MODEL ANSWERS

AS - 2837
B.Sc. (Hon's), I Semester Examination 2013
Botany
LBC-101: Plant Diversity I (Virus, Bacteria, Cyanobacteria, Algae & Fungi)

Section A: Answer all the questions (1 X 10 = 10 Marks)

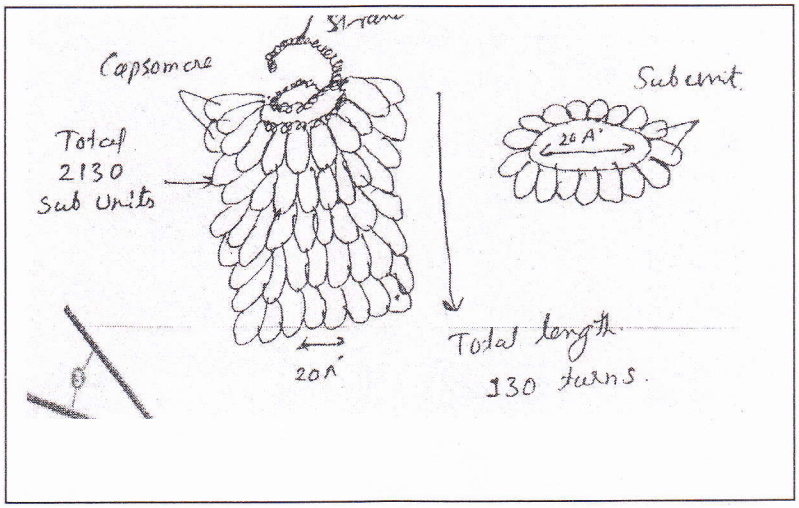
1. a. Virus
2. b. 11 proteins
3. a. Archaebacteria
4. a. cell wall.
5. d. Oscillatoria
6. a. Anabaena
7. b. Diploid
8. b. Carposporophyte
9. a. *Peziza*
10. a. *Cercospora*

Section B : Answer any four question (Each question carry 5 Marks)

2. Describe structure of TMV, draw diagram.

Tobacco mosaic virus (TMV) is a single stranded RNA virus that infects plants, especially tobacco and other members of the family Solanaceae.

Structure: TMV is made up of a piece of nucleic acid (ribonucleic acid; RNA) and a surrounding protein coat. The complete virus is a submicroscopic, rigid, rod-shaped particle. Once inside the plant cell, the protein coat falls away and nucleic acid portion directs the plant cell to produce more virus nucleic acid and virus protein, disrupting the normal activity of the cell. Its capsid is made from **2130 molecules of coat protein** and **one molecule of genomic single strand RNA 6400 bases long**. The **protein monomer** consists of **158 amino acids** which are assembled into **four main alpha-helices**, which are joined by a prominent loop proximal to the axis of the virion. Virions are ~300 nm in length and ~18 nm in diameter. There are three **RNA nucleotides per protein monomer**. TMV can multiply only inside a living cell but it can survive in a dormant state in dead tissue, retaining its ability to infect growing plants for years after the infected plant part died.



Schematic model of TMV: 1. nucleic acid (RNA) 2. capsomer (protomer) 3. capsid

The coat protein self-assembles into the rod like helical structure (16.3 proteins per helix turn) around the RNA which forms a hairpin loop structure.

2. Differentiate between Gram Positive and Gram negative Bacteria.

Characteristic	Gram-positive	Gram-negative
Gram reaction	Retain crystal violet dye and stain dark violet or purple	Can be decolorized to accept counterstain (safranin); stain red
Peptidoglycan layer	Thick (multilayered)	Thin (single-layered)
Teichoic acids	Present in many	Absent
Periplasmic space	Absent	Present
Outer membrane	Absent	Present
Lipopolysaccharide (LPS) content	Virtually none	High
Lipid and lipoprotein content	Low (acid-fast bacteria have lipids linked to peptidoglycan)	High (due to presence of outer membrane)
Flagellar structure	2 rings in basal body	4 rings in basal body
Toxins produced	Primarily exotoxins	Primarily endotoxins
Resistance to physical disruption	High	Low
Inhibition by basic dyes	High	Low
Susceptibility to anionic detergents	High	Low
Resistance to sodium azide	High	Low
Resistance to drying	High	Low

3. Comment on significance of heterocyst and akinetes.

Significance of heterocyst: Heterocysts are specialized nitrogen-fixing cells formed during nitrogen starvation by some filamentous cyanobacteria, such as *Nostoc punctiforme*, *Cylindrospermum stagnale*, and *Anabaena sphaerica*. They fix nitrogen from N_2 in the air using the enzyme nitrogenase, in order to provide the cells in the filament with nitrogen for biosynthesis. Nitrogenase is inactivated by oxygen, so the heterocyst must create a micro-anaerobic environment. Heterocysts:

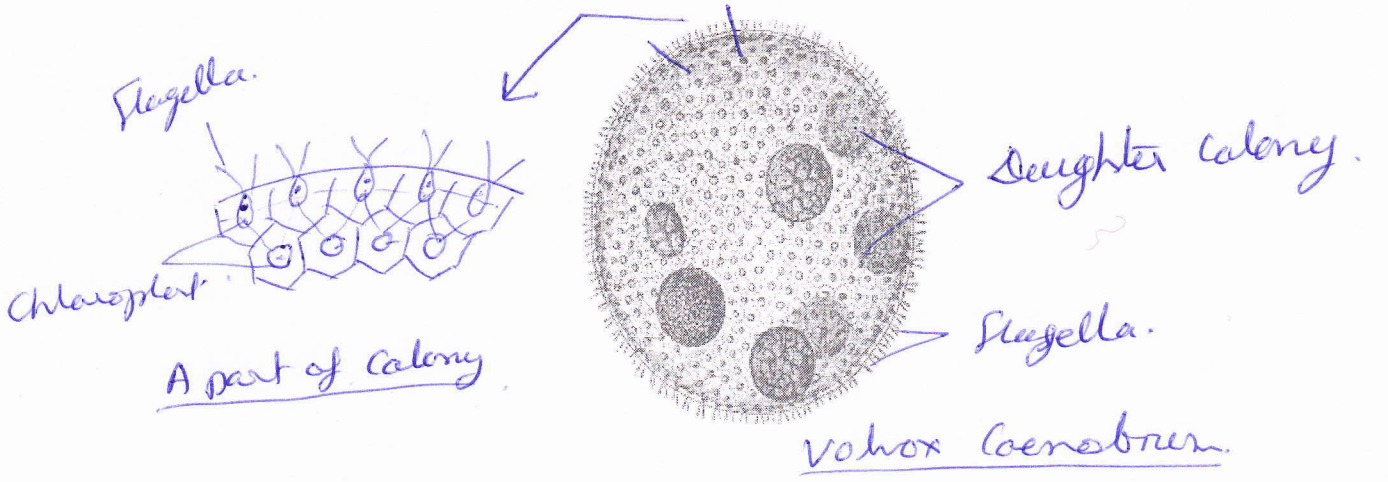
- produce three additional cell walls, including one of glycolipid that forms a hydrophobic barrier to oxygen
- produce nitrogenase and other proteins involved in nitrogen fixation
- degrade photosystem II, which produces oxygen
- up-regulate glycolytic enzymes
- produce proteins that scavenge any remaining oxygen
- contain polar plugs composed of cyanophycin which slows down cell-to-cell diffusion

The lack of photosystem II prevents heterocysts from photosynthesizing, so the vegetative cells provide them with carbohydrates, which is thought to be sucrose. The fixed carbon and nitrogen sources are exchanged through channels between the cells in the filament. Heterocysts maintain photosystem I, allowing them to generate ATP by cyclic photophosphorylation.

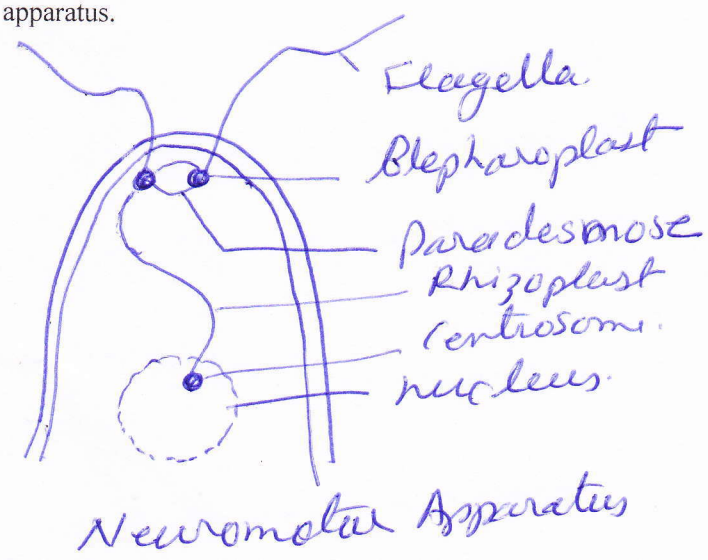
Significance of akinetes: An **akinete** is a thick-walled dormant cell derived from the enlargement of a vegetative cell. It serves as a survival structure. It is a resting spore of cyanobacteria and unicellular and filamentous green algae. Akinetes appears thick walled with granular-looking cytoplasms under magnification. Development of akinetes from a vegetative cell involves, increase in size, gradual disappearance of gas vacuoles, increase in cytoplasmic density, number of ribosomes & cyanophycin granules. The akinetes are filled with food reserves in order to survive through stressful times, such as drought. It protects the spore from biotic (microbial, fungal viral), as well as abiotic (wind, heat, xeric conditions) factors. Akinete are responsible for the ability of cynobacteria or algae to lie dormant within the soil of a field for long periods until the right conditions occur for viability.

