Model Answers
M.Sc. (First Semester) Examination, 2013
Paper-LZT 101 (Non Chordata and Chordata)

Section A

Q. 1- Answer

(i)- (b)	(ii)- (a)	(iii)- (a)	(iv)- (a)	(v)- (a)
(vi)- (d)	(vii)- (b)	(viii)- (b)	(ix)- (b)	(x)- (d)

Section B

Q.2- Answer

(i) Nucleus in Protozoa:

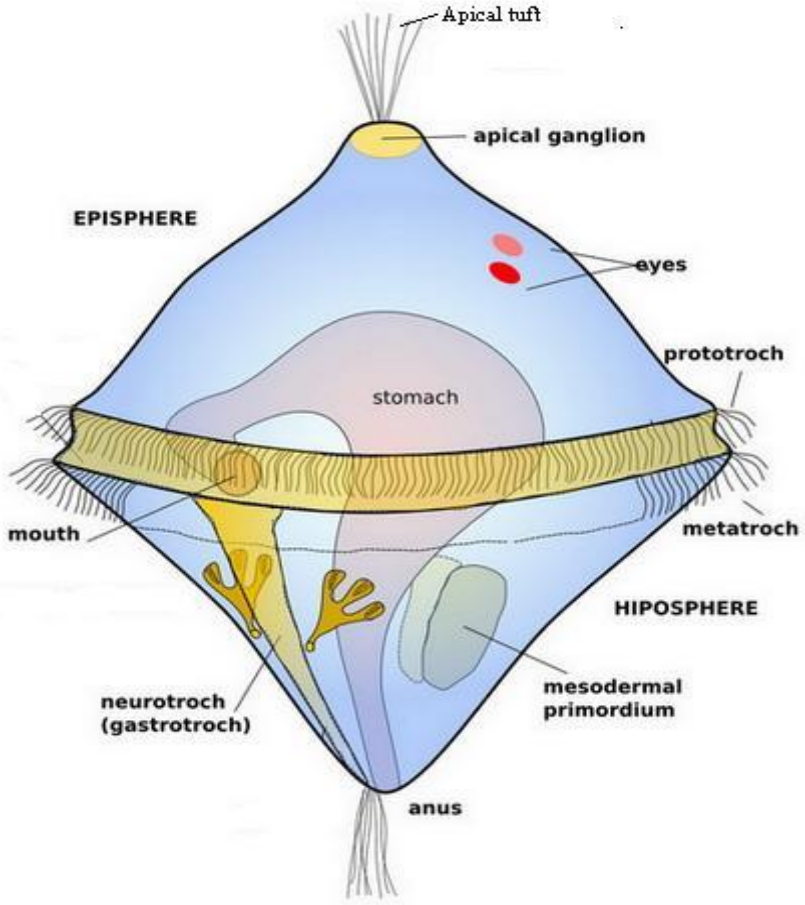
- Protozoans are unicellular organism with each cell a self-sufficient unit capable of carrying out all the metabolic activities of which multicellular organisms are capable of.
- Presence of well-defined nucleus bounded by envelop are a feature of all protozoans.
- Some protozoa have only one nucleus, others have two or more identical nuclei, and still others, like ciliophorans, have two different types of nuclei- a large ellipsoidal nucleus called a macronucleus and at least one small nucleus called a micronucleus.
- The macronucleus is large and can be quite variable in shape, resembling in some species a string of beads or a horseshoe. It is somatic or non-reproductive nucleus containing more than two sets of chromosomes. The macronucleus controls the metabolic activities of the cell so it is concerned with normal functioning of the cell. It usually disintegrates during sexual reproduction but re-formed from the products of micronuclear division after the sexual phase is completed.
- Micronuclei, whether one or more are concerned with reproductive activities.
- On the basis of morphology, nuclei of protozoa can also be differentiated in to vesicular and compact type.
- In vesicular nucleus chromatin is irregularly distributed creating numerous clear areas which give the impression of many small sacs or vesicles. The chromatin areas may be concentrated peripherally or internally.
- The compact type of nucleus is generally larger than vesicular nucleus and may vary in shape from round to ovate. It contains large amount of densely packed chromatin. Compact nuclei are found in the ciliophorans, where they are involved in the sexual process called conjugation.

