I Semester B.Sc. Degree examination, April 2023

ZOOLOGY

Cytology, Genetics and Infectious Diseases

Paper : I

(NEP Scheme 2021-22 Freshers and Repeaters)

Time: 2.30 Hrs **Maximum Marks: 60**

Instructions to Candidates: 1. Draw neat labelled diagrams wherever necessary.
2. Answer should be completely in English.

PART- A

I. Answer the following in one word or one sentence **(5x1=5)**

1. **What is endocytosis?**
   Ans: Process by which cells absorb and transport materials like proteins by formation of vesicles.
2. **Define apoptosis.**
   Ans: Programmed cell death. It is the phenomenon of programmed cell death that occurs in the cells of multicellular organisms due to either significant cell damage or as result of development process.
3. **Write the genotypic ratio of monohybrid cross.**
   Ans: **1 : 2 : 1**
4. **Give an example for sex-influenced trait.**
   Ans: Baldness / Horns in male sheep
5. ***Giardia lamblia*** lives as a flagellate parasite in the small intestine of man.

PART- B

II. Answer any five of the following. **(5x3=15)**

1. Write a note on microtubules. **Note with or without functions - 03 marks**

Ans. These are hollow, fine cylinders (tubules) about 23 – 25 nm in diameter. Variable in length can grow 1000 times as long as they are wide. These may occur singly or in aggregates in the skeleton. These are made up of a tubulin protein. Commonly made up of 13 protofilaments of beta tubulin. They have a very dynamic behaviour, binding GTP for polymerization.

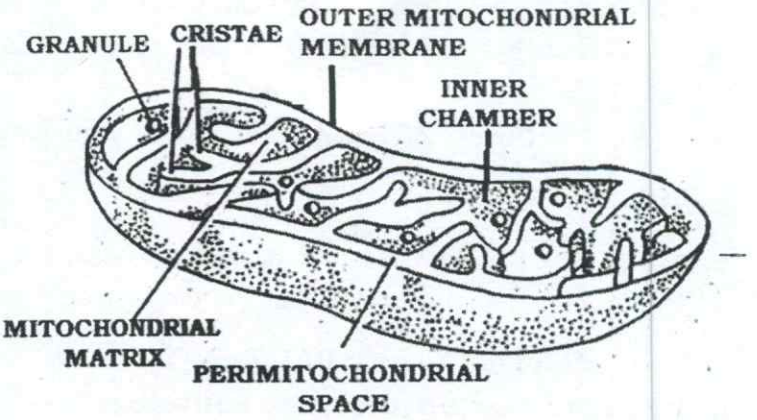
FUNCTIONS.

- These provide polarity to cell and also help in maintaining cell shape.
- Along with microfilaments are involved in anaphasic movements of chromosomes.
- Help in intracellular transport.
- Synthesis of the cell wall in plants.

2. Mention any three types of cell junctions. **Any 3 types - 1 mark each**

i. The tight junction / Zonula occludens.
ii. The belt desmosome / Intermediary junction / Zonula adherens.
iii. The spot desmosome / Macula adherens.
iv. The gap junction / Nexus.

3. Draw a neat labelled diagram of mitochondria. Diagram with any 3 labellings.



4. Name any three types of DNA in Eukaryotes. **1 mark each**

Ans: B form (B-DNA), Z-DNA, A-DNA, C-DNA, D-DNA, palindromic DNA, repetitive DNA, double stranded, single stranded and circular DNA, non-chromosomal DNA, centriolar and nucleolar DNA.

5. Explain incomplete dominance.

Definition – 01 mark, Inheritance – 04 marks

Ans: It was discovered by Carl Correns. Sometimes in a heterozygote the dominant allele does not completely mask the phenotypic expression of the recessive allele so this result in intermediate phenotype is called incomplete dominance.

Ex: *Mirabilis jalapa* (4'O' clock plant)

When a pure breeding red flowered plant is crossed with pure breeding white flowered plant all F1 hybrid plants would have pink flowers. When these pink hybrids are selfed, the F_2 offsprings are in the ratio of 1:2:1 (1 red: 2 pink: 1 white)

Parents : Pure Red flowered plant X Pure White flowered plant

Genotypes : RR X rr

Gametes : R X r

F_1 generation : Rr - Pink flowered plant (Heterozygous hybrid)

F_1 X F_1 Selfing Rr X Rr

F_2 generation :

♀ \ ♂	R	r
R	**RR** Red flowered plant	**Rr** Pink flowered plant
r	**Rr** Pink flowered plant	**rr** White flowered plant

Phenotypic ratio is 1 : 2 : 1 (1 Red : 2 Pink: 1 White)

6. Briefly explain inheritance of multiple allelism.

Def - 1 Marks, Explanation - 02 M.

Ans: When a single gene for a character occurs in more than two alternative forms, occupying the same locus on homologous chromosomes are called **multiple alleles**. **OR** Three or more alleles representing the same locus of a chromosome are called as multiple alleles. The phenomenon of inheritance of traits controlled by multiple alleles is called as **multiple allelism or Gene polymorphism** (many allelic forms of a gene). The concept of multiple alleles was introduced by Thomas Hunt Morgan in 1914.

7. What is X-linked recessive inheritance? Give an example.

Explanation - 02 marks, any one ex - 01 mark

Ans: Also known as Criss cross inheritance. X linked recessive gene is transmitted from P1 male to F2 male through F1 carrier daughter. Ex: Colour blindness, Haemophilia

PART- C

III. Answer any four of the following. **(4x5=20)**

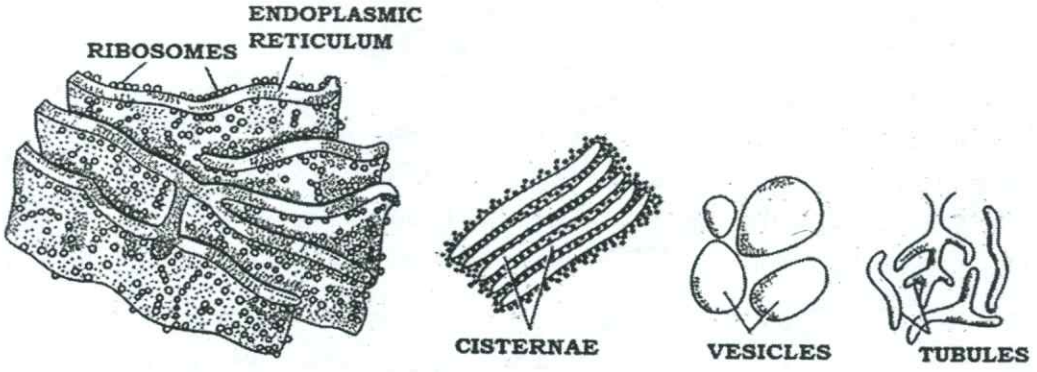
1. With a neat labelled diagram explain the structure of endoplasmic reticulum.

Diagram – 02 marks, Explanation – 03 marks

Ans: It was discovered by **Garner** in 1847. It was first noticed by **Porter in 1945**. Structurally it exists as Cisternae, Vesicles and Tubules.

a. **CISTERNAE** - Elongated, flattened, sac like membrane tubules, which are arranged in parallel bundles. Their thickness varies from 40-50mμ. Found in abundance in cells which are very active in protein synthesis and basophilic in nature. Ex: Liver, Pancreas, Brain etc.

b. **VESICLES** - These are large, irregular, oval membrane bound vacuolar structures forming a reticular system along with the cisternae and vesicles. These are devoid of ribosomes so their membrane is smooth. Their size varies from 25- 500 mμ. These are more in number in cells which are synthetically active.



c. **TUBULES** - These are abundant in the cells which are usually non secretory in function. These are haphazardly distributed. Their shape and size show a great diversity. Diameter ranges from 50-100 mμ. These are mainly concerned with storage and transport of steroid, cholesterol, glycine and hormones. Endoplasmic Reticulum may be smooth without ribosomes are termed Smooth Endoplasmic Reticulum **(SER).** Endoplasmic reticulum may be rough, rich in ribosomes called Rough Endoplasmic Reticulum **(RER).**

2. Describe nucleosome model of chromatin organization with a neat labelled diagram. **Diagram – 02 marks, Explanation – 03 marks**

Ans: Euchromatic chromosomes are composed of DNA and protein. Mammalian chromosome is made up of approximately 13-20 % DNA and remaining consists of proteins and varying small amount of RNA. In eukaryotes DNA is tightly bound to an equal mass of histones, which serve to form a repeating

array of DNA-protein particles are known as nucleosomes. These are the basic structures of chromatin and give beaded appearance to chromatin. Each nucleosome consists of a spiral of DNA wrapped around an **octomer** of histone molecules to form core particle is called **platysome**. DNA makes about 3 or 4 turns around and octomer forms a flattened wedge shape of the dimensions **55 A^0 X 110 A^0**. Each turn of DNA is **80-100** nucleotide base pairs long, making the total nucleosome approximately **140 – 200** base pairs long. The number of nucleotide pairs may vary from **154 (*Aspargillus*)** to **241 (sperm of sea urchin).**

Each nucleosome is linked to the next one with **15-100** nucleotide pairs of **linker (internucleosomal) DNA**. It has a diameter of about **200 A^0**.

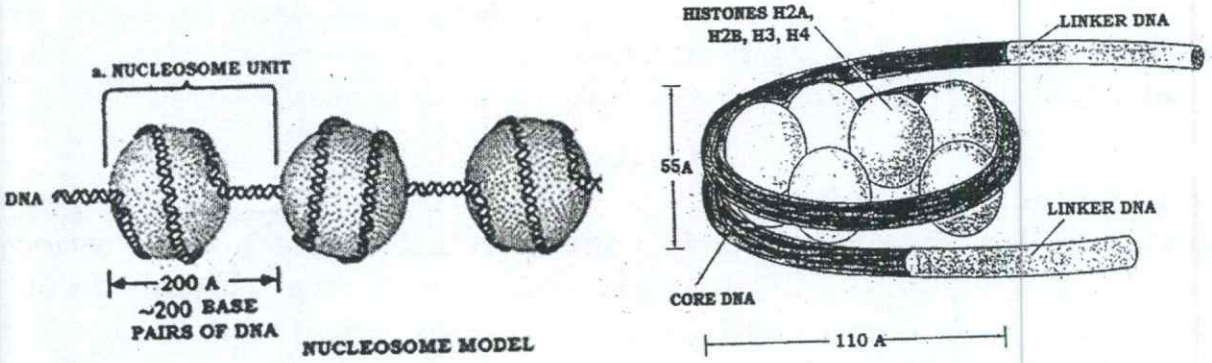


DIAGRAM OF A NUCLEOSOME CORE PARTICLE. THE DNA MOLECULE IS WOUND ONE AND THREE FOURTH TURNS AROUND A HISTONE OCTAMER. IF H1 WERE PRESENT, IT WOULD BIND TO THE OCTAMER SURFACE AND TO THE LINKERS, CAUSING THE LINKERS TO CROSS.

One DNA enzyme makes single-strand nicks at about every 10^{th} base pair in the DNA associated with the nucleosomes.

Histones are small protein molecules with **100-200** amino acids, among these 20-30% are **lysine** and **arginine**. Since both have a positive charges, histone molecules bind to DNA primarily by **electrostatic attraction** to the negatively charged phosphate groups in the sugar phosphate back bone of DNA. Chromatin is placed in a solution with high salt concentration to eliminate the electrostatic attraction which results the dissociation of histones from DNA. Both DNA-histone and histone-histone binding is very important for chromatin structure.

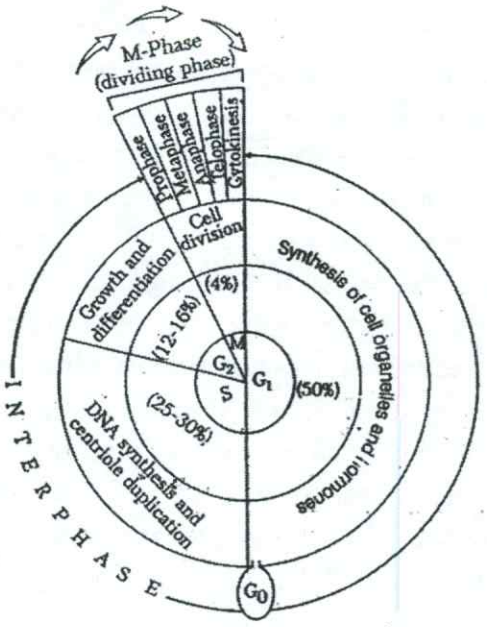
The **octomer** of proteins consists of four different histones, each in two copies known as **tetramers**. These histones are **H_2A, H_2B, H_3** and **H_4** are arranged one on top of the other and have finger-like projections around DNA. These projections contain NH-terminal regions. **H_1** is the 5^{th} class of histones, play a different role in finishing the packaging, holds two ends of DNA in a nucleosome, but it does not form integral part of nucleosome.

3. What is cell cycle? Explain it with appropriate diagram.

Diagram – 02 marks, Explanation – 03 marks

Ans: The sequential repetition of dividing and non-dividing phase in an orderly manner is called cell cycle. Process of mitosis or meiosis is called dividing phase while interphase is called non-dividing.

© **INTERPHASE (INTER MITOSIS / PHASE –I)** - It is the period between two dividing phases. It is the period of intense cytogenic activities even though it looks like the long resting or non-dividing phase of the cell cycle. In this stage cell prepares for the entire proceedings of the division. Chromosomal material is in the form of loose coiled threads called chromatin. It is further sub divided into G_1, G_0 ,S and G_2 phases.



The eukaryotic cell cycle

G_1-PHASE (FIRST GAP/POST MITOTIC GAP PHASE) - Cell remains metabolically active and acquires nutrients from its environment to perform it's specialized functions like synthesis and secretion of hormones.No change in the DNA - first gap phase. Involves the synthesis of cell organelles, proteins, lipids, RNA and membranes which leads to the growth of nucleus and cytoplasm of each daughter cell hence also called first growth phase. Chromatin is fully extended but not distinguishable as chromosomes. Involves transcription of rRNA, tRNA and mRNA, which indicates appearance of nucleolous in the nucleus. Regulatory protein controls various events of mitosis and enzyme like DNA polymerase for DNA synthesis of the next stage and tubulin and other mitotic apparatus proteins are synthesized. This phase is about 30-50% of the total time of the cell cycle. Completion of this phase might go about 10 hours. After this phase a cell may continue cell cycle and enter S phase or it may enter G_0 phase. This depends on storage of energy rich compounds and mitosis inducing factors called mitogens.

G_0 PHASE (QUIESCENT STAGE) - It is an extension of G_1 phase. This phase is due to absence of **cyclin proteins** which control the cell cycle. During this phase the cell neither divides nor synthesis organelles but the metabolic activity of the cell continues. Cells present in this phase usually function as reserve cells, which can rejoin the cell cycle anytime on receiving a proper stimulus through cyclin proteins. Ex-liver cells can resume G_1 phase in response to certain chemicals. Muscles and nerve cells of human body remain in this phase permanently.

S PHASE (SYNTHESIS PHASE) - The cell synthesis a replica of its genome by the process of DNA replication and also it includes synthesis of histone proteins and kinetochores.At the end of this phase each chromosome has two DNA molecules and a dulpicate set of genes. After this phase each chromosome composed of two sister chromatids held together at centromere. It is about25-30% of cell cycle and lasts for about 8 hrs.

G_2 PHASE (PRE-MITOTIC / SECOND GAP PHASE) - It is gap between DNA synthesis and next division. In involves synthesis of RNA, proteins and other molecules which are required for cell growth. Mitochondria and other cell organelles replicate, chromosomes condense and microtubules begin to assemble to form spindles. DNA synthesis stops. It lasts for about 5 hrs and occupies about 12-16% of cell cycle.

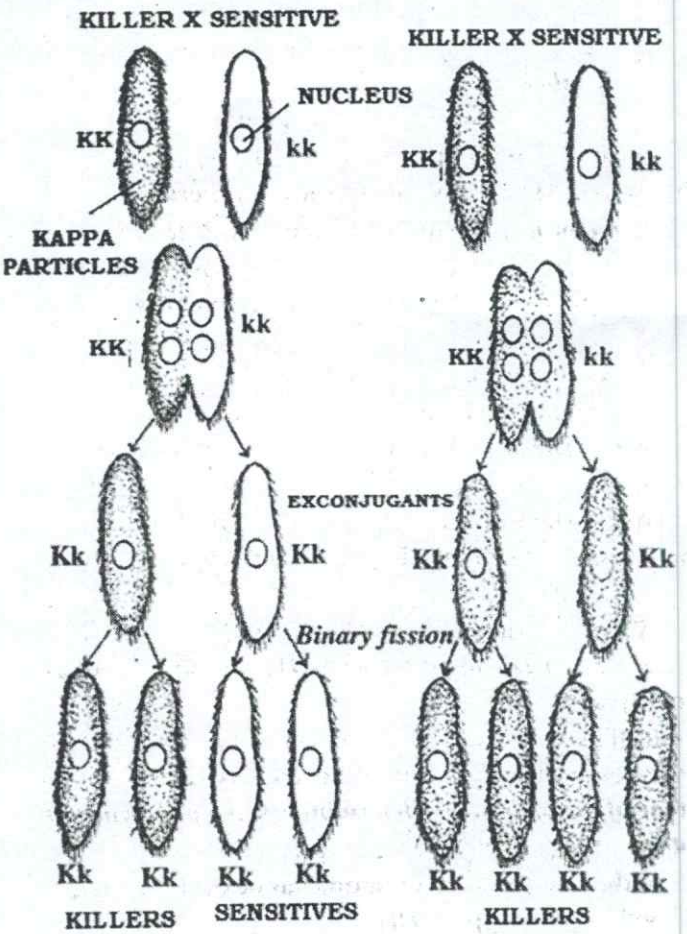
4. With reference to maternal inheritance explain Kappa particles in *Paramecium*.

Diagram – 2.5 marks, Explanation – 2.5 marks

Ans: Kappa particles are self-duplicating cytoplasmic particles present in Paramoecium. There are two strains of Paramoecium, namely **killer and sensitive**. The Paramoecium containing kappa particles is called

Killer strain. The Paramoecium without kappa particles is called sensitive strain. Killer strain produces a toxic substance called **paramecin** that kills the other type. The production of paramecin is controlled kappa particles. Kappa particles multiply during cell division, which is controlled by a dominant **nuclear gene K**. This gene can control only maintenance, existence and production of kappa particles and cannot initiate its production. These kappa particles are transmitted from one generation to another through the cytoplasm. When killers **KK** conjugate with non-killers **kk**, the exconjugants are **Kk**. But development of a particular type depends upon the **duration of cytoplasmic exchange**. In normal conjugation only nuclear material is exchanged and there is no exchange of cytoplasmic material. Hence each exconjugant gives rise to its own type, i.e killer exconjugant produces killers and non-killer produces non-killers. Sometimes the conjugation period is prolonged and the cytoplasmic bridge between the two conjugants is larger. In these in addition to the nuclear material, the cytoplasmic materials are also exchanged. Kappa particles which are present in killers enter the non- killers during cytoplasmic exchange. These kappa particles convert non-killers into killers. So all the offsprings produced by the exconjugants are killer type. This shows that a Paramoecium becomes a killer when it receives kappa particles and it becomes a sensitive when it does not receive kappa particles.

Note: Kappa particles are plasma genes, which contain DNA. These follow Cytoplasmic Inheritance. These are considered as symbiotic bacteria or a Parasite or a congenital disease.



