of food materials .
- The food seized with the help of fore legs labrum and labium and passed to mandibles for biting and chewing.
- Mandibles help in biting and chewing the food materials.
- The lacinia, galeae, glossae and paraglossae hold the food during chewing.
- Labrum and labium prevent the fall of food particles at the time of mastication.
- The food materials mixed with saliva.

ii) Digestion :

- After swallowing the a food through pharynx and oesophagus, and reaches crop. Where most of the food is digested because the backward movement of digestive juice from mesenteron to crop is known as **regurgitation** occurs through the grooves of gizzard.
- As the gizzard acts as grinding mill and filtering apparatus, the larger food particlcs are broken into smaller particles, filtered and sent into the lumen of mesenteron.
- The enzymes invertase and amylase convert carbohydrates into maltose (disaccharide)
- The enzyme maltase acts upon maltose and converts into glucose.
- protease enzyme converts proteins into amino acids.
- Lipase a lipolytic enzyme acts upon lipids or fats and convert them into fatty cids and glycerol.
- Cellulose of food is digested by the enzyme **cellulase** secreted by the microorganisms present in the hindgut of cockroach. Cellulose is converted to glucose.
- Amino acids, fatty acids and glycerol arc absorbed into blood through the wall in the posterior region of mesentcron into haemolymph.
- The undigested waste is carried to proctodaeum.
- **Rectal papillae** helps in absorption of excess water from undigested food particles.
- Elimination of undigested waste through anus is called defaecation or egestion.
- It is eliminated in the form of laccal pellets