Vesicular Nucleus

Compact Nucleus

(ii) Trochophore Larva:

- Trochophore is a small, translucent, free-swimming larva found in marine annelids and most groups of molluscs.
- It is unsegmented, spherical or pear-shaped with distinct oral and aboral surfaces and is girdled by a ring of cilia, the prototroch that enables them to swim.
- There is a sensory apical organ or plate bearing a tuft of cilia. Apical ganglion is present beneath the apical organ.
- An ocellus (simple eye) is also present near the ganglion.
- Digestive tract is complete. Mouth is present on the ventral surface just beneath the prototroch.
- A post oral ciliated band called metatroch lies behind the mouth whereas telotroch lies just in front of anus. Below the prototroch are the mouth, stomach and anus. Mesoderm is a pair of undifferentiated masses of cells located in the lower cone. Solenocyte maintain proper internal salt-water balance. In some molluscs (such as gastropods and bivalves), the trochophore develops into a second stage, the veliger, before metamorphosing to adult form.



Trochophore larva

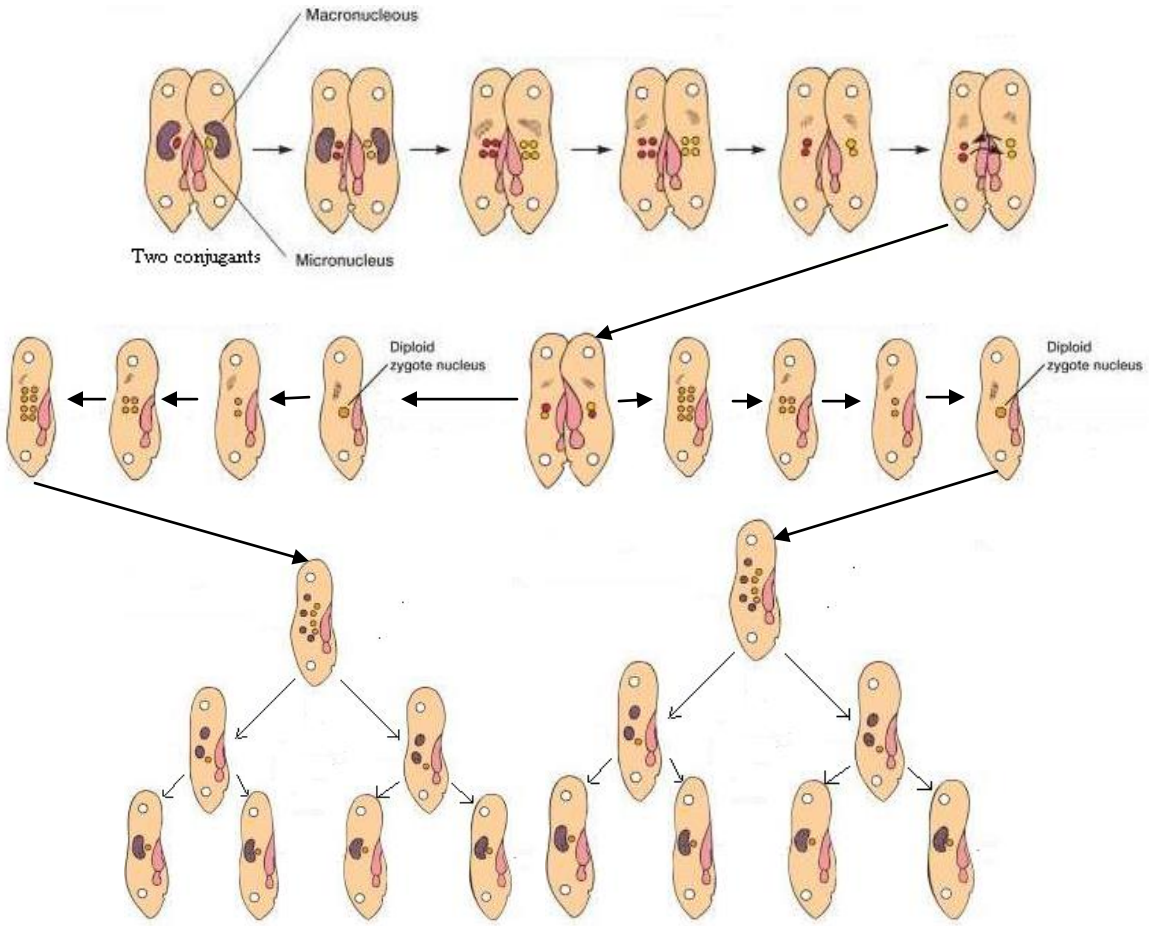
Q.3- Answer

Conjugation: Temporary union between two paramecia of different clones for the exchange of nuclear material and multiplication is called conjugation.