Conjugation without cytoplasmic exchange.

conjugation with cytoplasmic exchange.

5. With a suitable example explain autosomal recessive pattern of inheritance.

Ans: Autosomal recessive inheritance is **a way a genetic trait or condition can be passed down from parent to child.** A genetic condition can occur when the child inherits one copy of a mutated (changed) gene from each parent. The parents of a child with an autosomal recessive condition usually do not have the condition.

Ex: **Cystic fibrosis. Sickle cell disease. Tay-Sachs disease.**

6. Mention the name and disease caused by any five pathogenic protozoans.

Ans: *Giardia lamblia* – giardiasis, *Entamoeba histolytica* – Amoebic dysentery, *Trypanosoma gambiens* – Sleeping sickness, *Leishmania donovani* – Leishmaniasis / Kala azar, *Plasmidium vivax* – Malaria

PART- D

IV. Answer any two of the following. — **(2x10=20)**

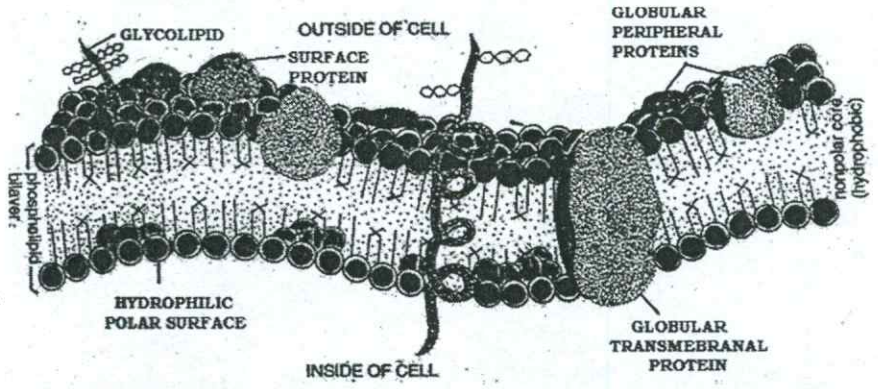
1. With a neat labelled diagram describe the fluid mosaic model of plasma membrane. **Explanation - 07 marks, Diagram - 03 marks**

Ans: This model was proposed by **S. J. Singer** and **G. L. Nicolson** in **1972**. It is widely accepted model, according to this model lipid and integral proteins are arranged in as mosaic manner. Mosaic refers to proteins are embedded in a bilayer of phospholipids to produce a pattern. The cell membrane is fluid / oily in nature due to the lipid. The proteins float in the oily membrane is called fluid mosaic pattern. Fluid refers to the fact that the lipid and protein of the membrane are not rigid, but have mobility. Proteins and the membrane lipids are capable of **lateral** movement in the plane of the membrane, due to the fluid nature of lipid association. Lipid-anchored proteins are also potentially mobile as well, moving by virtue of their association with mobile lipids.

ARRANGEMENT OF LIPIDS - The fundamental, the major lipid of the cell membrane is **phospholipids** bi-layer but little **cholesterol** and **glycolipids** are also present. Lipids are bamboo – shaped and is called polar molecules, the polar and hydrophilic (water loving) heads are directed outwards. One layer faces the outside and the other faces the interior of the cell / the cytoplasm. The non-polar and hydrophobic (water fearing / water insoluble) fatty acid tails project inwards so as to face each other. In an animal cell there are in addition some **cholesterol** molecules and **glycosphingolipid** molecules.

ARRANGEMENT OF PROTEINS - The extrinsic proteins are found both on the outer and on the inner side of the phospholipids bilayer. The intrinsic proteins are embedded in the bilayer. The proteins and lipids exhibit semisolid and semi-fluid properties with the mosaic pattern in their arrangement. Some of the globular proteins embedded here and there in the membrane, cross the membrane and project on both the sides called **trans-membranal** proteins. They may form a channel through which certain materials can pass.

ARRANGEMENT OF CARBOHYDRATES - Carbohydrates are present on the external surface only. These are attached to lipids to form **glycolipids** and proteins to form **glycoproteins**. The inner side of the membrane may be attached to internal support called **microtrabecular lattice**.



FLUID MOSOIC MODEL OF PLASMA MEMBRANE.

2. Describe mitotic cell division with neat labelled diagram.

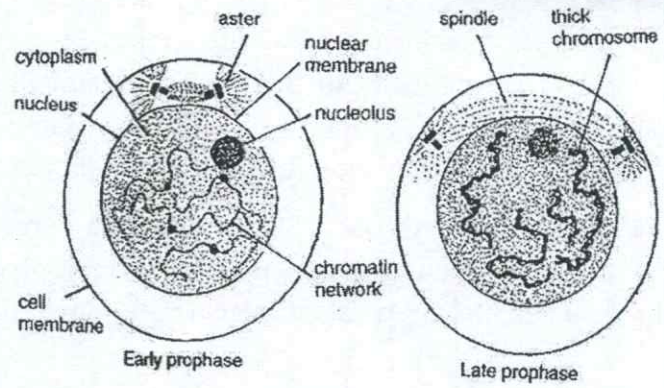
Diagram -04 marks, explanation – 06 marks

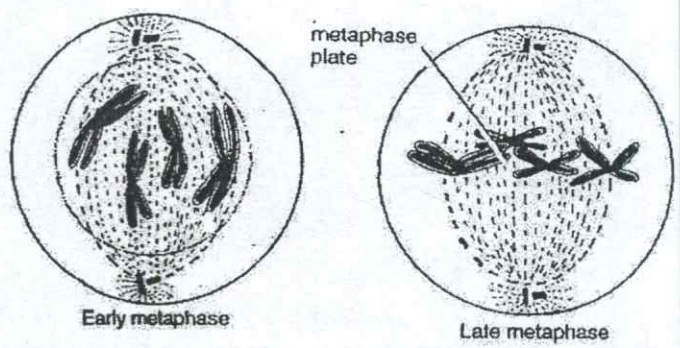
Ans: It is **equational** cell division as there is distribution of duplicated chromosomes into two daughter nuclei. It is also known as **indirect, somatic** or **homotypic**

division. It is similar in both animal and plant cells and occurs in both diploid and haploid cells.

PROPHASE - First stage of karyokinesis. The animal cell becomes almost doubles in size and round in shape as the cytoplasm becomes heavier, refractile and more viscous, the number of changes occur simultaneously both in cytoplasm and the nucleus. **centrosome** is replicated, **centriole** duplicates in early prophase and moves apart towards the opposite poles of the cell. Many delicate microtubules appear around the centrioles to form star-like structures called **Asters (astral mitosis)**. A number of microtubules radiate as thin lines in all the directions from asters to form spindle fibres. In plant cells centrioles are absent hence asters are not formed hence mitosis is called **Anastral mitosis**. Spindle fibres are formed in the cytoplasm whose poles are determined by the formation of clear zones at the opposite poles of the nuclear membrane. Centrosomes are not always used in mitosis.

© Simultaneously there is a change in nucleus. The genetic material in the nucleus is in a loosely bundled coil called chromatin. The chromatin network of the nucleus becomes distinctly visible as chromosomes. They gradually become tightly coiled, short and thick due to **spiralization** and **dehydration**. Each chromosome composed of two coiled filaments called **chromatids**, because they duplicate during interphase. Two sister chromatids of each chromosome are held together along their length by a centromere. The chromosomes are evenly distributed in early prophase but in the late prophase the chromosomes move towards the nuclear envelope. The nucleolus gradually shrinks and finally disappears. The nuclear membrane also breaks down and disappears to release the chromosomes into the cytoplasm. This marks the end of prophase



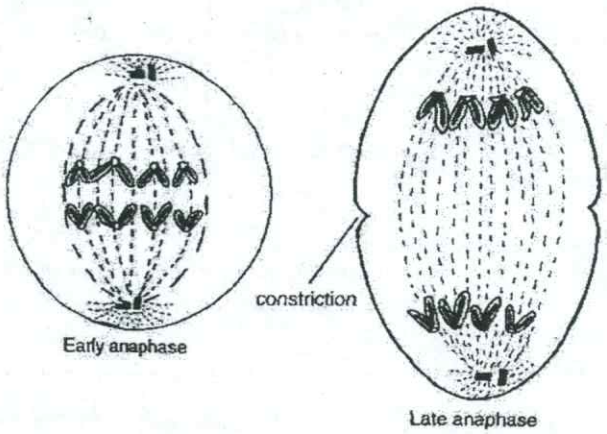


METAPHASE (Gr.META- AFTER, PHASIS – APPEARANCE)

- The chromosomes become short and thick with distinct chromatids due to heavy coiling and dehydration.

- As a result, the chromosomes come under longitudinal tension from the two ends of the cell.
- The centromeres of the chromosomes, in some sense, convene along the metaphase plate or equatorial plane that is equidistant from the two centrosome poles. This line is called the spindle equator.
- This even alignment is due to the counterbalance of the pulling powers generated by the opposing kinetochores, analogous to a tug-of-war between people of equal strength.
- In certain types of cells, chromosomes do not line up at the metaphase plate and instead move back and forth between the poles randomly, only roughly lining up along the midline.
- Because proper chromosome separation requires that every kinetochore be attached to a bundle of microtubules (spindle fibres), called Chromosomal spindle fibers. Some spindle fibres are continuous called Continuous spindle fibres (interzonal fibres).
- It lasts for a short duration.

ANAPHASE - Depending upon the position of the centromeres, the chromosoes appear as V,L,J / rod shaped when they move towards the poles. Movement of chromosomes is still not completely understood. Two events occur: first, the proteins that bind sister chromatids together are cleaved. These sister chromatids now become separate daughter chromosomes, and are pulled apart by shortening chromosomal microtubules and move toward the respective centrosomes (poles) to which they are attached. Continuous spindle fibres elongate, pulling the centrosomes (and the set of chromosomes to which they are attached) apart to opposite ends of the cell. The force that causes the centrosomes to move towards the ends of the cell is still unknown, although there is a theory that suggests that the rapid assembly and breakdown of microtubules may cause this movement. Early anaphase is usually defined as the separation of the sister chromatids, while late anaphase is the elongation of the microtubules and the chromosomes being pulled farther apart. At the end of anaphase, the cell has succeeded in separating identical copies of the genetic material into two distinct populations.



TELOPHASE (Gr. TELO – END; PHASIS- APPEARANCE)

3. Describe dihybrid cross with an example.

Ans: A cross between two homologous individuals differing in two pairs of contrasting characters is called a dihybrid cross. The hybrid obtained from such a cross is called Dihybrid. Mendel selected two pairs of contrasting characters in two pure breeding garden peas, *Pisum sativum*, were Round seeds (shape of the seed) with Yellow cotyledon (colour of the seed) and Wrinkled seeds (shape of the seed) with Green cotyledon (colour of the seed). When a cross is performed between two pure breeding

homozygous Round Yellow and Wrinkled Green pea plants, F_1 hybrids were Round seeds with Yellow cotyledon. This showed that Round shape is dominant over Wrinkle and Yellow colour of the cotyledon is dominant over Green colour cotyledon. Self-pollination of F_1 plants produced 4 types of plants in F_2 generation in the ratio of 9:3:3:1. 9 Round Yellow, 3 Wrinkled Yellow, 3 Round Green and 1 Wrinkled Green. This shows that cotyledon colour and seed shape are two independent characters controlled by non-allelic factors. The formation of new combinations like wrinkled yellow and round green shows that yellow colour can dissociate itself from round and green colour from wrinkled seed shape. Mendel concluded that different traits are inherited independently of each other, so that there is no relation, for example, between a cat's color and tail length. This is actually only true for genes that are not linked to each other.

Parent generation (P generation) : Homozygous Round Yellow X Homozygous Wrinkled Green

Genotype : RRYY rryy

Gametes : RY ry

F1 Generation : RrYy Round Yellow (Heterozygous Hybrid)

F1 Selfing : RrYy X RrYy (Inbred)

Gametes : RY, Ry, rY, ry RY, Ry, rY, ry

F2 Generation Using Checker board

♂ / ♀	RY	Ry	rY	ry
RY	RRYY Round Yellow	RRYy Round Yellow	RrYY Round Yellow	RrYy Round Yellow
Ry	RRYy Round Yellow	RRyy Round Green	RrYy Round Yellow	Rryy Round Green
rY	RrYY Round Yellow	RrYy Round Yellow	rrYY Wrinkled Yellow	rrYy Wrinkled Yellow
ry	RrYy Round Yellow	Rryy Round Green	rrYy Wrinkled Yellow	rryy Wrinkled Green

Dihybrid Phenotypic Ratio : 9 : 3 : 3 : 1

9 RoundYellow : 3 Wrinkled Yellow : 3 Round Green : 1 Wrinkled Green

Genotypic Ratio : 1 : 2 : 1 : 2 : 4 : 2 : 1 : 2 : 1 (Robert H Tamarin)

4. Add a note of following with reference to *trypanosoma.*

a) Morphology - 03 marks

It is unicellular, microscopic, elongated, leaf-like, flattened and tapering at both ends. It is about 10-40μ in length and 2.5 - 10μ in width. Free flagellum is present at its anterior end while posterior end is blunt.

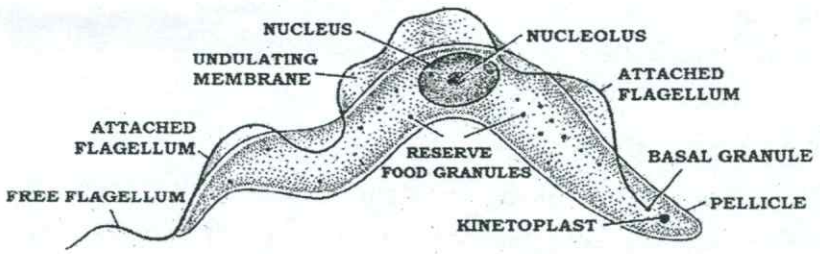
Animal body is covered by thin, elastic pellicle, which is composed of many microtubules. It is believed that microtubules help to maintain the shape of the organism while it swims in the blood.

It is uniflagellate. Single flagellum arises from a basal body (kinetosome), present near the posterior end of body. It runs forward along the entire length of body by a fin-like undulating membrane which is formed of cytoplasm and folded pellicle .Undulated membrane is an adaptive structure for locomotion in the viscous environment (blood lymph).Flagellum shows the usual 9+2 internal fibril arrangement and bounded by plasma membrane.

Cytoplasm is differentiated into an outer clear ectoplasm and inner granular endoplasm.The endoplasm contains single nucleus, mictochondrion,golgi appartus , endoplasmic reticulum and ribosomes. Contractile and food vacuoles are absent but contains many scattered greenish refractile bodies called volutin granules which store food particles like glycogen and phosphates. Many small vacuoles are present with hydrolytic enzymes (lysosomes).

Central nucleus is single, oval, vesicular covered by nuclear membrane and contains nucleolus which is surrounded by a clear space. As nucleus is concerned with the nurtitive functions of the parasite, often it is known as trophonucleus .

Mitochondrion is elongated, giant and extends from anterior to posterior ends of the body called chondriome. A conspicuous mass of double stranded DNA (kinetoplast) is present in mitochondrion near the gullet. A golgi complex is present between the reservoir and nucleus. Endoplasm reticulum is present throughout the cytoplasm. Ribosomes are present on the endoplasmic reticulum as well as scattered freely in cytoplasm.



MORPHOLOGY OF *TRYPANOSOMA GAMBIENSE*.

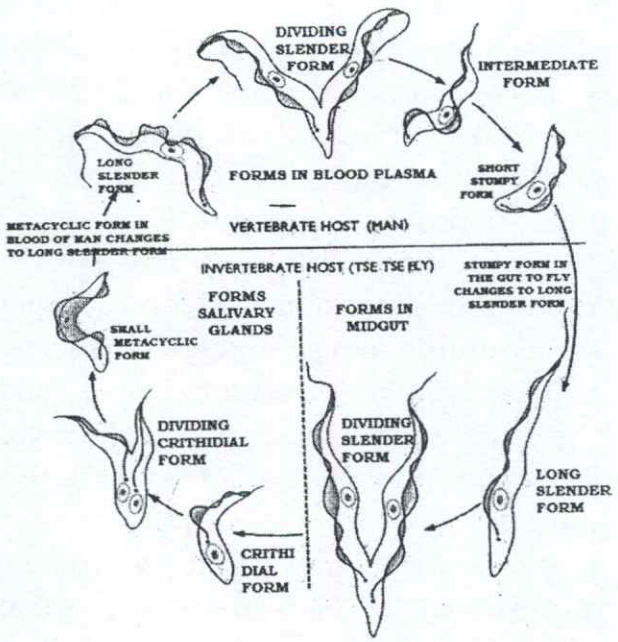
b) Life cycle **Explanation - 04 marks, diagram - 03 marks**

It is digenetic pathogen as it completes its life cycle in two hosts like primary (principal / definitive) host is **man** and intermediate host (vector) is **tsetse fly** (***Glossina palpalis***). The mammals like antelopes, pigs, buffaloes often act as reservoir hosts harbouring the parasite.

b. **LIFE CYCLE IN MAN –** The man gets infection by the bite of tsetse fly which harbours the infective metacyclic forms in the lumen of its salivary glands. When fly feeds on man's blood, it releases the trypanosomes into blood. The fly holds skin surface of the host with its claws while feeding and punctures it with its proboscis. Fly first introduces saliva with anticoagulant to prevent clotting of blood along with it inoculates infective forms of trypanosoma.

In man parasites are found in blood plasma. The metacyclic forms which are without free flagella are transformed into long slender forms with flagella. These swim freely by the beating of their free flagella and the vibratile movements of the undulating

membrane and multily actively by longitudinal binary fission, while multiplication these use energy by anaerobic glycolysis.



When absorption of glucose decreases due to production of antibodies in blood, multiplication stops so they shrink to short stumpy forms which are without free flagellum. Intermediate forms with short body and a small free flagellum appear during this transformation from long slender forms to short stumpy forms, the. Intermediate and short forms depend on their energy by aerobic oxidation of pyruvic acid. The short, stumpy forms do not feed and ultimately die if they are not sucked by *tsetse* fly.
Some of the long and slender trypanosomes do not transform, but change the antigens of blood to which the host has produced antibodies. These unaltered forms survive and continue to multiply in blood leads to relapsing of infection.

LIFE CYCLE IN *TSETSE* FLY – Short stumpy forms are sucked by fly along with blood from an infected person. Further development takes place in the insect's midgut within **peritrophic** membrane, where parasites transform into long slender forms and multiply by longitudinal binary fission. The **kinetoplast** moves farther from the posterior end of body. Energy provided by mitochondrial oxidation of **pyrvic acid**.
Long slender forms move into salivary glands via the oesophagous and mouth parts of insects. They metamorphose into **crithidial** forms with short body, reduced free flagellum and the kinetoplast infront of the nucleus. The mitochondrion develops an extensive network of cristae and the parasite respires more economically as the blood glucose gradually declines. The crithidial forms multiply in the lumen of salivary glands and transform into slender **metacyclic forms**. At this stage the mitochodrial activity is again suppressed. Metacyclic forms along with saliva enter into body of healthy person when fly bites, thus continues life cycle.