4. Comment on the following
    a. Coenobium
    b. Neuromotor apparatus

a. Coenobium: A **coenobium** (plural coenobia) is a **colony** containing a fixed number of cells, with little or no specialization. They occur in several groups of algae. The cells are often embedded in a mucilaginous matrix and may be motile or non-motile. Eg. Volvox

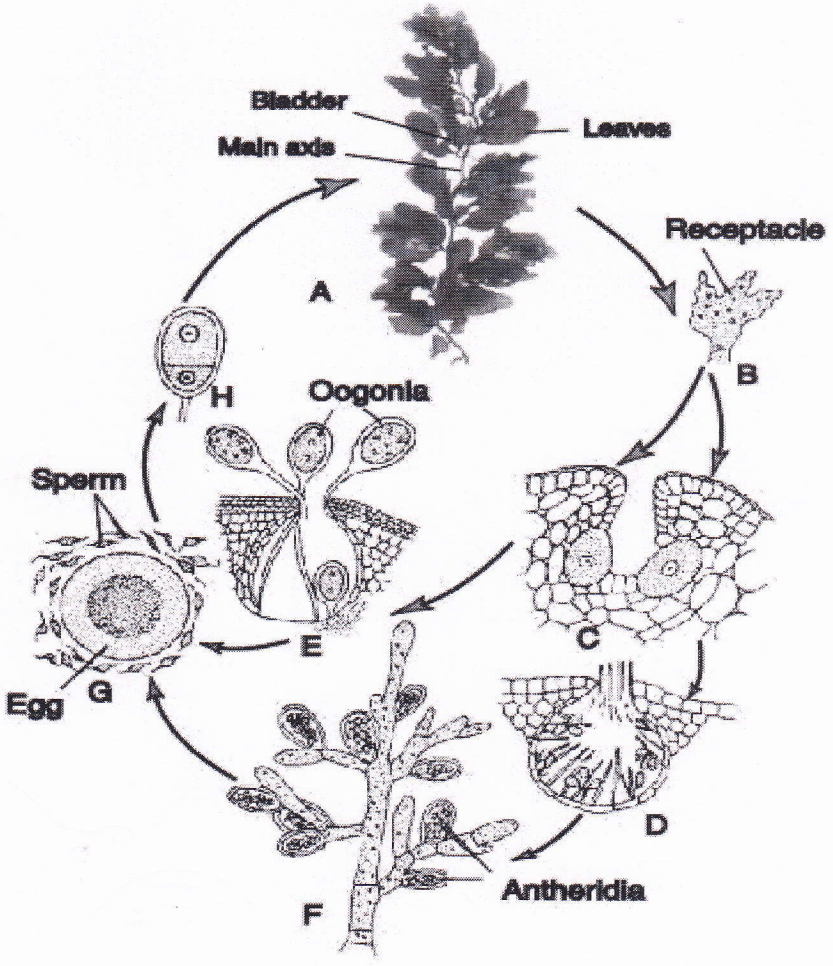


b. **Neuromotor apparatus:** Flagella in Volvocales are produced by an apparatus called Neuromotor apparatus or flagellar apparatus. At the base of each flagellum (usually two flagellas are present at anterior motile body) a flagella producing granule called blepharoplast is present. Each blepharoplast is connected with each other by thin fibril called paradesmose. One of the blepharoplast is connected by a long fibre called rhizoplast, to the centrosome situated inside or outside the nucleus, this whole apparatus is known as neruomotor apparatus.



5. Give a detailed account of sexual reproduction in Sargassum.

Sexual reproduction in Sargassum is Oogamous type. Thallus of Sargassum is monoecious or dioecious. Receptacles unisexual or bisexual, developed in axils of laterals or ramuli. Fertile branches of adult algae produce gametes. The male sex organs are anthridia and female sex organs the oogonia. When the ova are squeezed out of the conceptacle, they are not broadcast into the surrounding water like most algal gametes, but remain attached to the receptacle by a mucilaginous stalk made of mesochitin. After fertilization, the zygotes continue to grow on the parent for several days before dropping to ocean floor. The enveloping mucilage protects them from environmental stress, as does their multicellular form. Their large size also allows them to settle rapidly, and the well-developed rhizoids adhere quickly to the substrate. This results in germlings settling near the parent (within 3 meters), where conditions are likely to be favorable. The life cycle is diplontic. Plant body is sporophytic (diploid). The meosis takes place prior to gamete formation. There is no declared alternation of generation.



Life cycle of Sargassum.

6. Differentiate between Mastigomycotina and Zygomycotina (draw diagrams were necessary).

Phylum	Mastigomycotina	Zygomycotina
Habitat	water	mostly terrestrial
	Mostly parasitic	Mostly saprophytic
Cellular organization	Organisms without cellular separation (Coenocytic)	Moslty coenocytic higher zygomycotina has some septum
Flagellated Cells	yes	no
Pathogens / Plant Diseases	black wart of potato, brown spot of com	soft rot of many taxa
Walls	lacking in some	yes
Chitin	yes	yes
Hyphae	aseptate, coenocytic	aseptate, coenocytic
Asexual Reproduction	zoospores	nonmotile spores
Specialized Cell Where Nuclear Fusion Occurs	None occurs	fusion of two gametangia
Sexual Spore	Motile zoospore (flagellate)	zygospore in zygosporangium (nonflagellate)
Perfect spore	oospore	zygospore

7. Draw a well labeled diagram of HIV retrovirus .