Conjugation in Paramecium:

- During the process of conjugation two senile paramecia from two different mating types come together and closely appose one another.
- They attach at the region of cytopharynx by their ventral surfaces. The individual participating in this act are called the conjugants.
- The pellicle at the site of the union disintegrates and the cytoplasm of the two conjugants merges with each other.
- The macronuclei of both the conjugants disintegrate slowly. The micronucleus of each conjugant divides meiotically to produce four haploid nuclei.
- Of the four haploid nuclei formed three from each conjugant disintegrate so that one nucleus remains in each.
- The remaining nucleus in each conjugant divides unequally to form a small migratory pronucleus and a large stationary pronucleus.
- Now the migratory pronucleus of one conjugant passes into the other conjugant and fuses with stationary pronucleus of that conjugant.
- Thus a diploid synkaryon or conjugation nucleus is formed in each conjugant.
- The two conjugants now separate. Each separated individual is called exconjugant.
- The synkaryon of each exconjugant divides thrice by mitosis so that each exconjugant has eight nuclei. Of these eight nuclei four enlarge in size to become macronuclei. The remaining four behave as micronuclei.
- Three of the four micronuclei disintegrate so that each exconjugant contains four macronuclei and one micro nucleus.
- Then each exconjugant along with its micro nucleus divides in such a way that each of the resulting individuals has two macronuclei and one micro nucleus.
- Again these individuals divide so that the final daughter nucleus has one macro nucleus and one micro nucleus. These last two divisions are mitotic divisions.
- By the end of conjugation eight daughter paramecia form both the conjugants with rejuvenated vigor are formed.

Significance: The conjugation is a method of nuclear reorganization. It restores the lost vigor and vitality due to repeated binary fissions. Due to the exchange of nuclear material between the members of the different clones, it results in hereditary variations.



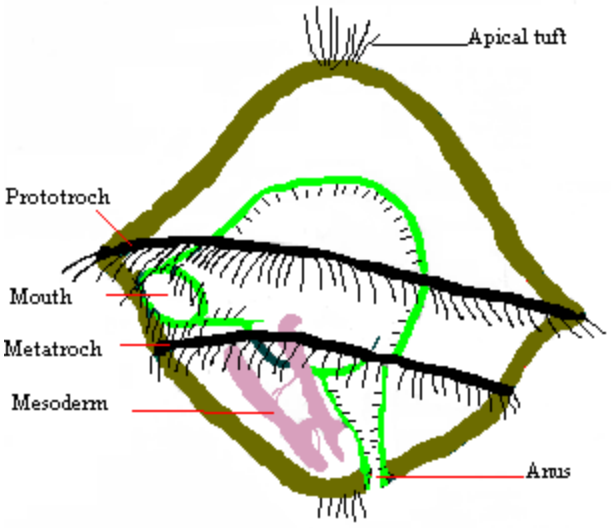
Conjugation in Paramecium

Q. 4 Answer

Molluscan Larvae:

Basic Larval Form:

- The most basic molluscan larva is a trochophore like that of an annelid.
- Trochophore is planktonic and feeds on floating food particles by using the two bands of cilia around its "equator". Upper band is called prototroch while lower band is called metatroch.
- There is a sensory apical organ or plate bearing a tuft of cilia.
- Digestive tract is complete. Mouth is present on the ventral surface just beneath the prototroch.
- Mesoderm is a pair of undifferentiated masses of cells located in the lower cone.
- The trochophore stage is often succeeded by a veliger stage in which the prototroch develops into the velum which is a pair of cilia-bearing lobes. Velum helps in swimming.
- Eventually, the larva sinks to the seafloor and metamorphoses into the adult form.



Trochophore

Types of Molluscan larva on the basis of importance of the pelagic phase and amount of planktonic food taken

a. **Planktotrophic larvae with long larval life:**

- Larval life of 2 or 3 months.
- Ciliary feeders.
- Large cilia of velum help in collection of food particles.
- Large or unwanted particles are removed by rejectory tracts upon the foot.
- Widely distributed, found in tropical and subtropical region mainly.
- Examples include Lamillibranchs and Prosobranchs.

b. **Planktotrophic larvae with long larval life:**

- Larval life not more than a week.
- Velum never elaborates.
- Main object of planktonic life is distribution, feeding is secondary.
- Little growth between hatching and settling.
- Adaptable to unfavourable conditions.
- Examples include Nudibranch larva, *Hydrobia ulva* etc.

c. **Yolk larvae:**

- They are lecithotrophic, as they hatch from very yolky eggs.
- They are comparatively large in size.
- They are not planktotrophic.
- Swim little, passively float.
- Found in Amphineura, Scaphopoda etc.