BENGALURU CITY UNIVERSITY

VI Semester B.Sc. Degree Examination, August/September - 2023

ZOOLOGY

Animal Physiology and Techniques in Biology

(CBCS Scheme Fresher and Repeaters 2020-21 Onwards)

Paper – VIII

Time: 3 Hours **Maximum Marks: 70**

Instructions to candidates:

Draw neat labelled diagrams wherever necessary

Answer should be completely in English

PART-A

I. Answer all the following in one word or one sentence 10x1=10

1. Expand GIP hormone

Gastric inhibitory peptide or glucose insulinotropic peptide

2. Name the metabolic ion present in haemocyanin

Copper

3. Give an example for uricotelism

Aves

4. What is the function of earossicle?

Transfer and amplify air vibrations

5. Name the birth hormone

Oxytocin

6. What is anaemia?

Anaemia is the iron deficiency disorder because iron is required to produce haemoglobin

7. Give an example for Catadromous migratory fish

Eel

8. Mention the role of alcohol used in micro technique

Dehydration

9. Define fractionation

Fractionation is the separation of a mixture (solid, liquid,suspension or an isotope) into its component parts, or fractions, collected based on differences in their specific property of individual component

10. What is resolution?

The resolution of a microscope or lens is the smallest distance by which two points can be separated and still be distinguished as separate objects. The smaller this value, the higher the resolving power of the microscope and the better the clarity and detail of the image.

PART-B

II. Answer any five of the following 5x3=15

11. Write a note on Fuld and Spiros theory of blood clotting

According to this theory an enzyme called thrombokinase plays an important role in the blood coagulation. Thrombokinase is nothing but **thromboplastin** secreted from ruptured blood platelets. Thromboplastin converts prothrombin into thrombin which in turn changes fibrinogen into fibrin.

Thrombokinase

Prothrombin ----------->Thrombin

Ca+ +

Fibrinogen + Thrombin ----------> Fibrin

In all the above methods of coagulation the soluble fibrinogen is converted into insoluble fibrin to form a clot. This clot is also known as **Buffy coat.** The blood fails to coagulate in some people even when a wound appears on the body. This condition is called **Haemophilia** which is a **hereditary.** Sometimes it is most fatal. Haemophilia is also called **Royal disease** since it is most common in Royal family of British.

12. Explain Bohr's effect

The Bohr effect is a phenomenon first described in 1904 by the Danish physiologist **Christian Bohr. O**xygen binding affinity of haemoglobin is inversely related to the concentration of carbon dioxide and H^+ concentration. The Bohr effect increases the efficiency of oxygen transportation through the blood. When released into the bloodstream, carbon dioxide forms bicarbonate and protons through the following reaction:

$CO_2+H_2O \rightleftharpoons H_2CO_3 \rightleftharpoons H^+ + HCO_3^-$

13. Write a note on neurotransmitters.

Neurotransmitters are substances which neurons use to communicate with one another and with their target tissues in the process of synaptic transmission (neurotransmission).

Neurotransmitters are synthetized in and released from nerve endings into the synaptic cleft. There are more than 40 neurotransmitters in the human nervous system; some of the most important are acetylcholine, norepinephrine, dopamine, gamma-aminobutyric acid (GABA), glutamate, serotonin, and histamine.

14. What is negative feedback mechanism? Give an example

Explanation -2 marks ex. 1 mark

It occurs when the original effect of the stimulus is reduced by the output.

Negative feedback mechanism normalizes the things when they start becoming too extreme.

For eg. The thyroid gland is regulated by a negative feedback mechanism.

The insulin secretion by the pancreas is also controlled by the negative feedback mechanism.

15. List any three causes of renal failure.

Any 3 causes

A person suffering from diabetes mellitus or with high blood pressure is more prone to renal failure.

Excessive dehydration

Kidney trauma

Exposure to pollutants or excessive medicines

Polycystic kidney disease

Blocked urinary tract

16. Give the applications of electrophoresis.

Any 3 applications

It is used extensively used in research and clinical investigation (blood sampling i.e haemoglobin and glycoprotein.

It is used in isolation of macromolecules, like proteins and nucleic acids.

It is used in DNA finger printing in forensic laboratories

Used in fragmentation of DNA molecules with the help of restriction enzymes in the field of biotechnology

It is used in identification of mutations in DNA,

Electrophoresis of proteins and aminoacids is used in peptide mapping.

17. What is autoradiography? Mention any two applications.

Defination- 1 mark,any 2 applications

Autoradiography is a detection method in which X-ray or photographic film is exposed to emissions from radioisotopes on TLC plates to produce an image on the film.

Applications

Is used in detection of RNA DNA or Proteins

Used in detection of histopathological diseases.

Viral sequences can be located using 32P, 33P or 35 S

It is used to detect radioactive substances separated in PAGE.

PART-C

III. Answer any five of the following 5x5=25

18. Explain symbiotic digestion in ruminants

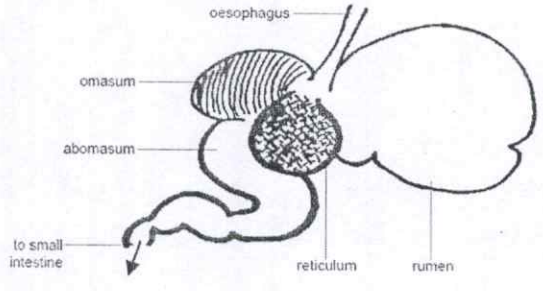
Ruminants are also called as grass-eating animals. These are hoofed animals whose body stands on four limbs. Ruminants include, cows, buffaloes, sheep, giraffe, camel, deer etc.

Rumination is ruminants swallow the food without chewing. After feeding, they bring the food from the stomach back into the mouth and chew it leisurely. This process is called chewing.

Stomach of a ruminant is divided into four chambers – the rumen, reticulum, omasum and abomasum. Rumen is the largest part of the stomach.

Grass-eating animals swallow the food quickly and store it in the rumen. Rumen also inhabits cellulose digestive bacteria which establish a symbiotic relationship with the animal stomach.

Digestion in ruminants is a good example of symbiosis. Microorganisms present in the stomach of ruminants help in digesting cellulose and in turn obtain shelter and nourishment form the animal. A symbiotic relationship exists between microorganisms and the ruminants.



As rumen is full, the food is taken into second part of the stomach, the reticulum.

Digestive juices of the reticulum partially digest the food. The partially digested food in the reticulum is called as cud.

While resting, cow brings back the cud into the mouth for regurgitation.
Food is chewed completely and swallowed into omasum for further digestion.
Then the food moves into abomasum for digestion brought about by digestive juices.
A large sac-like structure called the caecum lies between the small and large intestines.The symbiotic bacteria present in the caecum help in complete digestion of cellulose. Digestion of food is completed in the intestine.

19.Explain oxygen transport in blood

Oxygen is poorly soluble in plasma, so that less than 2 percent of oxygen is transported dissolved in plasma. The vast majority of oxygen is bound to haemoglobin, a protein contained within red cells. Haemoglobin is composed of four iron-containing ring structures (haemes) chemically bonded to a large protein (globin). Each iron atom can bind and then release an oxygen molecule. Enough haemoglobin is present in normal human blood to permit transport of about 0.2 millilitre of oxygen per millilitre of blood. The quantity of oxygen bound to haemoglobin is dependent on the partial pressure of oxygen in the lung to which blood is exposed.

The amount of oxygen extracted by the cells depends on their rate of energy expenditure. At rest, venous blood returning to the lungs still contains 70 to 75 percent of the oxygen that was present in arterial blood, this reserve is available to meet increased oxygen demands.

Haemoglobin binds not only to oxygen but to other substances such as hydrogen ions (which determine the acidity, or pH, of the blood), carbon dioxide, and 2,3-diphosphoglycerate (2,3-DPG, a salt in red blood cells that plays a role in liberating oxygen from haemoglobin in the peripheral circulation). These substances do not bind to haemoglobin at the oxygen binding sites. However, with the binding of oxygen, changes in the structure of the haemoglobin molecule occur that affect its ability to bind other gases or substances. Conversely, binding of these substances to haemoglobin affects the affinity of haemoglobin for oxygen. Increases in hydrogen ions, carbon dioxide, or 2,3-DPG decrease the affinity of haemoglobin for oxygen, and the oxygen-dissociation curve shifts to the right. Because of this decreased affinity, an increased partial pressure of oxygen is required to bind a given amount of oxygen to haemoglobin. A rightward shift of the curve is thought to be of benefit in releasing oxygen to the tissues when needs are great in relation to oxygen delivery, as occurs with anaemia or extreme exercise. Reductions in normal concentrations of hydrogen ions, carbon dioxide, and 2,3-DPG result in

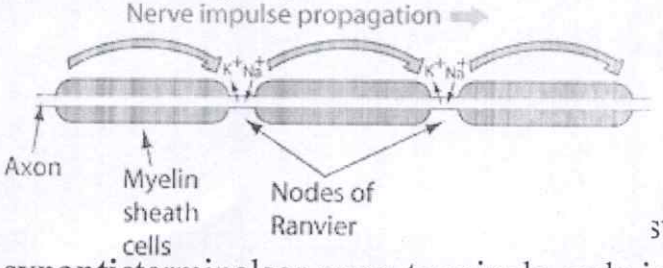
an increased affinity of haemoglobin for oxygen, and the curve is shifted to the left. This displacement increases oxygen binding to haemoglobin at any given partial pressure of oxygen and is thought to be beneficial if the availability of oxygen is reduced, as occurs at extreme altitude.

Temperature changes affect the oxygen-dissociation curve similarly. An increase in temperature shifts the curve to the right (decreased affinity, enhanced release of oxygen), a decrease in temperature shifts the curve to the left (increased affinity). The range of body temperature usually encountered in humans is relatively narrow, so that temperature-associated changes in oxygen affinity have little physiological importance.

20. Explain synoptic transmission of nerve impulse.

The nerve impulse is transmitted from one neuron to the next through a gap or cleft called asynaptic gap or cleft or a synapse by a chemical process. Synapses are specialized junctionsthrough which cells of the nervous system communicate to one another and also non-neuronalcellssuchasmusclesandglands.

Structureofasynapse



st-synapticneuron.The**pre-synaptic**terminalsor axon terminals ends in small **synaptic knobs or bulbs**. It contains a number of **vesicles** thatcontain the **neurotransmitters** and a number of mitochondria. The pre-synaptic membrane alsohasanumberofvoltagegated**Caionchannels**whichopenasthenerveimpulsereaches the knob. As Ca+ enters the knob the vesicles become attached to the **docking proteins** on the insideof the **pre-synaptic membrane** and they burst open releasing the neurotransmitters into thesynaptic cleft or gag. These neurotransmitters are chemicals like acetylcholine, epinephrine, norepinephrine,histamine,serotoninetc.

The **post-synaptic membrane** of the succeedingneuron has specific **protein receptors**to which the neurotransmitters are attached and they excite, inhibit or modify the post-synaptic neuron. The changes in the potential of the postsynaptic cell are called **post-synaptic potential.**

21. Discuss the hormonal control of metamorphosis in insects

Changes during metamorphosis are accompanied with growth and ecdysis. Hormones play an important role in ecdysis and metamorphosis.

The various hormones controlling ecdysis and metamorphosis are as follows

1. Brain hormone (JH). It is secreted by the neurosecretory cells of the brain. Chemically, it is a lipid. It activates the corpora cardiaca, a component of the retro-cerebral complex.
2. Prothoracicotropic hormone (PTTH). It is secreted by the corpora cardiaca and activates the prothoracic glands.
3. Prothoracic gland hormone (PGH). Ecdyosone, a hormone secreted in the prothoracic gland, chiefly controls ecdysis.
4. Juvenile hormone (JH). The hormone is secreted by corpora allata, another component of the retro-cerebral complex. Chemically it is an unsaponifiable, non-sterolic lipid. It prevents metamorphosis of the insect larva into the pupa, under the influence of ecdysone. As long as the juvenile hormone remains active, each moult simply results into a larger larva. When juvenile hormone declines, the ecdysone is free to bring about the change from larva to pupa and then to the adult.

22. Give the causes, symptoms and prevention of diabetes mellitus

Cuses: Insulin resistance, autoimmune disease, Hormonal imbalances,pancreatic damage, Genetic mutations

Synptoms: Increased thirst,Weight loss,Increased urination,Hunger due to starvation of cells,Fatigue,Slow healing of wounds

Prevention: Eat a healthy diet, Get physically active. Limit alcohol intake.

Get adequate sleep (typically 7 to 9 hours) and seek treatment for sleep disorders.

Quit smoking.

23. Write the principle and applications of immunoassay

Principle -2 ½ markand **Applications** - 2 ½ mark

Principle

It is based on the competition between the labeled and unlabeled antigens to bind with the antibody to form antigen-antibody complexes.

A known quantity of an antigen is made radioactive by labelling it with Gamma-isotopes of iodine attached to tyrosine.

The radio labelled antigen is then mixed with known amount of antibody specific for it.

The serum from a patient containing unknown antigen is added which causes the unlabeled antigen from serum to compete with radiolabeled antigen for its binding sites.

As the concentration of unlabelled antigens increases it displaces the radiolabeled antigen

Applications

It is a very sensitive test used to measure antigens in very small quantities (picogram 10-12)

Commonly used in reproductive biology and endocrinology for assay of hormones in picogram

Used in detectingIg E type of natural antibody

Used in detecting hepatitis B virus antigen, certain serum proteins and also enzymes

It is used to detect drugs and vitamin

ELISA is used to detect antigens or antibodies of plants or animal hormones

Used to toxicology to detect toxins & screening of drugs.

Used to detect viruses such as HIV & other viruses

24. What is endoscopy? Mention its applications

Definition- 1 mark **Applications** 4 marks

Endoscopy, is the examination of internal body cavities using a specialized medical instrument called an endoscope.

Physicians use endoscopy to diagnose, monitor, and surgically treat various medical problems.

Applications

It is used in detection of ulcers, polyps, obstructions etc.

Used in detection of cancer

It is a diagnostic tool for specific symptom.

Most surgeries can be conducted by laproscopic and endoscopic technique.

It is used to get organ tissue out for biopsy and even deliver medicines

PART-D

IV. Answer any two of the following **2x10=20**

25. Explain the sliding filament theory of muscle contraction

Explanation- 5 marks **diagram** – 5 marks

Hug Huxley and Andrew Huxley proposed theSliding Filament Theory

The sliding filament theory is a suggested mechanism of contraction of striated muscles, actin and myosin filaments to be precise, which overlap each other resulting in the shortening of the muscle fibre length. Actin (thin) filaments combined with myosin (thick filaments) conduct cellular movements.

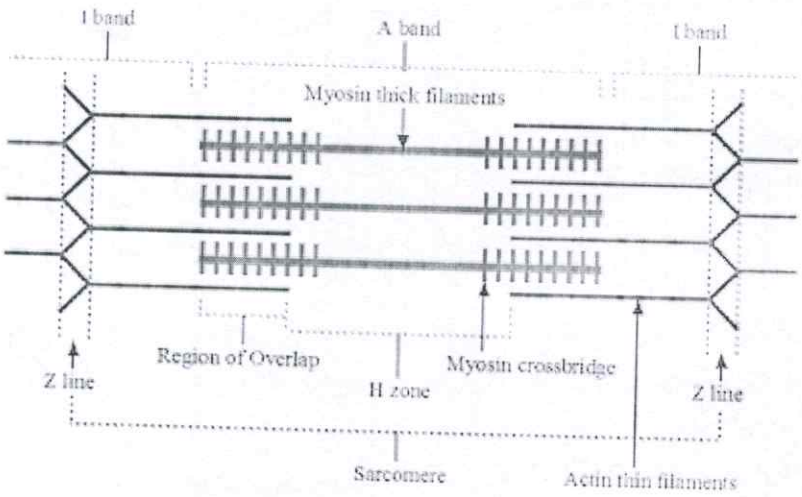
Myosin is a protein that converts ATP (chemical energy) into mechanical energy, thus creating thrust and movement. Also, actin polymerization and actin-myosin interaction are responsible for movements of a cell across a

surface. Actin filaments have myosin-binding sites which are revealed when troponin molecules bind to calcium ions in filaments, facilitating bridge formation between actin and myosin. This process is fueled by ATP, which acts as an energy source. ATP is hydrolysed in the heads of molecules of myosin causing a change in the shape of the head and binding to actin filaments.

A series of basic structural units forming striations (striped pattern) in muscle cells that make up the skeletal muscles are called sarcomeres.

A single sarcomere has a bundle of many myofibrils – actin and myosin filaments. Sarcomeres in the skeletal muscles initiate this movement through contraction which is attributed to its structure.

The A-band, a zone of repeated sarcomeres maintain a constant length during contraction. This band is present in the centre of the sarcomere where filaments overlap.



It consists of the H-zone, composed of thick myosin.

The two I-bands contain a thin filament, while the thick filaments are not too far away.

The Z-lines are responsible for the striped nature.

The M-line is located in the mid of Z-lines containing myomesin.

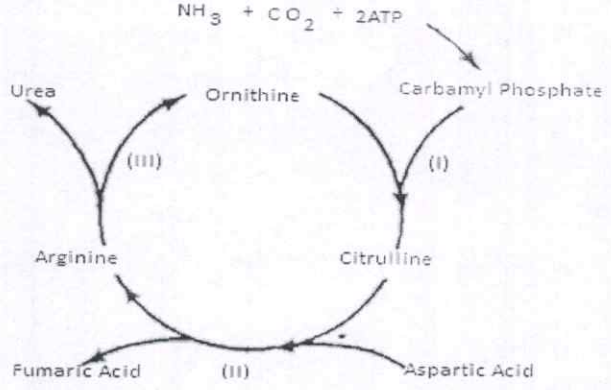
26. Give an account of the anterior pituitary gland hormones and mention their functions.

Hormones – 5 marks functions- 5 marks

Anterior pituitary gland secretes 6 hormones- ACTH,TSH,LH,FSH,PRL and GH

Adrenocorticotropic hormone (ACTH) – stimulates the adrenal gland to release stress hormones, especially cortisol. Under stressful conditions, cortisol is released in high amounts in the blood and regulates the body's reaction to stress. In particular, cortisol increases glucose metabolism, regulates blood pressure, and reduces inflammation.

(a).The reaction of citrulline with aspartic acid to form arginosuccinic acid (the reaction proceeds with the participation of ATP, with the liberation of adenylic acid [adenosine monophosphate, or AMP] and pyrophosphate, H4P2O7);
(b).The splitting of arginosuccinic acid to yield arginine and fumaric acid. In rea ction (III), arginine is hydrolyzed to urea and ornithine, which re-enters the cycle.



b) Fluorescent microscopy ------ 5 marks

A **fluorescence microscope** is an optical microscope that uses fluorescence and phosphorescence instead of, or in addition to, reflection and absorption to study the properties of organic or inorganic substances.

Principle

Most cellular components are colorless and cannot be clearly distinguished under a microscope. The basic premise of fluorescence microscopy is to stain the components with dyes.

Fluorescent dyes, also known as fluorophores or fluorochromes, are molecules that absorb excitation light at a given wavelength (generally UV), and after a short delay emit light at a longer wavelength. The delay between absorption and emission is negligible, generally on the order of nanoseconds.

The emission light can then be filtered from the excitation light to reveal the location of the fluorophores

Applications

To identify structures in fixed and live biological samples.

Fluorescence microscopy is a common tool for today's life science research because it allows the use of multicolor staining, labeling of structures within cells, and the measurement of the physiological state of a cell.

By
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Thyroid-stimulating hormone (TSH) – a glycoprotein that stimulates the production and secretion of thyroid hormones (T3 and T4) by the thyroid gland. The thyroid hormones play a vital role in regulating metabolism, energy homeostasis, growth, and nervous system activities. An overproduction of TSH leads to hyperthyroidism, whereas a lack of TSH causes hypothyroidism.

Follicle-stimulating hormone (FSH) and luteinizing hormones (LH) – these hormones are collectively known as gonadotrophins, which stimulate the ovary to release estrogen and progesterone and the testes to release testosterone. Both LH and FSH play important roles in regulating the growth and maturation of sperm and egg cells.

Prolactin – this hormone stimulates the mammary glands to produce milk after childbirth. A high prolactin level can affect the functions of ovary and testes.

Growth hormone (GH) – Stimulates growth in children and participates in maintaining various body tissues/organs in adults, including bones, liver, and fat and muscle tissues.

27. With reference to thermoregulation, explain the role of hypothalamus.

Thermoregulation is a process that allows the body to maintain its core internal temperature. All thermoregulation mechanisms help return our body to homeostasis. This is a state of equilibrium.

Thermoregulation is the set of mechanisms that an organism uses to keep its internal temperature constant. When the temperature outside changes, organisms must maintain homeostatic control over their bodies. A constant temperature is essential because the enzymes in our bodies only operate at specific temperatures, usually about 37°C. Temperature fluctuations also have an effect on the fluidity of cell membranes. When an organism's core body temperature is too high or too low, some physiological systems might shut down, resulting in the organism's death.

Thermoregulation is a critical component of human homeostasis. The majority of body heat is produced by deep organs, including the liver, brain, and heart, as well as by skeletal muscle contraction.

Sweating: Sweat glands release sweat, which cools the skin as it evaporates. This helps lower internal temperature.

Vasodilatation: The blood vessels under the skin get wider. This increases blood flow to the skin where it is cooler — away from warm inner body. This lets body release heat through heat radiation.

If body needs to **warm up**, mechanisms include:

Vasoconstriction: The blood vessels under the skin become narrower. This decreases blood flow to the skin, retaining heat near the warm inner body.

Thermogenesis: Body's muscles, organs, and brain produce heat in various ways. For example, muscles can produce heat by shivering.

Hormonal thermogenesis: Thyroid gland releases hormones to increase the metabolism. This increases the energy your body creates and the amount of heat it produces.

The hypothalamus maintains the set point for body temperature through reflexes that cause vasodilation and sweating when the body is too warm, or vasoconstriction and shivering when the body is too cold. It responds to chemicals from the body.

Its main function is maintaining the body's internal balance- homeostasis.

It also connects the endocrine and the nervous system.

Hypothalamus stimulates or inhibits many of the body's activities in order to maintain homeostasis, such as regulating body temperature, appetite and body weight, heart rate and blood pressure, etc.

It is involved in many essential functions of the body, including:Childbirth, Emotions, Sleep cycles, Balancing body fluids, Appetite and thirst control, Blood pressure and heart rate.

28. Explain:

a) Ornithine cycle -- 5 marks

A cyclic enzymatic process consisting of consecutive transformations of the ami no acid ornithine and leading to the synthesis of urea. The ornithine cycle is the most important means of assimilation of ammonia (and thus for its neutralizatio n) in many species of animals, as well as in plants and microorganisms.

The reactions of the ornithine cycle have been most thoroughly studied in mam mals (H. Krebs and K. Henseleit 1932), in which the reactions take place primar ily in the liver.

The ornithine cycle consists of three main reactions: the conversion of ornithine into citrulline, the conversion of citrulline into arginine, and the splitting of argi nine into urea and ornithine.

Reactions (I) and (II) require expenditures of energy, which is provided in the fo rm of adenosine triphosphate (ATP).

Reaction (I) proceeds in two steps:

(1).The formation of carbamyl phosphate, which has an energy-rich phosphate bond, from ammonia, carbon dioxide, and two molecules of ATP (the reaction is activated by *N*-acetylglutamic acid; ammonia is apparently supplied to the liver in the form of glutamine,which is split by liver glutaminase in to NH_3 and glutamic acid)

(2).The formation of citrulline in the reaction of carbamyl phosphate with ornith ine (the reaction proceeds using the energy of the carbamyl phosphate bond).

Reaction (II) also has two stages:

BENGALURU CITY UNIVERSITY

VI Semester B.Sc. Degree Examination, September/October - 2022

ZOOLOGY

Developmental Biology and Organic Evolution

(CBCS Scheme F+R 2020-21 Onwards)

Paper – VII

Instructions: 1) Draw neat labelled diagrams wherever necessary

2) Answer should be completely in English

Part-A

I. Answer the following with one word or one sentence each 10x1=10

1. What is amphimixis?

Amphimixis is a type of sexual reproduction in which haploid male pronucleus fuse with haploid female pronucleus to form diploid zygotic nucleus.

2. What is telolecithal egg?

The yolk of egg is concentrated more towards the vegetal pole.

3. Define radial cleavage

Radial cleavage is a characteristic feature in the early embryonic development of deuterostomes, this cleavage results in daughter cells that are located exactly on top of one another. The arrangement of the spindle axes are parallel or at 90° to the oocyte's polar axis.

4. Define is metamorphosis?

The change from nymph or larva to adult is called metamorphosis, the young one does not resemble the adult, the transformation of a larva into an adult is characterized by a series of morphological, physiological, and behavioural changes.

5. Name the foetal membrane in chick that helps in nutrition

Yolk sac

6. Give an example for non deciduate placenta.

All primate mammals including man.

7. Define regeneration.

Regeneration is one of the processes in which if an organism is cut into several pieces, each of its parts regrows to the original state. This process is carried out by specialized cells called stem cells.

8. What is gene pool?

Gene pool is the collection of different genes in a population of a particular species at a given time. The gene pool is used typically for referring to the

population of individuals of a particular species and it includes all the genes and combinations of genes in the population.

9. What is sympatric speciation?

Speciation within a population that occupies the same geographic environment by either ecological isolation (differing habitats) or by chromosomal aberrations as seen in plants is known as sympatric speciation

10. What is atavism?

It is the reappearance of certain ancestral characters which had either disappeared or were reduced. There are present some examples of atavism in human beings, viz., the power of moving pinnae in some persons, greatly developed canine teeth, short tail in some babies and presence of additional mammae in some individuals.

PART- B

II. Answer any five of the following **5x3=15**

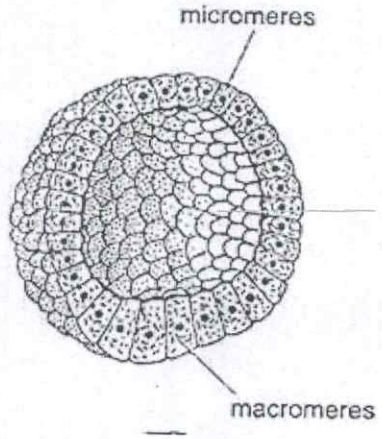
11. Explain briefly viviparity with an example

Scheme: Definition - 2 marks **example**- 1 mark

Animals that give birth to offspring are called viviparous. In viviparous animals, both fertilization, as well as the development of the embryo, takes place inside the female reproductive system. Ex-Dolphin, Whales, Humans, Lion, Tiger, Elephant, Dogs, etc give birth to young ones.

12. Sketch and label the V. S of blastula of amphioxus.

Scheme: Labelled diagram at least 2 labelling 3 marks



13. What are fate map? Mention any two methods of construction.

Scheme: Description-1 mark **any two methods**- 2 marks

A fate map is a diagram of an egg or blastula, indicating the fate of each cell or region, at a later stage of development. Fate maps are essential tool in most embryological experiments. The analysis of the fate of each blastomere after first and second cleavage is called cytogeny or cell lineage study.

Methods :

a. Observing Living Embryos b, Vital Dye Marking c. Radioactive Labelling &Fluorescent Dyes d. Genetic Marking

14. Explain arhenotokhy with an example.

Scheme: Definition -2 marks **example** 1 - mark

Arhenotokoy is a type of natural parthenogenesis, the haploid eggs develop into the haploid individuals. In these cases, the haploid individuals are always males for example, Insects, Arachnids and Rotifers

15. What is morphollaxis? Give an example.

Scheme: Definition -2 marks any one example 1 - mark

Morphallax is type of regeneration in which apart of body develops in to a new individual it involves reorganization of various parts of an organism from few cells to form a new organism. For eg. If Hydra, sponge or planaria is cut into two or more pieces, each piece will reconstitute itself into a new and complete individual.

16. With reference to speciation explain mutation.

Scheme: Description-3 marks

Mutation creates new genetic variation in a gene pool. It is how all new alleles first arise. In sexually reproducing species, the mutations that matter for evolution are those that occur in gametes. Only these mutations can be passed to offspring. For any given gene, the chance of a mutation occurring in a given gamete is very low. Thus, mutations alone do not have much effect on allele frequencies. However, mutations provide the genetic variation needed for other forces of evolution to act.

17. What are fossils? Explain casts.

Scheme: Definition- 1 mark **Casts explanation** -2 marks

Remains or vestiges or traces of plants and animals of the past are called fossils. The word 'fossil' is derived from the Latin word "fossilis" which means "to dig up".

Decay of tissue in an organism results in the formation of a hollow. When this hollow gets filled with mineral matter i.e. sediments, it results in the formation of a cast. An exact replica of the original plant material is thus resulted.

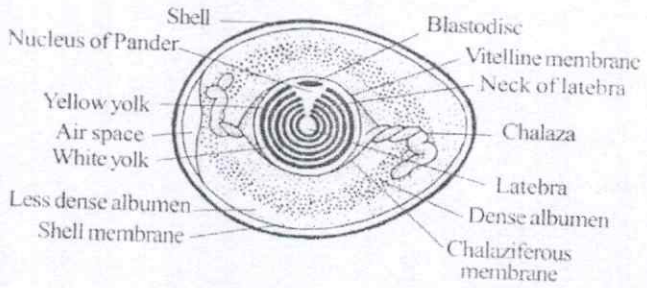
Like molds, there is also no involvement of the actual part of the plant in casts. Fruits, hard seeds and tree trunks are commonly fossilized as casts. In casts also, a three-dimensional view of the organ is seen similar to molds.

PART- C

III. Answer any five of the following **5x5=25**

18. Sketch and label the Hen`s egg.

Scheme:Labelled sketch at least 5 labelling



19. What is Polyspermy? Explain with examples.

Scheme: Definition -1 mark explanation -4 marks

Polyspermy refers to the fertilization of one egg with multiple sperm cells that result in the formation of an embryo with abnormal sets of chromosomes. This typically happens with conventional insemination where the egg and the sperm are placed in the same culture environment for fertilization.

Pregnancies that result from Polyspermy often result in spontaneous miscarriages during the second or third trimesters of pregnancy and foetuses that survive until childbirth are likely to not survive beyond a few days.

Polyspermy can also complicate in vitro fertilization (IVF) by producing non-viable embryos

a) Physiological Polyspermy- more than one sperm nuclei and centrioles enter the egg but only one sperm take part in fertilization and intiation of spindle fibres. Ex: reptiles, birds, urodeles and some insects

b) Pathological Polyspermy- In this type of Polyspermy more than one sperm nuclei and centrioles not only enters egg but they take part in fertilization process, leading to a pathological Polyspermy. Fusion of more than one sperm nucleus with one female pronucleus results a condition called polyandry, which is a lethal condition.

20. Explain the planes of cleavage.

Scheme:Description-3 marks diagram -2 marks

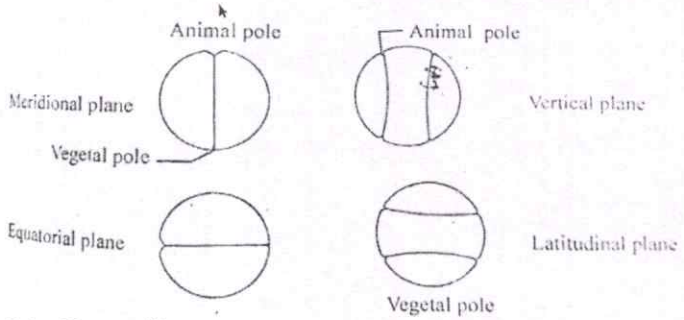
The process of cleavage remains one of the earliest mechanical activities in the conversion of a single celled egg into a multicellular embryo. It is initiated by the sperm during fertilization.

The process of cleavage or cellulation happens through repeated mitotic divisions. These divisions result in cells called blastomeres. In later stages of development the blastomeres occupy different regions and differentiate into several types of body cells.

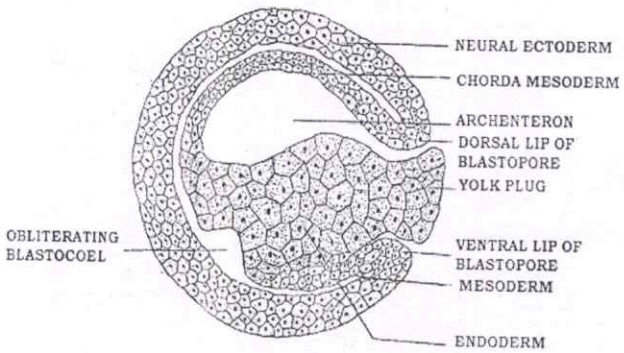
Meridional plane: The plane of cleavage lies on the animal vegetal axis. It bisects both the poles of the egg. Thus the egg is divided into two equal halves.

Vertical plane: The cleavage furrows may lie on either side of the meridional plane. The furrows pass from animal to vegetal pole. The cleaved cells may be unequal in size.

Equatorial plane: This cleavage plane bisects the egg at right angles to the main axis. It lies on the equatorial plane. It divides the egg into two halves.
Latitudinal plane: It is similar to the equatorial plane, but it lies on either side of the equator. It is also called as transverse or horizontal cleavage.

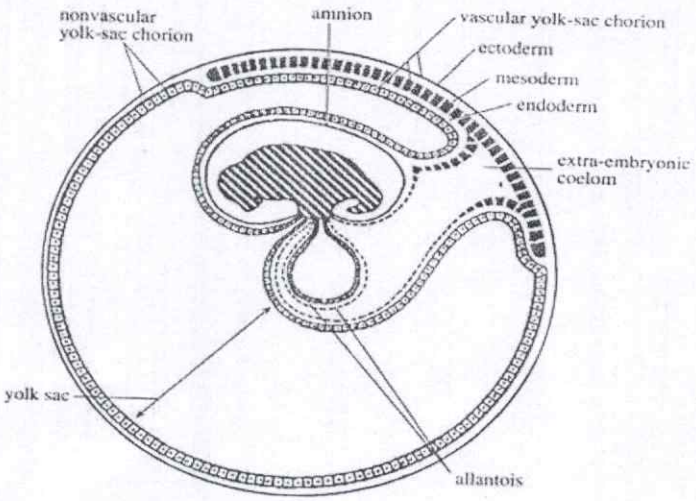


21. Describe the gastrula of frog with a neat labelled diagram.
Scheme:Description- 3 marks **diagram-** 2 marks
Frog's gastrula is two or three layered hollow embryodeveloped from blastula by **gastrulation**, which takes place by two main morphogenetic movements like **epiboly** and **emboly**.
Epiboly forms **epiblast** and emboly forms **hypoblast**. Epiblast is made up of epidermal and neuroectodermal cells (micromeres). Hypoblast is made up of chorda mesodermal cells and yolky endodermal cells (megameres).
It encloses a cavity called **archenteron (gastrocoel),** opens outside by blastopore. Gradually blastocoel is obliterated.
Archenteron is lined ventrally by endodermal cells and roof by notochordal cells and sides by mesodermal cells.



Blastopore is a slight depression at grey crescent guarded by dorsal lip above, ventral lip below and two lateral lips on the sides, which are made up of micromeres.
Due to contraction of blastoporal lips some endodermal cells project out through the blastopore called **yolk plug**.
22. Write a note on yolk sac placenta
Scheme:Description – 2 marks sketch – 2 marks examples – 1 mark

In some mammals, particularly in most marsupials (Didelphys, Macropus), the allantois remains relatively small and never makes contact with the chorion. The yolk sac on the other hand becomes very large and fuses with the chorion .
In these mammals the chorion receives its blood supply from the yolk sac (vitelline circulation) and the placenta is thus called choriovitelline placenta. In marsupials, although only a portion of the yolk sac (and thus the chorion) is provided with vascular mesoderm, it is still referred to as yolk- sac placenta. The chorion, however, never advances beyond a smooth membrane, applied closely with the endometrium.

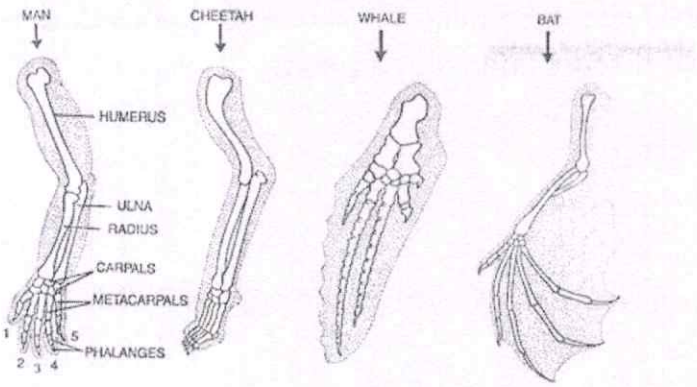


Among eutherian mammals, many carnivores, rodents and insectivores, a similar type of placenta may exist either temporarily or permanently. In those where the yolk sac placenta exists temporarily, the yolk sac provides the initial vascular supply.
It then gradually regresses, while the developing allantois reaches the chorion and vascularizes it. In the other type the yolk sac shares with the allantois the task of vascularizing the chorion.

23. Homologous organsare evidences of evolution substantiate.

Scheme: Definition- 1 mark, description with examples – 4 marks

The organs which have the same fundamental structure but are different in functions are called homologous organs. These organs follow the same basic plan of organisation during their development.
The fore-limbs of man, cheetah, whale and bat have the same basic structural plan. In each case the fore-limb consists of humerus, radio-ulna, carpals, metacarpals and digits. The skeletal parts of the fore-limbs of all these vertebrates are similar in structure and arrangement. But the fore-limbs of these animals have different shapes and functions. In man they are used for grasping, in cheetah for running, in whale for swimming and in bat for flying.



Another example of homologous organs is of different mouth parts of some insects. The mouth parts of cockroach, honey bee, mosquito and butterfly have the same fundamental plan. In each of these insects the mouth parts comprise labrum, a pair of mandibles and two pairs of maxillae, but they have different functions to perform, keeping in view their different feeding habits. The mouth parts in cockroach are adapted for biting and chewing. In honey-bee for chewing and lapping, in mosquito for piercing and sucking, in house-fly for sponging and in butterfly for siphoning.

24. List the salient features of Neanderthal man.

Scheme: each salient features – ½ mark

Body was about 150-165 cm tall and powerfully built.

He walked up right, with bent knee.

Skull was large and massive with a thick, bony ridge over the eyes.

Broad and short nose.

Flattened cranium and thick cranial bones.

Head was thrust forward.

Limbs stout, short and thick.

Broad shoulders and stooped forward.

Long legs and the knees bent forward.

Made variety of beautiful tools from flint and used them in collective hunting.

The part of brain involved in speech as well as intelligence was quite developed, this suggests that social life and language.

Evidences of religions and cultural activities.

As more of the weapons, tools utensils and ornaments made by Neanderthal man.