Q-5 Answer

According to the theory of evolution, life began in the seas, and the first advanced vertebrate animals were fish. Fish continued to evolve during the Silurian period (440 - 410 million years

ago). At the same time some groups of animals took a major step as they colonized the land for the first time. Following factors are mainly responsible for transition of animals from water to land.

- Competition in the marine ecosystems.
- Opportunity to escape predators.
- The availability of new terrestrial niches.
- Compared to water, land had more oxygen in air, food, cover, shelter and breeding places.

Origin of Amphibia: Amphibians were originated 300 million years ago, during Devonian period. The earliest fossils of amphibian are known as Labyrinthodontia because of the folded nature of their teeth.

Piscine ancestry:

- Amphibians have originated from fishes.
- Resemblances: Both are cold blooded, both respire by gills during early stage of their life, both have air bladders serving as lungs, both usually lay eggs in water where larval development usually continues.

Devonian fishes: Three groups of fishes were contemporaries of Labyrinthodontia during Devonian period- Actinopterygii, Dipnoi and Crossopterygii.

a. **Actinopterygian ancestry:** Due to presence of many specialized features they are not considered as direct ancestors of tetrapods.

b. **Dipnoi:** They show many similarities with amphibian but these similarities are only due to convergent evolution. They are also not considered as direct ancestors of amphibian because certain specialized features like skeleton of their fins is not reminiscent of that of primitive tetrapod.

c. **Crossopterygian ancestry:** They show many morphological similarities with early amphibians like-

- Both were predators, armed with sharp and strong teeth.
- Homology between pentadactyl limb of amphibians and crossopterygians fin.
- Similar skull and jaws.
- Similar position of external and internal nares.

Q. 6 Answer-

Characteristic features of Cyclostomata:

- Body elongated, eel like
- Median fins with cartilaginous fin rays.
- Tail diphycercal
- Trunk and tail muscles segmented in to myotomes separated by myocommata.
- Endoskeleton fibrous and cartilagenous.
- Notochord persists throughout life.
- Jaws absent.
- Mouth ventral, suctorial and circular.
- Digestive system without stomach, intestine is provided with a fold called typhlosole.
- Gills 5 to 16 pairs in lateral sac- like pouches of pharynx.

- Heart two chambered with one auricle and one ventricle. Hepatic portal system present while renal portal system absent.
- Kidney mesonephric.
- 8 to 10 pairs of cranial nerves.
- Sexes separate or united. Fertilization external.

Affinities of Cyclostomata: Affinities of Cyclostomata can be described by discussing their primitive, advanced, specialized and degenerate characters.

A. Primitive characters:

(i) Resemblances with Cephalochordata:

- Lack of jaws, exoskeleton, paired fins and gonoducts.
- Persistent notochord.
- Numerous gill slits.
- Straight and simple alimentary canal.

(ii) Differences from fishes:

- Absence of jaws, true teeth and fin rays, stomach spleen and gonoducts.
- Continuous median dorsal fin.
- Single median nostril rather than paired.
- Poorly developed cranium, vertebral column, intestinal spiral valve, pancreas, brain, nervous system and lateral line organs.
- Non-myleinated nerves.

(iii). Affinities with Ostracoderms:

Similarities:

- Absence of biting jaws
- Absence of paired limbs.
- Internal ear with only 2 semicircular canals.
- Presence of lateral line system.
- Single nasal opening.
- Pineal eye.
- Pouch like branchial sacs.

B. Advanced Characters:

- Distinct head with paired eyes and internal ears.
- Presence of differentiated brain with several pair of cranial nerves.
- Presence of cranium for protection of brain.
- Stratified or multilayered epidermis.
- Gills primarily used for respiration and not for food collection.
- Well developed circulatory system with a muscular contractile heart.
- Blood with erythrocytes and leucocytes.
- Presence of hepatic portal system.
- Mesonephric kidney.