No evidences of agriculture or domestication of animals.

Buried their dead reverently with food and ornaments.

The pattern of flowers around the buried body was identified as pollen grains of different plants which were herbs commonly used for medicinal purposes later in history.

Neanderthals may not only have been religious or superstitious, but they may also have had some knowledge of disease and its treatment.

Part-D

IV. Answer any **two** of the following 2x10=20

25. Explain the mechanism of fertilization

Scheme: Each event 2 marks

Fertilization begins with the approach of the sperm to the egg and ends up with the formation of diploid zygote.

The process of fertilization requires five general events:

Recognition of egg and sperm (approach of spermatozoan to the egg, attachment and binding)

Acrosome reaction and penetration

Fusion of plasma membranes of egg and spermatozoa.

Activation of egg

Fusion of egg and sperm pronuclei

26. What is cell lineage? Explain with reference to Nereis

Scheme:Definition 2 **Explanation** 6 diagram 2

Cell lineage is the analysis or the study of each blastomere after the first and second cleavage. It helps to track the fate of the blastomeres after the four celled stage and gives us an idea of the determinate type of development. Cell lineage was studied in detail by E. B Wilson in 1892.The study is done using stains called vital stains like Janus green, Nile blue. In Nereis, the first two divisions result in four cells, these four cells are named as A,B,C and D. The fate of the cells are fixed as the egg is mosaic and cleavage is determinate. The cell D gives rise to the dorsal surface of the embryo, cell B gives rise to the ventral surface and cell C gives rise to the lateral surface of the embryo.

Cell lineage of A is shown.

Cell A is formed after two divisions.

During the third cleavage:

Cell A divides into a larger cell 1a and a small 1a

During 4^{th} division:

Cell 1A divides in to a larger 2A and a smaller 2a.

Cell 1a divides into smaller micromeres - $1a^1$ and $1a^2$.

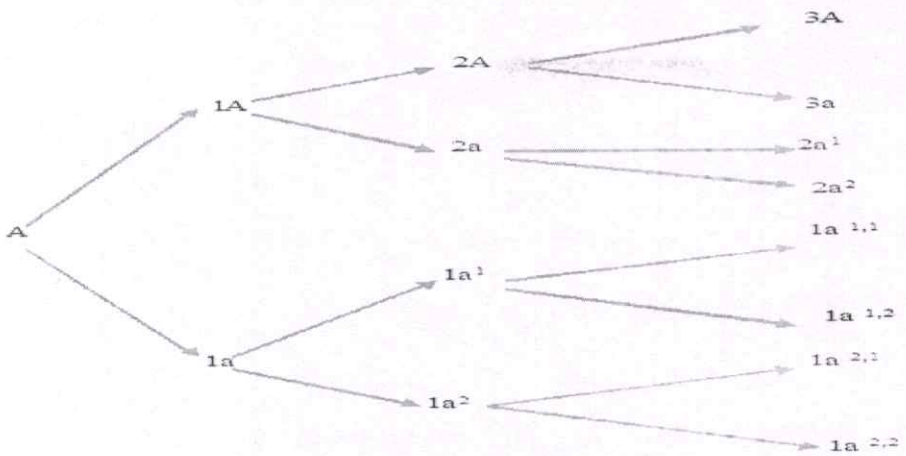
During the fifth division:

Cell 2A divides into a larger 3A and smaller 3a.

Cell 2a divides into two smaller $2a^1$ and $2a^2$.

Cell $1a^1$ divides into two smaller $1a^{1,1}$and $1a^{1,2}$.

Cell $1a^2$ divides into two smaller $1a^{2,1}$ and $1a^{2,2}$



27. Explain the transplantation experiments of Spemann and Mangold

Scheme:Role of gray crescent supported diagram 3+2 Heteroplasty experiments with diagram 3+2

Spemann`s discovery of Organizer was made in experiments with Newts, a variety of salamanders. The peculiarity of the salamander`s egg is that about half of its surface is dark coloured and the other half is light or colourless. Immediately after fertilization a small crescent shaped grey coloured region appears between light and dark areas. This region called as grey crescent, a features of fertilized egg.

Spemann using a strand of babies hair made a slip noose, looped it cover the cleaving egg and drew the strand light, leaving only a slender bridge of protoplasm between the two halves. The nucleus of the cell was retained in one of the half.

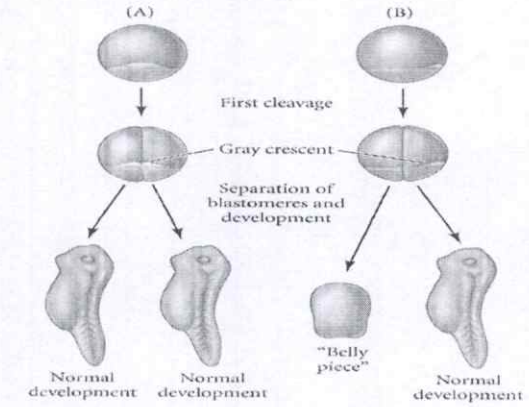
At first only half containing nucleus divides whereas the half without the nucleus remains undivided.

The undividing portion also start dividing soon as a nucleus from the divided cell enters in to undividing portions through narrow bridge. The net result was two embryos, one younger than the other.

Based on the result, Spemann performed similar experiment perpendicular to the plane of the first cleavage ie., separating the dorsal and ventral region rather right and left sides, he obtained a different result all together.

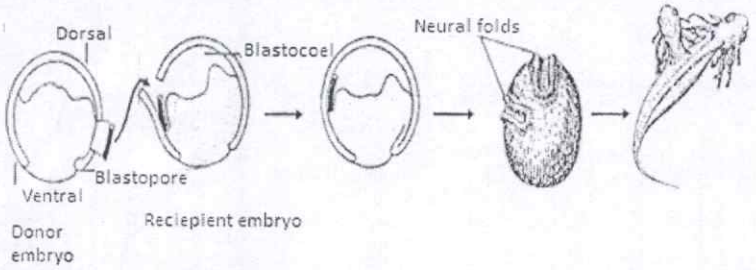
One side gave rise to a normal larva and the other side produced unorganized tissue mass, which he called the belly piece as it contained gut cells of endodermal region only.

The distinguishing difference between the two experiments is that first experiment, each half of the cleaving egg had a part of grey crescent, whereas in the second experiment, only one half had greycrescent.



Hetero transplantation (heteroplasty) experiments in Newts

The experiment was conducted by Spemann and Mangold. They used differentially pigmented embryos of two species of Newt, the darkly pigmented *Triturus taeniatus* and non - pigmented *Triturus cristatus* they transplanted cells of the dorsal lip of the blastopore of an early gastrula of *Triturus cristatus*before their morphogenetic movement into the early gastrula of *Triturus taeniatus*.



The transplanted piece of dorsal lip invaginated into the interior has developed into notochord and somites. It included the host ectoderm above the site of graft to form a neural groove resulting in two headed creature.

The process by which one embryonic region interacts with a second region, to cause the later tissue to differentiate in a direction it otherwise would not is called induction. The transplanted dorsal lip of blastopore that induces development is called the primary organizer.

28. What is isolation? Explain premating mechanism.

Scheme:Definition - 2 marks any 4 mechanism description with relevant example 2 marks each

Any external or internal barrier, which prevents interbreeding between populations, is called isolation. As a result the population of a species is either separated into smaller units or exchange of genes (gene flow) between them is prevented.

Ecological or Habitat isolation:

Mating inability between the organisms of closely related species or subspecies occupying the same region but different habitats, e.g. two species Rana i.e. Rana grylio (Pig frog) and Rana areolata (Gopher frog) live in different habitats. So the two species show ecological isolation.

Seasonal or Temporal isolation:

Due to the effect of factors like photoperiod, temperature and humidity, the breeding season of the animals of one species is different from that of other species, so are reproductively isolated e.g. American toad (Bufo Americans) breeds in early part of rainy season, while Fowler's toad (B .fowleri) breeds in later part of rainy season, so are reproductively isolated.

Ethological isolation:

Reproductive isolation due to difference in courtship or sexual behavioural patterns between members of closely related species e.g. males of different species of Sticklebacks have different mode of nest building and courtship dancing behaviour. Similarly, Pintail duck and Mallard duck also show ethological isolation.

Mechanical isolation:

This type of isolation occurs due to the differences in morphological structures such as external genitalia e.g. In Drosophila and Glossina.

Physiological isolation:

Mating inability due to functional incompatibility in their mating e.g. swelling of vaginal mucous membrane of Drosophila in case of inter-specific mating.

Gamete mortality:

Mating and sperm transfer takes place but egg is not fertilized. In Drosophila vaginal wall swells killing spermatozoa should interspecific crosses take place. If mating takes place between Bufo fowleri and Bufo valliceps, sperms cannot penetrate the egg membrane of each other, leading to mortality of gamete.

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V SEM BSc DEGREE EXAMINATION, March-2021
Zoology-VI
Genetics & Biotechnology (CBCS) (2021 onwards)
Scheme of Valuation

Time : 3 Hours **Maximum Marks :70**

Part-A **10x1=10**

I. Answer the following in one word or one Sentence

1. What type of twins is produced when a zygote splits into two cells?
   Identical twins are produced when a zygote splits into two cells.
2. Write the phenotypic ratio of Mendel's dihybrid ratio.
   9:3:3:1
3. What are alleles?
   A pair of genes controlling the same character and located at the same locus on the homologous chromosome is known as alleles or allelomorphs.
4. Mention two types of gynandromorphs?
   Bilateral, Anteroposterior, Sex pie bald.
5. Give any two methods of negative eugenics.
   a)Segregation
   b)Sterilization
   c)Birth control
   d)Prevention of consanguineous marriages
   e)Genetic counseling .
6. What are cosmids?
   Cosmids are the vectors possessing the characteristics of both plasmids & bacteriophage.
7. List any two types of Bioreactors?
   - Continuous stirred tank Bioreactors
   - Bubble column Bioreactors
   - Airlift Bioreactors
   - Fluidized Bioreactors
   - Packed Bed Bioreactors
   - Photo Bioreactors
8. Mention two types of host cells used in rDNA technology.
   a) Prokaryotic host cells b) Eukaryotic host cells
9. Define artificial insemination.
   It is the process of introduction of sperms into the female genital tract other than sexual intercourse.
10. Expand AFLP.
    Amplified fragment length polymerase.

PART-B 5x3=15

ii.Answer any Five of the following.

11. State the law of segregation. 3

In a monohybrid cross the F1 hybrid has both dominant and recessive factors which remain pure or uncontaminated and these segregate or separate during gametogenesis.

12. What is hypertrichosis? Name the chromosome involved in it. 2+1

Excessive hair growth on the ear pinna in case of male only is called hypertrichosis. Y-Chromosome is involved in it.

13. Define 1+1+1

a) Cistron: It is the modern term of gene is considered as the functional part of the gene which is capable of directing the synthesis of protein or polypeptide chain.

b) Muton: It is the smallest unit of the gene that can undergo mutation.

c) Recon: It is the smallest unit of the DNA capable of recombination.

14. Write a note on Physical mutagens. 3

Radiations like alpha, beta & fast & slow neutrons, ultra violet rays have been found to be mutagenic. Ionizing radiations like X-rays & gamma rays & alpha partials may cause DNA breakage & other damages. Ultraviolet radiations with wavelength above 260 nm are absorbed strongly by nitrogen bases, producing pyramiding dimmers, which can cause error in replication if left uncorrected. Ionizing radiations like X-rays penetrate deeper tissues & causes damage. Zirkle in 1930 showed that in plants the nucleus is more sensitive to ionizing radiations than cytoplasm. Non-Ionizing radiations have low penetrating power & these are used in treatment . UV radiations are non ionizing radiations . These produce several effects like formation of bonds between two adjacent .Thymine bases (dimer). The formation of dimer causes distortion of the double helix. High dosesof radiations damages the internal organs. The property of radiations is to kill the cells. It is used to kill the cancerous cells. The gonds are also affected & it causes sterility.

15. List the steps involved in embryo transfer. any 3

a)Monitering of follicular develop ent b)Monitering forLH C)Documentation of ovulation.

d)Embryo transfer e)Hormonal supplements f)Pregnancy test g)Follow-up consultation

16.What is gene therapy ? Mention any two types. 1+2

Gene therapy is a technique that modifies the person's gene to treat or cure diseases.

Types; a) Somatic cell gene therapy

b)Germ cell gene therapy

c)Embryo cell gene therapy

17) List any three applications of DNA finger printing. 3

a)Forensic Science b)Agriculture c)Food industry d) Medical diagnosis

e)Parentage testing

PART-C

III. Answer any Five of the following: 5x5=25

18.Write a note on erythroblastosis foetalis 5

Rh compatibility between foetal maternal blood results in a disease called erythroblastosis foetalis or haemolytic disease of the new born (HDN) foetus. Rh incompatibility occurs when Rh_ve mother bears an Rh+ve child (father being Rh+ve).The importance of Rh factor was recognized by Levine.This disease is caused due to the Rh antigen produced in the foetus enters into the blood of the mother. The blood of the mother produces Rh antibody. When this antibody enters the foetus, the foetus isaffected. The Rh antibody destroys the RBC of the foetus. The destruction of RBC leads to haemolytic jaundice & anaemia. The dead RBC are carried to liver for disintegration . As more work is given to liver , the liver is heavily damaged causing jaundice .Protection : When a child is diagnosed with erythroblastosis foetalis , within 72 hrs the Rh_ve mother is given intravenous injections of anti rhesus antibody called anti-D.The antibodTheies attach themselves to the rhesus antigen on the foetal RBCs circulating in the mothers blood stream . This prevents the mothers immune system from recognizing the antigen .

19. Explain cytoplasmic inheritance with reference to Kappa in Paramecium . 3+2

Kappa particles are self duplicating cytoplasmic particles present in Paramecium. There are two strains of paramecium, namely Killer & Sensitive strain .The Paramecium containing Kappa particles –Killer strain .Paramecium without Kappa particles _Sensitive strain.

Killer strain produces a toxic substance called Paramecin that kills the other type. The production of paramecin is controlled by Kappa particles. Kappa particles multiply during cell division, which is under the control of dominant nuclear gene "K". This gene can control only maintain the kappa particles & cannot initiate its production. These Kappa particles are transmitted through cytoplasm. When Killers KK Conjugate with non-killers kk, the exconjugants are Kk. But development of a particular type depends upon the duration of cytoplasmic exchange. In normal conjugation only nuclear material is exchanged.Hecce each exconjugant produces of its own type. Sometimes conjugation is prolonged & formation of cytoplasmic bridge results in the exchange of Cytoplasmic material along with nuclear material. Kappa particles present in killer enter non-killer during cytoplasmic exchange. The Kappa particles convert the non killer into killer strain .

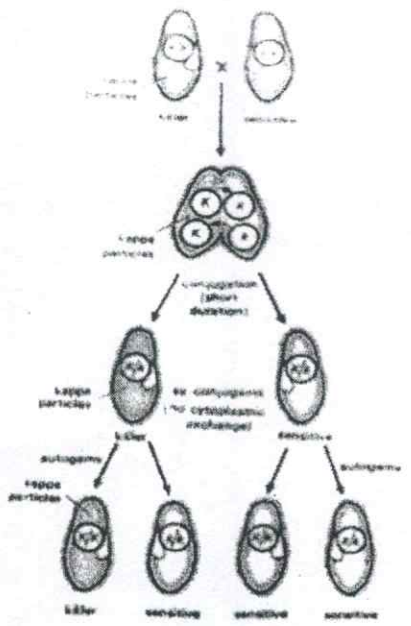


Fig: Results of a cross between a killer (*KK*) and a sensitive (*kk*) strain of *Paramecium*, when no cytoplasmic exchange is allowed.

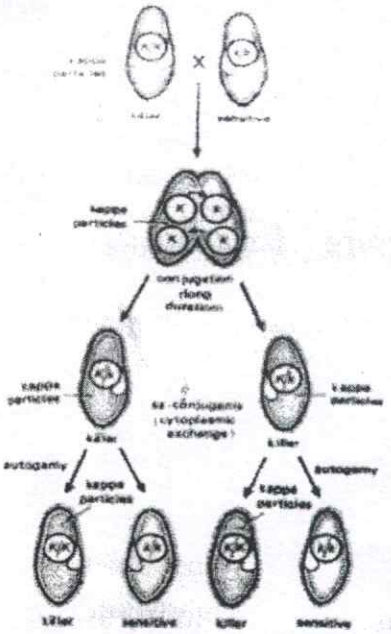
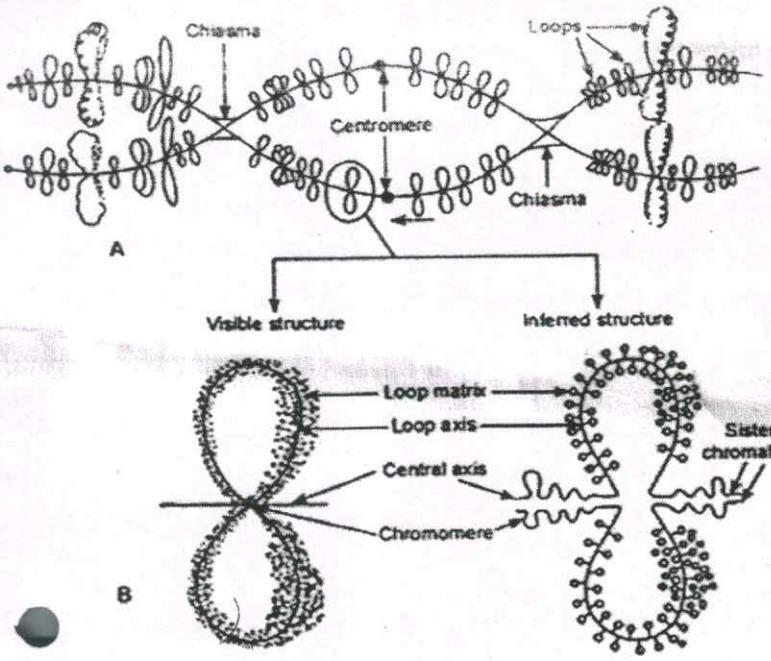


Fig: Results of a cross between a killer (*KK*)and a sensitive (*kk*) strain of *Paramecium*, when cytoplasmic exchange is allowed.

20. Describe the structure of Lampbrush chromosomes. 3+2

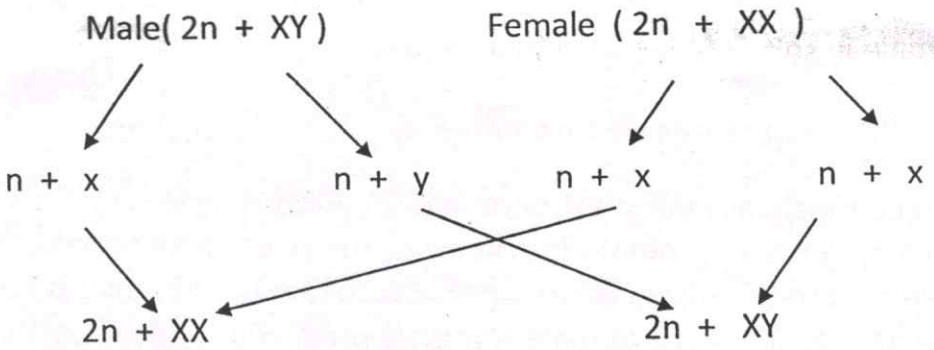
Lampbrush chromosomes of tailed and tailless amphibians, birds and insects are described best of all. Chromosomes transform into the lamp brush form during the diplotene stage of meiotic prophase I due to an active transcription of many genes. They are highly extended meiotic half-bivalents, each consisting of 2 sister chromatids. Lampbrush chromosomes are clearly visible even in the light microscope, where they are seen to be organized into a series of chromomeres with large chromatin loops extended laterally. Amphibian and avian lamp brush chromosomes can be microsurgically isolated from oocyte nucleus (germinal vesicle) with either forceps or needles. Each lateral loop contains one or several transcription units with polarized RNP-matrix coating the DNA axis of the loop. Giant chromosomes in the lamp brush form are useful model for studying chromosome organization, genome function and gene expression during meiotic prophase, since they allow the individual transcription units to be visualized. Moreover, lamp brush chromosomes are widely used for high-resolution mapping of DNA sequences and construction of detail cytological maps of individual chromosomes.



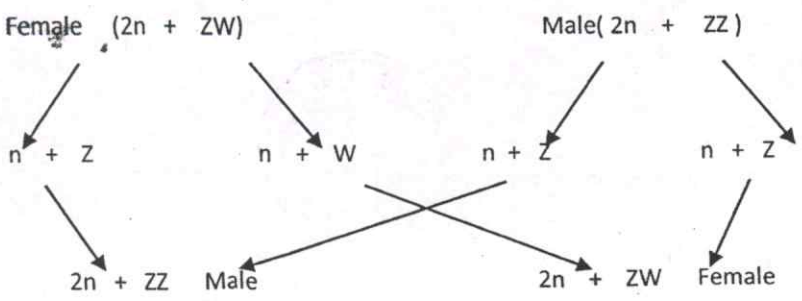
21. With reference to sex determination explain the 2.5+2.5

a)XX-XY : In certain mammals females have two X- Chrmosomes & are the homogametic sex . The males have an X-chromosome & a Y-chromosome . It is heterogametic .Therefore it produce two tyres of sperms , One with an X & other with a Y- chromosome .

Therefore the sex of an organism depends on the sperm fertilizing the ovum .



b) ZZ = ZW : In fishes , reptiles & birds Males have two similar chromosomes Z& Z & they are homogametic & produces two identical gametes . The females are heterogametic & have Z W Chromosomes .They produce two dissimilar gametes. The sex of the individual depends upon the type ovum fertilizing the sperm.



22. Explain the genic balance theory of Bridges. 5

In Drosophila there are four pairs of chromosomes. Three pairs are autosomes & the fourth pair is allosome or sex chromosome. At first, the mechanism of sex determination was thought to be usual XX-XY type. The males were heterogametic & the females were homogametic. It was onlywhen non-disjunction of X-chromosome occurred the female produces two types of gametes or ova . When normal sperms fertilized such as abnormal ova, the individuals obtained did not show expected sex in relation to their genotype. Four types of individual were obtained, different from the normal.

AA + XX

↓

A+XX & A+O

Non-Disjunction of the X chromosome

Gametes	A+XX	A+O
A+X	AA+XXX Super female	AA+XO Male(sterile)
A+Y	AA+XXX Female	AA+YO Non-viable

The above example shows that the individuals obtained were different in their phenotypes as limited below

AA + XXX was a Super female

AA-XO was a male in spite of the absence of Y chromosome. However, it was sterile, as Y chromosome promotes fertility.

AA-XXY turned out to be female in spite of having Y chromosome.

AA-YO was non-viable due to the absence of an X chromosome.

Calvin B Bridges in 1921 worked mechanism of sex determination .According to him the X Chromosome in drosophila carry genes to promote femaleness., the strength of female promoting genes is 1.5. The male promoting genes are carried autosomes. The value is 1.The normal female has genotype AA+XX . The ratio of male & female promoting genes 2:3. The normal male has AA+XY. The ratio is 2:1.5.

a) AA+XXX=2:4.5 b) AA+XO=2:1.5 C)AA+XXY=2:3 d)AA+Y0=non viable

Normal male AA+XY X Triploid female AAA+XXX

Gametes	Ratio	Phenotype/sex

AAXXX	3 : 4.5	Triploid female
AXXY	2 : 4.5	Super female
AAAXX	3 : 3	Inter sex
AAXX	2 : 3	Normal female
AAAXXY	3 : 3	Inter sex
AAXXY	2 : 3	Female
AAAXY	3 : 1.5	Super male
AAXY	2 : 1.5	Normal male

23. Write notes on 2.5

a) Electroporation: It basically involves the use of high field strength electrical impulses to peeablize the cell membrane for the uptake of DNA .This technique can be used for the delivery of DNA into Plant cells & protoplast . The plant material is incubated in a buffer solution containing the desired foreign DNA & subjected to high voltage electrical impulses. This results in the formation of pores in the plasma membrane through which DNA enters & gets integrated into host cell genome. It has been successfully used for the production of transgenic plants of many cereals. Eg: Rice, Wheat, and Maize

Advantages: This technique is simple, convenient & rapid. Transformed cells are at the same physiological state after electroporation.

Limitations:

- Under normal conditions, the amount of DNA delivered into plant cells is very low.
- Efficiency of electroporation is highly variable, depends on plant material & conditions.
- Regeneration of plants is not very easy, particularly when protoplast is used.

(b) Micro-injections **2.5**

It is a direct physical method involving mechanical insertion of desirable DNA into target cell. It is used for the transfer of cellular organelles & manipulation of chromosome. It involves the gene through micropipette into the cytoplasm/nucleus of plant cell or protoplast. The recipient cell is kept immobilized in agarose embedding & held by a suction holding pipette during this process. As the process of micro-injection is complete. The transformed cell is cultured & grown to develop into transgenic plant.

Limitations: It is slow & expensive & has to be performed by trained & skilled persons.

24. Define PCR technique? Mention its applications. 2+3

Polymerase chain reaction (PCR) is a method widely used to rapidly make millions to billions of copies of a specific DNA sample, allowing scientists to take a very small sample of DNA and amplify it to a large enough amount to study in detail.

Applications:

1. Diagnosis of genetic diseases.
2. Genetic fingerprints.
3. Detection and diagnosis of infectious diseases.
4. Detection of infection in the environment.
5. Cloning of genes.
6. Identification of mutation.

Part-D

2x10=20

25. What are supplementary genes?

2+2+2+4

With reference to inheritance of comb shaped in poultry fowls workout the following crosses:

Supplementary genes can be defined as 'a pair of independent dominant genes which, when together produce trait(new) different from what each dominant gene can produce when alone. (2)

1. Rose Comb (RRpp) * Single comb(rrpp) (2)

RRpp X rrpp

gametes Rr X rp

F1 generation Rrpp Rose Comb

Rose Comb Rrpp X Rrpp Rose Comb

Rp rp Rp rp

	Pr	pr
Pr	PPrr Pea	Pprr Pea
pr	Pprr Pea	pprr Single

Phenotypic Ratio 3:1 **Genotypic Ratio** 1:2:1

(b) Pea comb x Single Comb (2)

rrPP rrpp

Gamete Pr rp

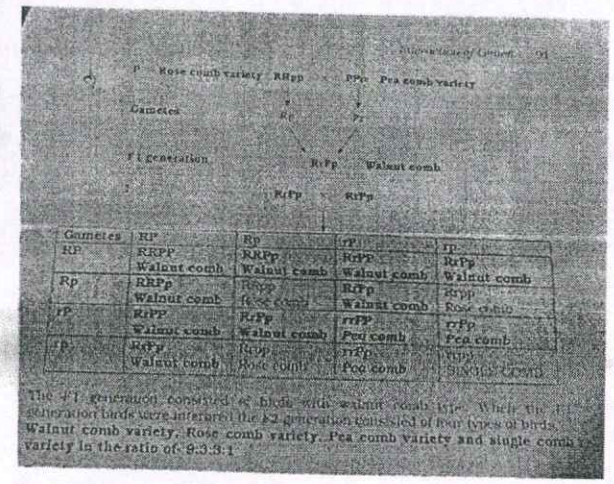
F1 Pprr Pea comb X Pprr Pea comb

Pr pr Pr pr

	Pr	Pr
Pr	PPrr Pea	Pprr Pea
pr	Pprr Pea	pprr Single

Phenotypic ratio 3:1 Genotopic ratio 1:2:1

c) Rose comb variety x Pea comb variety (4)



26. Explain the inheritance of: 5

a) ABO blood groups in man.

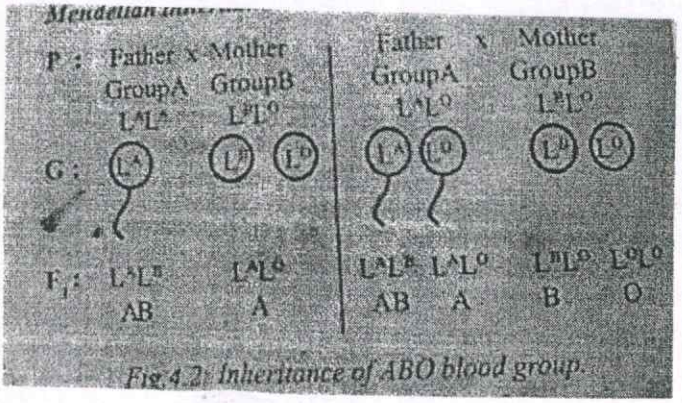
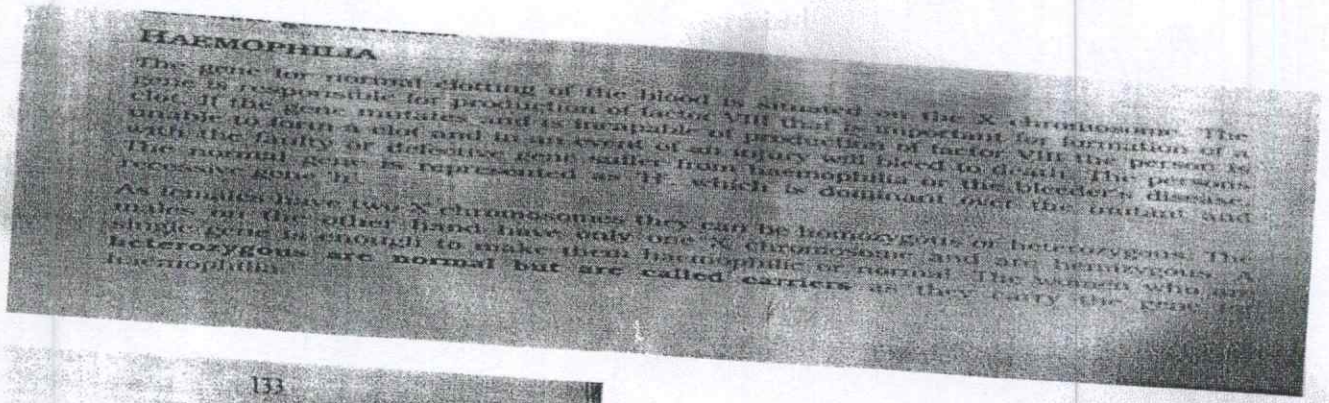


Fig 4.2: Inheritance of ABO blood group.

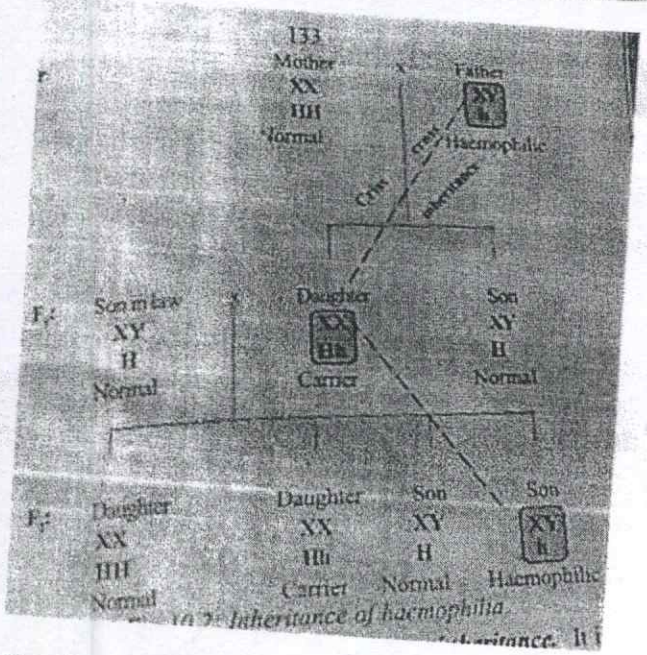
b)Hemophilia



HAEMOPHILIA

The gene for normal clotting of the blood is situated on the X chromosome. The gene is responsible for production of factor VIII that is important for formation of a clot. If the gene mutates and is incapable of production of factor VIII the person is unable to form a clot and in an event of an injury will bleed to death. The person with the faulty or defective gene suffers from haemophilia or the bleeders disease. The normal gene is represented as 'H' which is dominant over the mutant and recessive gene 'h'.

As females have two X chromosomes they can be homozygous or heterozygous. The males on the other hand have only one X chromosome and are hemizygous. A single gene is enough to make them haemophilic or normal. The women who are heterozygous are normal but are called carriers as they carry the gene for haemophilia.



Inheritance of haemophilia

29. Write note on

a) Klinefelters syndrome

5 Marks

A genetic condition in which a male is born with an extra copy of the X chromosome. Klinefelter's syndrome isn't inherited, but rather occurs only as a result of a random genetic error after conception. Males born with Klinefelter's syndrome may have low testosterone and reduced muscle mass, facial hair and body hair. Most males with this condition produce little or no sperm. Treatment may include testosterone replacement and fertility treatment.

b) Cystic fibrosis

5 marks

- CF is a genetic disease that mainly affects the lungs and digestive system, but it can result in fatal complications such as liver disease and diabetes.
- The defective gene responsible for CF leads to the creation of thicker, stickier mucus than is usual. This mucus is difficult to cough out of the lungs. This can make breathing difficult and lead to severe lung infections.
- The mucus also interferes with pancreatic function by preventing enzymes from properly breaking down food. Digestive problems result, potentially leading to malnutrition.
- This thickening of mucus can also cause male infertility by blocking the vas deferens, or the tube that carries the sperm from the testes to the urethra.
- CF is serious, with potentially life-threatening consequences. The most common cause of death in people with CF is respiratory failure.

2+4+4

28. What are Stem cells? Explain the types, sources & their applications?

Stem cells are biological or undifferentiated cells which don't have any tissue specific structures that allow them to perform specialized functions (2)

Types: Embryonic Stem cells-These are derived from inner cell mass of 3-5 days old hollow blastocyst in human beings.

This can be further differentiated into following types. (2)

a)Umbilical Cord Stem Cells
b) Placenta Derived Stem Cells
c)Totipotent Stem Cells
d) Pluripotent Stem Cells
e) Multi potent Stem Cells

- Adult Stem Cells: These are derived from many organs & tissues.

Sources: These can be taken from inner cell mass of blastocyst, fetal stem cells from gremlin tissues or aborted foetus, Placental blood are umbilical cord blood just after birth. In human beings adult stem cells are present in bone marrow, peripheral blood, Blood vessels, Adipose tissue, Skeletal muscles, Skin & lever. (2)

Applications : (4)

Embryonic Stem cells differentiate give raise to multiple specialized cell types that makeup skin lung heart brain & other tissues.
Studies of human embryonic stem cells yield information about complex events that occurs during human development & in the differentiation of different stem cells.
Adult stem cells generate replacements for cells that are lost through wear & tare injury or disease.
Adult stem cells are used in medical repairs. These form the basis for diseases like diabetes, pakinsonia, heart dis[illegible]es, Alzhmer's disease, Stroke, burns osteoarthritis
Cancer, birth defects occur due abnormal cell division & differentiation. Better understanding of molecular & genetic control of these processes held to establish cause of these diseases & therapy.

VI Semester B.S.c. Degree Examination, September 2020
(CBCS) (F+R)(2016-17 and Onwards)
Zoology (Paper- VII)
Genetics and Biotechnology
SCHEME OF VALUATION
PART A

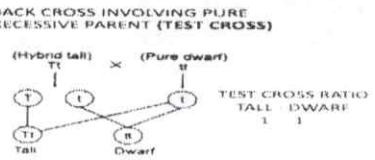
I. ANSWER ANY 5 5x3= 15

1)Write a note on norm of reaction. 1+2

The concept of norm of reaction was introduced by Richard woltereck. It describes the pattern of phenotypic expression of a single genotype across a change of environment. It also describes how related species respond to varying environment. For every genotype, phenotypic trait, and environmental variable, a different norm of reaction can exist; in other words complexity can exist in the interrelationship between genetic and environmental factors in determining trait. EX: Potentilla glandulosa or Himalayan Rabbit – Explain

2) What is Test Crossing? Give an example .

Test crossing is a crossing between unknown parent with recessive parent to know whether the unknown parent is homozygous or heterozygous.Ex : 1+2



Any cross involving a homozygous recessive trait and an unknown genotype (homozygous dominant or hybrid) is known as a TEST CROSS

3) List any 3 applications of blood grouping test. Any 3 one mark each

a) blood typing is useful in safe blood transfusion after accidents, burns or hemorrhages
b) it is the primary step in organ transplantation which avoids rejection of organs.
C) it helps to solve medico-legal cases of disputed parentage of babies.
d) it is useful in forensic investigation and crime detection

4) Define phenocopy. Give an example 1+2

Phenocopy-refers to replica of original or another phenotype.
ex: A person imitates another person in appearance is known as phenocopy of natural phenotype.
A person bleaches hair, will only be able to change his appearance or phenotype but the genotype can't be changed. When dye fades natural hair color will be visible
Morgan experiment in 1910 on drosophila flies.

5) write the function of the following molecular tools of genetic engineering 1+1+1

a) **Restriction Endonucleases** :is an enzyme produced naturally by bacteria to restrict replication. It cleaves specific sequences of nucleotide bases in DNA molecule at restriction or recognition sites.
b) **Alkaline phosphatase**it is a enzyme which is used to prevent unwanted self-legation of vector DNA molecule during cloning procedures. It removes phosphate group from 5` end of DNA molecule leaving a 5` hydroxyl group.
c) **DNA Ligase**is an enzyme associate with DNA repairing process or joining enzymes. It helps in joining of okazaki fragments formed during discontinuous DNA synthesis

6) Differentiate between in-vivo and Ex-vivo gene therapy. 1.5+ 1.5

In-vivo gene therapy: It involves direct transfer of the therapeutic gene into the target cells of a particular tissue in a patient. The tissue that can be subjected to in-vivo gene therapy are liver, muscles, skin, splean, lung, brain and blood cells. The vectors used for gene transfer are retro-viruses, Pure DNA constructs lipoplexus and human artificial chromosomes.The success of in vivo gene therapy depends on- the efficiency of uptake of remedial gene by target cells.
EX-Vivo gene therapy : it involves use of patients own cells for culture and genetic correction & the transfer of genes in cultured cells & returned back to the patients. It is applied only to selected tissues like bone marrow cells which can be cultured in lab. It will have no adverse immunological response since patients own cells are used.
The steps involved are a) Isolation of cells b) Insertion of therapeutic gene c) Culture of transfected cells
d)Transplantation of modified cell to the patient

7) Mention any 3 applications of monoclonal antibodies. Any 3 points

a) Pregnancy test-MAB are used to detect the presence of HCG a hormone secreted by chorionic villi at the time of implantation of embryo
b) Tissue typing: it is used in matching and selection of donor's organ for transplantation helping in reducing the causes of rejection by our immune system
c) Blood typing: these are used to determine ABO blood groups in man
d) Cancer detection : these can detect the antigens shed by the tumor cells
e) RIA & ELISA :these are used to measure the circulating level of enzymes, antigens, hormones etc

PART B

II .Answer any 5 **5x5=25**

1) Explain the law of segregation with an example. 1+4 2+3

Definition - The factors of each character segregate during gamete formation so that each gamete receives only one factor, for each character and is always pure.