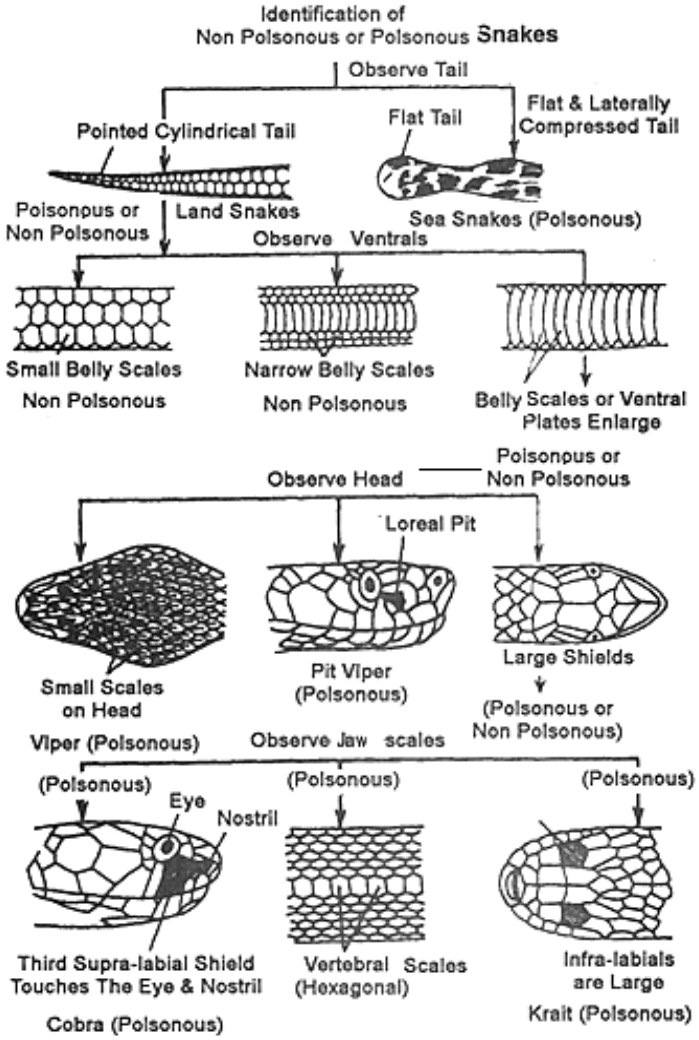
- Presence of lymphatic system

C. Specialized Characters:

- Suctorial Mouth with horny spikes in lampreys for attachment to host body.
- Powerful muscular tongue armed with sharp horny teeth serves as a rasping organ while feeding.
- Presence of anticoagulants in saliva.
- Posterior position of gill opening, which is an adaptation for burrowing.
- Complete separation of ventral sac like respiratory pharynx from dorsal oesophagus.
- Large mucous gland in hag fishes.

Q. 7 Answer-

Differences between poisonous and non-poisonous snakes



Comparison between venom of Cobra and Viper

Sl. N.	Venom of Cobra	Venom of Viper
1.	Neurotoxin	Haemotoxin
2.	Piercing pain, burning sensation	Discolouration of bitten part with acute burning pain
3.	Death results due to failure of respiration.	Death may result due to paralysis of vaso-motor centers.

Q. 8 Answer:

Factors responsible for migration in birds:

a) **Food:**

- One of the principle driving forces behind migration is food scarcity.
- If all birds were to stay in the same regions year-round, food would become scarce and breeding would be less successful.

b) **Breeding:**

- Birds have evolved different migration patterns, timing and destinations to disperse around the world to breed, taking advantage of a wide variety of suitable conditions to raising their young.

c) **Climate**:

- Birds have evolved different types of plumage to survive different climates, and changes in those climates can affect migration.
- The hottest tropical regions can be a harsh environment for raising chicks, and it is advantageous to lay eggs further north.

d) **Predators**:

- Habitats that have abundant food sources year-round also attract a greater number of predators that can threaten nests.
- Birds that migrate to different habitats can avoid that onslaught of predators, giving their young a better chance of reaching maturity.

e) **Disease**:

- Any large group of birds crammed in one type of habitat is susceptible to parasites and diseases that can decimate thousands of birds in a short period of time.
- While diseases can and do occasionally devastate breeding colonies, birds that disperse to different locations have less chance of spreading a disease to their entire population, including their new offspring.

Navigation during Migration:

- **Magnetic Sensing**: Many birds have special chemicals or compounds in their brains, eyes or bills that help them sense the earth's magnetic field. This helps the birds orient themselves for long journeys.
- **Visual landmarks or Geographic Mapping**: Because birds follow the same migration routes from year to year, their keen eyesight allows them to map their journey by different landforms and geographic features such as rivers, coastlines and mountain ranges.
- **Celestial bodies**: For birds that migrate at night, star positions and the orientation of constellations can provide necessary navigation directions. During the day, birds also use the sun to navigate.
- **Experience**: Some bird species learn migration routes from their parents and other adult birds in the flock. Once learned, younger birds can travel the route successfully themselves.