Ex: Mendel crossed a true breeding tall pea plant with a dwarf pea plant All the F, hybrid plants were tall. Further, when the F, hybrids are self-pollinated, in the F2 generation, the off springs produced in the ratio of 3 tall : 1 dwarf, The appearance of both tall and dwarf plants in F, generation clearly signify that during gametes formation, the two factors segregate and thus remain pure. These factors retain their individuality from generation to generation without getting contaminated when they are present in a hybrid.

Parents→ Tall plant Xdwarf plant
Genotype→TT tt
Gametes→ T t

F1 gen→ Tt-------- Tall plant

Self-crossing → Tt X Tt

F1 gametes T t T t

	T	T
T	TT Tall	Tt Tall
T	Tt Tall	Tt Dwarf

Phenotypic ratio: 3:1 (3 tall : 1 dwarf) Genotypic ratio: 1:2:1 (1 TT : 2 Tt : 1 tt)

2) What is erthroblastosis foetalis? Explain. 5 Marks

Rh incompatibility between foetal and maternal blood results in a disease called "Erythroblastosis foetalis" or "Haemolytic Disease of the new born (HDN) / of the fetus, HDFC. Rh incompatibility occurs when Rh –ve the mother bears an Rh+ve child (father being Rh +ve). Generally the first Rh +ve child is safe if Rh-ve mother has not had any previous Rh +ve blood transfusion.At later stage of first pregnancy and during delivery, some Rh +ve blood cells of the foetus cross placenta and enter into mother's circulation. The mother's immune system responds by producing antibodies against Rh antigens. The first child is generally safe as enough antibodies are not formed by the time it is delivered.

However during subsequent pregnancies where in the developing foetus will be Rh +ve the anti Rh antibodies enter into foetal circulation and cause agglutination of Rh +ve foetal blood cells (Erythroblast). This may result in premature birth or birth of severely anemic child.The new born baby also suffers from jaundice due to bilirubin produced as a result of erythroblast destruction. The blood of such new born baby is completely replaced by transfusion of healthy blood immediately after birth. In order to prevent Erythroblastosis fetalis in Rh +Ve new born 72 hours before the child birth or immediately after the delivery of first baby, intravenous anti-D (Rho Gamma Globulin) injection is given to Rh -Ve mother to suppress anti Rh antibody production.

3) Explain the following : 2.5 + 2.5

a)**Gynandromorphs** : Individuals who show male characters on some parts of the body and female characters other parts of the body. These are sterile and also called as "Gynanders". Gynanders are rare.These occur in Drosophila,

Butterflies, Beetles, Wasps, Bees, and Silkworms on etc. In moths usually males have large, beautifully coloured wings and females have small, stumps of wings. But in gynande
rs wings are of male on one side and wings of female on the other side. During the cleavage of fertilized egg, one of the X chromosome is left behind in the centre of the spindle so that one of the daughters receives only one X-chromosome and the other receive XX. The part that develops from XO will be male and the other that develops from the XX cell would be female.

TYPES - Bilateral gynandromorphism, Hemi gynandromorphism and mosaic gynandromorphism

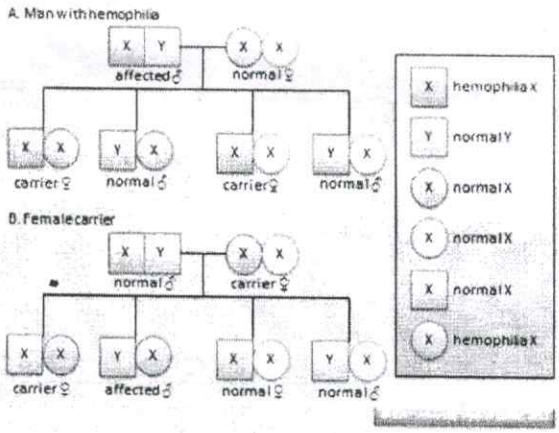
b) Free martins

Lillie in 1977 reported hormonal influence on sexual characters in cattle. It is a condition in which a female organism exhibits female characteristics externally, male characteristics internally and sterile characteristics physiologically. Free martins are seen in cattle. In cattle twins occur frequently. If both the young ones are zygotically of the same sex, they develop normally; if however, one member is a male and the other female then the development of the female is not normal. During development both the twins are connected by a common umbilical cord. The gonads of the male develop earlier than those of the female. So the male gonads produce male hormones earlier in development. These male hormones reach the female embryo and influence the development of male sex in the female embryo. This results in a sterile inter sex having female phenotype with sterile male gonads.

4) What is sex linkage ?explain with reference to Haemophilia in man. 1+4 1+2+2

Several genes are situated on the sex chromosome especially on the 'X' chromosomes. The presence of gene in the sex chromosome is termed as sex linkage. The presence of the gene in the sex chromosome is termed as sex linkage. If genes are present on X chromosome, it is called X-linked & if present on Y it is called Y-linked. They are about 56 genes on X chromosome of man.

Eg: Haemophilia



It is a hereditary blood disease discovered by John cotto in 1803. This disease is characterized by delayed blood clotting this is because of the absence of a factor in the blood called antihaemophilic globin which plays an important role in blood clotting. In normal persons the blood clots in 2 to 8 minutes but in haemophilia patients clotting is delayed for 20 minutes to 24 hours hence this blood continuously bleed from the wounds so haemophilia is also called as bleeder's disease.

Haemophilia is a sex linked recessive character. It is caused by recessive genes represented by hh and the normal condition is due to dominant gene H

The genes are located on the X chromosome the Y chromosome has has no genes so the male has only one gene for this character so the male is called hemizygous

5) Explain CIB method of detection of mutation 1+4 (schematic representation)

CIB method to detect induced mutations in Drosophila was devised by H.J.Muller. He used a special type of female fly carrying one normal X chromosome and following features:

a) An inversion that prevents the crossing over with the normal X chromosome.

b) It carried three genes -C, I and B

The gene 'C' is dominant over cross over suppressor gene. The gene 'I' is recessive X-linked lethal gene gene 'B' is dominant B is dominant bar eye gene. The females of this type are called CIB females, while the males wit
X- chromosome die due to X-linked lethal gene 'I'.

Experiment -

The male flies were exposed to X-rays to induced mutations. Then they were mated with bar eyed-CIB fem The F1 male flies receiving CIB X-chromosome.died because of lethal gene.

The F1 bar eyed CIB females were crossed with normal male flies. In the F2 generation, half of male flies receiving CIB X-chromosome died.

The other half which have received a radiated X-chromosome from F1 female parent carrying Induced mutation. case of lethal mutation, no male will survive. Thus it is possible to detect the mutation.

6) Define superovulation. Explain the steps involved in it

Superovulation, also known as controlled ovarian hyperstimulation, is the process of inducing a woman to release more than one egg in a month.it involves following steps

a) Induction of multiple ovulation
b) Artificial insemination
c) Embryo recovery
d) Embryo transfer

1- definition + 4 – explain each step

7) What is transgenesis? Explain knock-out technology in mice. 1+4

Transgenesis is the process of introducing an exogenous gene called transgene into a living organism, so that the organism will exhibit a new property and transmit that property to its offspring.

Knock out technology: It refers to 'genetic engineering method that involves by inserting the transgene into a chromosome, a new function is introduced while producing transgenic animals. On the other hand, in a process referred to as gene knockout and existing function can be blocked by destroying a specific gene. The largest gene disruption can be carried out by incorporating a DNA Sequence, usually a selectable marker gene into the coding region. The chromosome carrying the target gene with flanking sequences is subjected to homologous recombination with a vector carrying a selectable marker gene. The homologous recombination results in gene knock out i.e, disruption of the target gene. In the knockout, the loss of function occurs in transgenic animals. This is in contrast to gain of function that takes place by introducing a foreign gene.

PART-C

III. **Answer any three of the following:** **(3x10=30)**

1) Write a detailed account on genic balance theory of bridges. **4+6** (5+5)

Genic Balance theory was proposed by Calvin Bridges in the year 1921. According to this sex is determined by the balance between female sex determining genes are present on X chromosome & male sex determining genes present on autosomes. The female sex determining genes are present on X chromosome the male sex determining genes are present on autosomes, Y chromosome is said to be inert & it is essential for the fertility of male sex , but nothing to do with sex determination. According to this theory, each haploid set of autosomes carries factors with a male determining value of (1) each X chromosome carries factors with a female determining value (1.5). Let 'A' represents 1 haploid set of autosome in a normal male (AA+XY, the male & female determinants are in 2:1.5). Hence the genic balance theory is in favor of maleness. A normal female (AAXX) has male & female ratio to 2:1, hence the genic balance theory is in favor of femaleness.

Slno	Phenotype		No of X Chromosome (X)	No of X Autosome (A)	Sex ratio = X/A
1	Superfemale		3	2	1.5
2	Normal Female	Haploid female	1	1	1.0
		Diploid female	2	2	1.0
		Triploid female	3	3	1.0
		Tetraploid female	4	4	1.0
3	Intersex		2	3	0.67
4	Normalmale		1	2	0.50
5	Super male		1	3	0.33

	AX	AXX	AAX	AAXX
AX	AAXX Normal female	AAXXX Super female	AAAXX Intersex	AAAXXX 3n female
AY	AAXY Normal male	AAXXY Normal female	AAAXY Super male	AAXXY Intersex

2) Define sex-determination. Explain the different kinds of sex-determination mechanisms with example. **2+8**

Sex determination refers to the process by which male and female sexuality is determined in unisexual organisms. Chromosomes are involved in sex determination of the great majority of unisexual animals. The chromosomes associated with sex determination are called allosomes or sex chromosomes. E.D. Wilson (1905) used the symbols 'X' and 'Y' to denote sex chromosomes. In certain organisms 'Z' is used in place of 'X' and 'W' is used in place of 'Y' as the sex groups are reversed.

Three main types of chromosomal basis of sex determination are known. They are

A)XX-XY method of sex determination:

This is the most common method of sex determination seen in animals. This is seen in most mammals including human beings and other animals such as Drosophila. In this type, the diploid females have two X chromosomes and diploid males have one X and one Y chromosome. Autosomes (A) are identical in both sexes.

The chromosome constitution of diploid female is 2A + XX and of diploid male is 2A + XY. The females are homogametic as all the gametes will have same chromosomal constitution i.e. A + X. The males are heterogametic as they produce two different types of gametes with respect to the type of allosomes. 50% sperm are 'AX' type and other 50% are 'AY' type. Here the sperm that fertilizes the egg determines the sex of the offspring. The 'AX' type sperm is called gymnosperms. When it fertilizes the egg, the offspring is female (2A+XX). The 'AY' type sperm is called androsperm. When it fertilizes the egg, the offspring is male (2A+XY). In XX-XY method of sex determination the female parent contribute 'X' chromosome to both male and female offspring whereas male parent contribute 'X' chromosome to female progeny and 'Y' chromosome to male progeny,

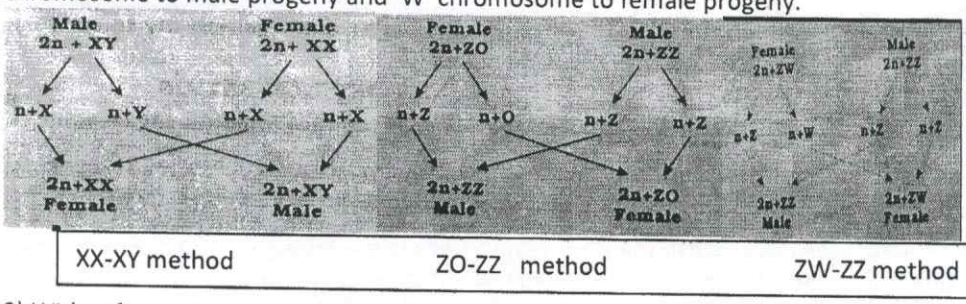
B)**XX-XO method of sex determination:**

This type of sex determination is seen in roundworms and certain insects like grass hoppers and bugs. Here the females possess even number of

chromosomes (2A + XX) whereas the males possess odd number of chromosomes (2A +XO) i.e. females are homogametic producing A'X' type of gametes and males are heterogametic producing.50% sperm are 'AX' type and other 50% are 'AO' type. In XX-XO method of sex determination the female parent contribute 'X' chromosome to both male and female offspring whereas male parent contribute 'X' chromosome to female progeny and only autosomes to male progeny.

C. ZZ-ZW method of sex determination:

This type of sex determination is seen in birds, butter flies, moths and certain fishes.Here the females are heterogametic with chromosomal constitution 2A + ZW and male are homogametic with chromosomal constitution 2A + ZZ.The symbols 'Z' and 'W' are used in place of allosomes X' and 'Y' to avoid confusion. In ZZ-ZW method of sex determination the male parent contribute 'Z' chromosome to both male and female offspring whereas male parent contribute 'Z' chromosome to male progeny and 'W' chromosome to female progeny.



XX-XY method ZO-ZZ method ZW-ZZ method

3) With reference to chromosomal aberration explain Turner's syndrome and Klinefelter's syndrome.**5+5**

Turner's Syndrome(22AA+X)=45

It is a genetic disease in human female caused by the absence of 1 X chromosome. It is a sexual abnormality in female discovered by turner in 1938. It is caused by chromosomal aberration. It is caused monosomy(Aneuploidy), where one chromosome is lost from one pair (2n-1).

This abnormality is due to 45 chromosome instead of 46. The missing chromosome is 1 (X) chromosome. Hence, the chromosomal makeup is 22AA+X=45. It is caused by non-disjunction of XX chromosome. When 1 abnormal egg without any X- chromosome is fertilized by a sperm with X-chromosome. The resulting baby contains X0 chromosome. The baby develops into sterile female. She has female phenotypes but there is no menstruation. Ovaries are represented by ridge of whitish tissue called streak gonad.

Klinefelter's Syndrome

It is a allosomal sex chromosome disorder seen in human having 2 X chromosome & 1 Y chromosome along with autosomes (Total 47 chromosomes). The chromosomal compliment is 44+XXY=47 chromosomes. The diagnostic features feminized males with enlarged breast. Under developed testes ,prostrate glands & genitalia (Hypogonadium).

- Scanty hairs on the body, absence of spermatogenesis.
- Presence of 1 barr-body
- Mental retardation.
- They are tall

4)Give a detailed account on positive and negative aspects of Eugenics (1+4)

5+5

Positive eugenics

- It is a constructive measure which increases the rate of children of parents with most desirable characters. According to Huller individuals with desirable traits should be allowed to produce more no. of children than others. The suggested sperm bank and artificial insemination methods to increase pregnancy of such people. The following some of the positive eugenics methods are:

• Immigration: it is one of the important factor that may affect the frequency of defective gene in a population. Then influences evolutionary changes admitting immigrants like professional, academics, scientists etc, & excluding feeble minded idiots, epileptics, alcoholics etc. people with good characters are welcome with open encouraged and given all type of benefits so that the whole society will improve from their contribution.

• Subsidizing to the fit: This is one of the best methods of positive eugenics. Individuals going to the assets to the society in terms of their characters to the given more privilege so that they need not struggle to obtain requirements of life. They should be encouraged to produce more no. of children to increase the desired population in children. Such individuals cancontribute a lot to the society.

• Early marriages: Its often seen that ambitious individuals marry quite a late in their age as they would be devoting the best part of the youth in realizing their ambitious. Genetic studies of late marriages have indicate that children born of late marriages are notgenetically strong Education Knowledge of fundamental principles of genetics with special reference to human heredity and an appreciation of desirable attitudes and ideas undoubtedly effect action of young person in choice of their mates. It is mainly carried out in schools, temples, print media, TV etc

• Other methods. It is possible to increase the desirable characters in population by gene therapy, organ transplantation by observing amniotic fluid etc.

Negative eugenics

- According to the negative eugenics, the approach for improvement of human race is based on eliminating undesirable traits of the society. It includes following ways-
- Segregation: Sexual segregation of undesirable individuals to prevent propagation of undesirable genes. For example persons with serious hereditary diseases, criminal records andlow IQ should not be permitted to marry normal intelligent people
- Birth control or sterilization: This in most effective way of preventing the persons of low eugenics value from contributing to children. The sterilization procedure for female is called tubectomy, where the fallopian tubule is cut and ligated to prevent the ovum from passing to uterus. The sterilization procedure for male is called vasectomy where the ducts deferens is cut and ligated to prevent the sperm moving out of the testis.
- Consanguineous marriages These are nothing but cousins marriages. These marriages lead to production of children with more defective characters. Most of the harmful threats are recessive as such they are expressed only in homozygous condition. All these recessive are to in of closely characters are likely to express in children of parents for related closely.
- Education. A knowledge of fundamental principles of genetics with special reference to humanheredity and an appreciation of desirable attitudes and ideas indubitably effect action of young person in choice of their motto. It's mainly carried out in schools, temples, print media TV. Radio etc and likely to express in children of parents for related closely.
- Genetic Counseling It is the discussion or interview between the members in relation to their specific problem. Counselors clarify their doubts and ill effects of hereditary diseases in their children. So that they can avoid genetic disease in their progeny. In developed countries like USA person with MD and PhD in genetics are appointed as official genetic counseling

(4+1)+(4+1)

5) Explain micro injection and electroporation with reference to gene transfer in animals. 5+5

Microinjection

DNA solution is injected directly into the nucleus of a cell or into the male pronucleus of a fertilized 1-2 cell ovum. It consists of a low-power stereoscopic dissecting microscope to view the ovum and the entire process and two micromanipulators, one for a glass micropipette to hold the ovum by partial suction and other for a glass injection needle to introduce the DNAinto the male pronucleus, due to its large size than the female pronucleusof mammalian ovum. In fish ova, the DNA in injected into the egg cytoplasm.

7 7

The general procedure for microinjection isas follows,

1. Donor females are induced to super ovulate using appropriate hormone treatment.
2. Female mice are subjected to a regime ofPregnantMouse Serum Gonadotropin (PMSG), which stimulates growth anddevelopment of follicles which contain thedeveloping oocytes.
3. The release of these oocytes ovulation is induced by subsequent treatment with Human Chorionic Gonadotropin (HCG).
4. The super ovulated females are then mated with fertile males, and large number offertilized 1-2 cell ova / embryos is collected from super ovulated females, the ova are then fertilized in vitro

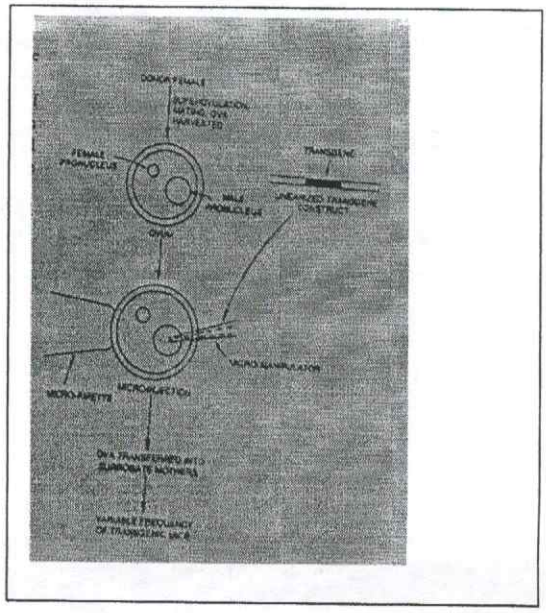
• Transgenics are identified by subjecting the tissue samples to DNA analysis by southern blot hybridizations with the new gene as a probe or by PCR amplification of the newgene.

Advantages

1. The quantity of DNA delivery can be optimized
2. DNA delivery is predictable even into the cellnucleus
3. Even the smallest cell can be targeted to deliver DNA.

Disadvantage

1. Requires skilled persons
2. Only one cell receives DNA per injection
3. Costly instruments



ElectroporationDescription - 5 marks

- is more suitable technique for the transformation of plant protoplast and animal cells
- It is one of the many standard techniques for efficient transformation, which facilitates cell to uptake DNA by reversibly alters the permeability of cell membrane.
- The transfection mixture with cell & DNA is exposed to a very high voltage gradient (4000-8000 v/cm)
- This induces transient pores in the cell membranes through which DNA enters the cells.

• Treatment of cells before electroporation increases the frequency oftransfection. This is most likely due to the arrest of cells at metaphase and associated absence of nuclear envelope orto an unusual permeability of the plasma membrane

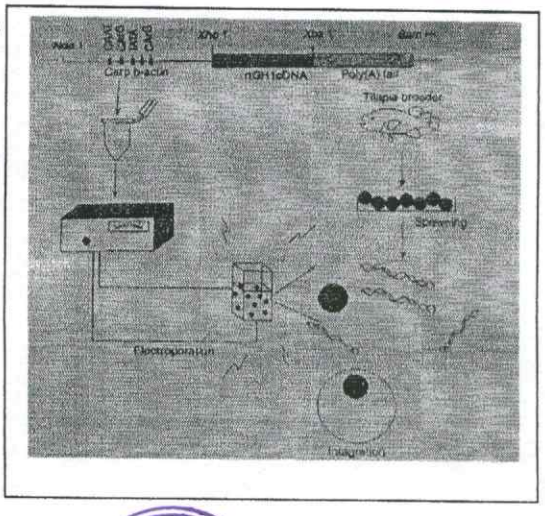
- Linearized DNA is more efficient in transfection than circular DNA

Advantages

1. Efficient transformation
2. Large number of transformed cells obtained
3. May not require skilled persons,

Disadvantages

1 Requires protoplast for transformation.
2. Difficulties associated with protoplast regeneration
3. Risk of staining genetic variation in protoplast regeneration plants



(1+6+3)

6) What is DNA fingerprinting? Explain the steps involved in it. Add a note on its applications. **2+4+4**

Identification of individuals at genetic level by matching DNA fragments using DNA probes is called DNA fingerprinting. Allec Jeffrey was the 1st person to develop this technique. Major steps involved in this are:

a) Collection of materials as a source of DNA
b) Isolation of DNA from the cellular extracts
c) DNA amplification (PCR) if required
d) Digestion (fragmentation of DNA) using RENs or RFLP analysis
e) Separation of electrophoresis
f) Denaturation of DNA fragments
g) Southern blotting
h) Hybridization using labeled probes
i) Auto radiography or visualization

APPLICATIONS - any three

1) Identifications of criminals, rapist, murderers etc
2) Settlement of paternity disputes
3) To establish different racial group evolutionary relationships
4) Identification mutilated remains and decomposed bodies
5) Authentication of plant seeds
6) Forensic wildlife
7) DNA sequencing and analysis

SECOND SEMESTER B.Sc. DEGREE EXAMINATION, MAY / JUNE 2019

(CBCS – 2018-19 onwards)

ZOOLOGY

PAPER II – NON-CHORDATA – PART II

PART – A

I. Answer the following in one word or one sentence each: (10×1=10)

1. Name any two excretory organs of arthropod.

   Green glands / coxal glands / malphigian tubules. ½ mark each

2. Which is the basic unit of compound eye?

   Ommatidium.

3. Peripatus is said to be a connecting link. Why?

   It has both annelidan and arthropodan characters.

4. Mention the respiratory pigment present in Unio.

   Haemocyanin.

5. What is radula?

   It is rasping organ with transverse rows of teeth.

6. Mention two types of pedicellariae.

   Straight and crossed.

7. Define autotomy.

   Whenever an arm is injured it readily breaks off its own arm for protection.

8. Name the class to which Balanoglossus belongs.

   Enteropneusta.

9. Give any two species of silkworm. **½ mark each.**

   Bombyx mori, Antheraea paphia / Antheraea mylitta, Antheraea assama, Attacus rechinii / Phlosamia ricinii, Attacus atlas, Antheraea pernyi.

10. What is royal jelly?

    Antibacterial, antibiotic. Product of apiculture. 66% water, 12.34% - proteins, 6.46% - fats, 12.49% - sugar and nearly 3% still undetermined substances. It acts with appetite, anaemia by considerable increasing the count of red cells, upon arteriosclerosis, arterial tension and also upon diabetes and other innumerable diseases.

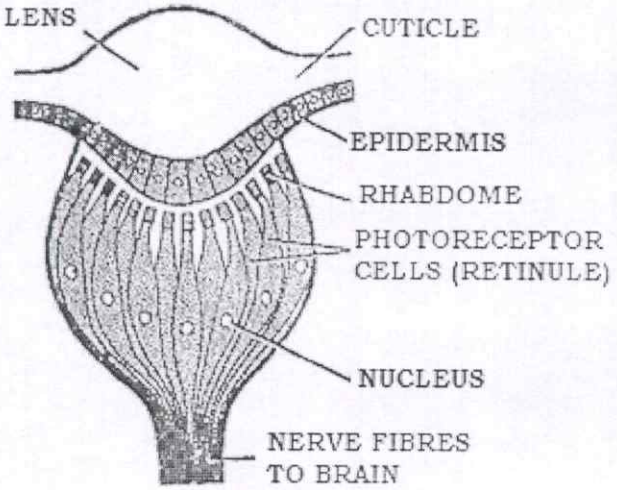
PART – B

II. Answer any FIVE of the following: (5×3=15)

1. Mention the function of: **01 mark each**
   a) Mandible – **Masticatory**
   b) Chelate leg – **Manipulation of food / offence and defence**
   c) Pleopod – **swimming**

2. Write a note on simple eye in arthropods. **Explanation – 03 marks**

   Present at the base of antenna. Each comprises of a single **corneal facet**. It is mainly concerned with light collecting rather than image forming. Probably it enhances the sensitivity of compound eyes.



SIMPLE EYE.

Retinal cells cylindrical in shape have a nucleus proximally and a light sensory rod / bacillus at the distal end. The eyes with distal receptive rods are termed direct eyes. Retinal cells are grouped in retinule which secrete a **rhabdome** as in a compound eye. **Nerve fibres** from individual cells join to form the **optic nerve** which connects the **optic ganglion** of brain.

3. Define metamorphosis. Explain ametabola citing an example.

   Definition – 01 mark, explanation of ametabola – 1.5 marks, ex – ½ mark

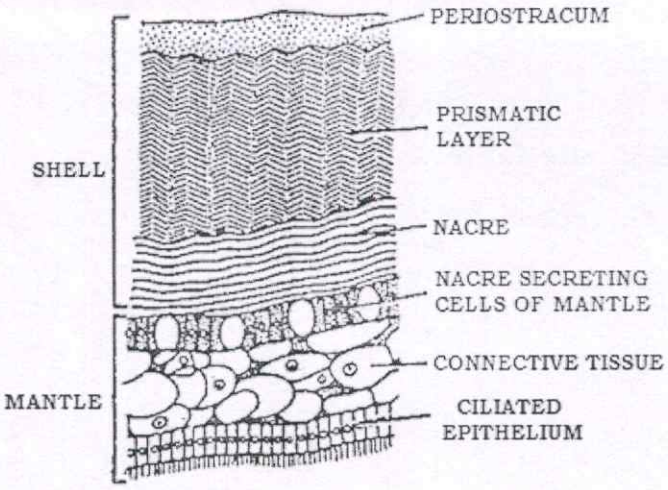
   Transformation of an immature larval individual into a sexually mature adult of different form, structure and habit of life. / All the changes undergone by the young to become an adult are collectively known as metamorphosis.

   AMETABOLA - In certain insects there is no metamorphosis. The young on hatching from the egg, resembles the adult in form, structure and mode of life, except in size, colour. It is smaller in size, then grows and after several moults attains the sexually matured adult size, without undergoing any change. In these insects there are 3 stages in the life history namely egg, young and adult (imago).

   Ex: Spring tails, Thysanura (Silver fish) and Protura.

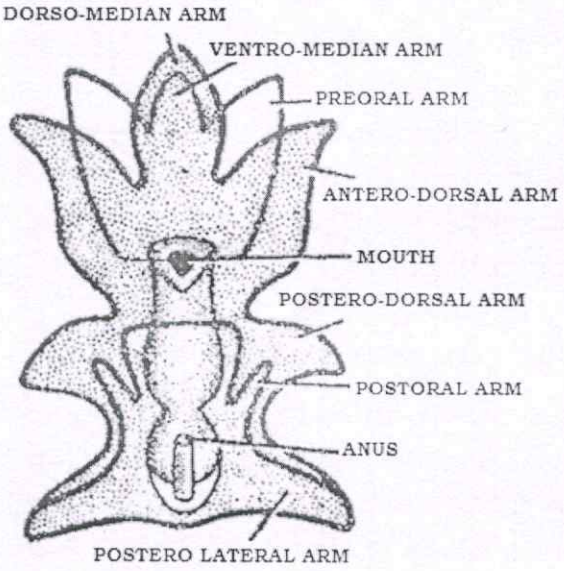
4. Sketch and label the sectional view of shell of Unio.

   Diagram with 3 labellings – 03 marks



5. Write a note on Bipinnaria larva.

Larva of **Asteroidea**. Free swimming, feeds on Diatoms. Presence of powerful ciliary band on the stomodeal walls helps in feeding. Two lateral longitudinal locomotory ciliated bands developed like pre-oral loop infront of the mouth and pre-anal loop infront of the anus. Pre-oral loop separates/ in some cases develop independently into an anterior ciliated ring around the body. Three lateral lobes (projections) are also developed on either side of the body bordered by ciliary bands. It develops in 2 – 7 days.



BIPINNARIA LARVA.

6. List any three affinities of Hemichordata with chordata. **01 mark each.**

i. Presence of a notochord
ii. Dorsal hollow nerve cord
iii. Pharyngeal gill slits.
iv. Structure and function of pharynx and branchial apparatus are similar to those of Urochordata and Cephalochordata.
v. Origin of coelom is enterocoelic in the form of five pouches from larval archenteron as in Branchiostoma.

7. Name any three bee products. **01 mark each**

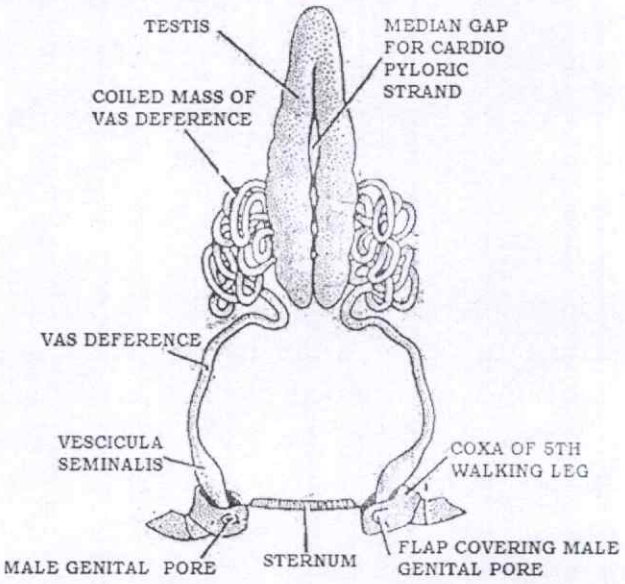
Bee wax, bee venom, honey, royal jelly, pollen, propolis,

PART – C

III. Answer any FIVE of the following: **(5×5=25)**

1. Describe the male reproductive system of Palaemon.

Diagram – 02 marks, Explanation – 03 marks



TESTES - soft, white tubular, elongated lie one on each side of the middle line, in thorax. Fused anteriorly to form a common lobe. Enclose a gap for the passage of the cardio-pyloric strand connecting heart to pyloric stomach. Histologically each testis consists of a large number of coiled, narrow and thin walled **seminiferous tubules** embedded in connective tissue. The cavity of each tubule is lined by a single layer of germinal epithelium, the cells of which undergo spermatogenesis to form spermatozoa. A mature sperm consists of a rounded cytoplasmic body, containing a large, dark, crescentic nucleus and a tail like blunt process.

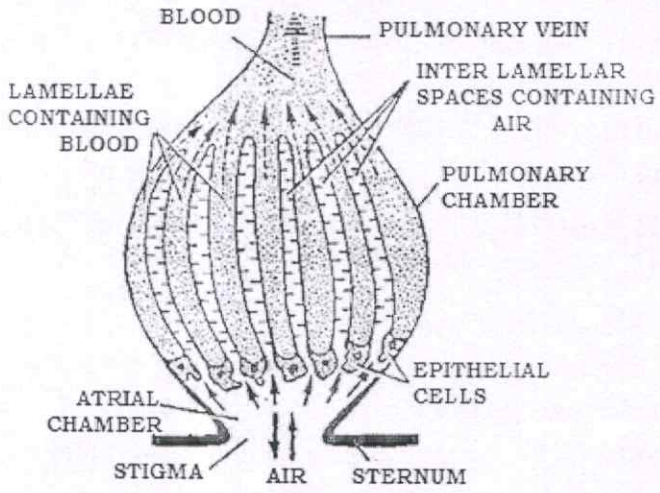
VASA DEFFERENTIA - Convoluted, long, coiled and narrow tubes; arise from posterior ends of testes. Soon after emergence they form highly coiled masses and then run vertically downwards between the abdominal flexor muscles on the inner side and thoracic wall on the outer side.

VESCICULA SEMINALIS - club-shaped, store spermatozoa in the form of white compact bodies called spermatophores. Each vescicula seminalis opens outside through a male genital aperture which lies on the inner side of coxa of fifth walking leg of its side. Aperture is covered by a small flap of integument.

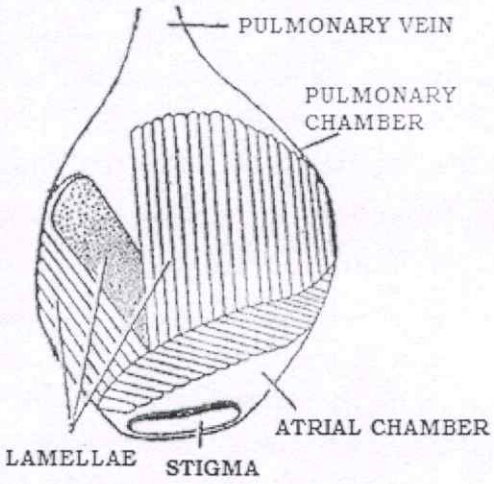
2. Write a note on book-lungs. **Diagram – 2.5 marks, Explanation – 2.5 marks.**

Found in all **scorpions** and most **spiders**. Scorpions have 4 pairs, a pair lies inside each **mesosomatic** segment from **3rd to 6th**. These are formed by **invaginations** of cuticle at the bases of rudimentary appendages. Each book lung consists of two parts, **ventral part** is in the form of a small compressed air cavity called **atrial chamber**. It communicates with outer air by a slit like opening called spiracle / stigma, lies obliquely on the ventro-lateral side of

sternum. Dorsal part is made of nearly **150 vertical folds / lamellae** running parallel and arranged like leaves of a book. Air is drawn into and expelled from the book-lungs by their **expansion** and **contraction**. Exchange of gases takes place in the lamellae as the air circulates in the narrow **interlamellar spaces**.



V.S of book lung.



A book lung.

3. Enlist any five classes of phylum Mollusca citing an example for each.

½ mark – class and ½ mark ex.

i. Monoplacophora - Ex: Neopilina galatheae, Vema ewingi.

ii. Amphineura - Ex: Chiton, Chaetoderma, Neomenia.

iii. Gastropoda - Ex: Patella, Haliotis, Pila, Cypraea, Murex, Aplysia, Doris.

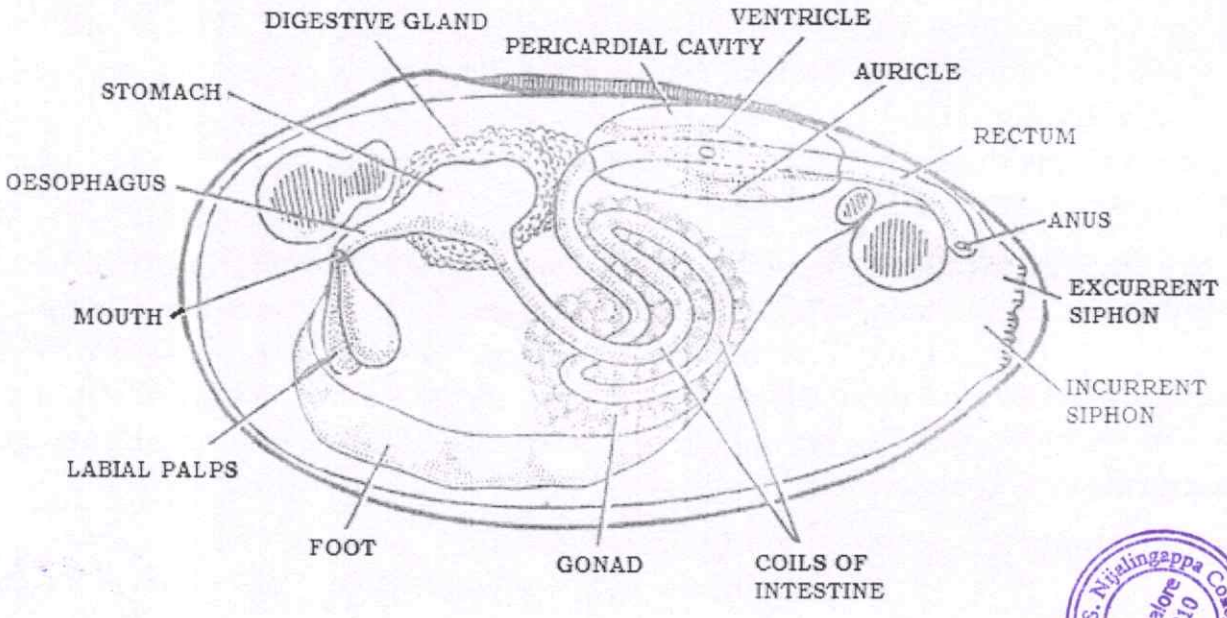
iv. Scaphopoda - Ex: Dentallium, Cadulus.

v. Pelecypoda - Ex: Mytilus, Ostreae, Pecten, Teredo, Unio etc.

vi. Cephalopoda - Ex: Nautilus, Loligo, Sepia, Octopus etc.

4. Explain the digestive system of Unio.

Diagram – 02 marks, Explanation – 03 marks



It consists of alimentary canal and digestive glands. Alimentary canal is **complete**, long, coiled tube and consists of mouth, oesophagus, stomach, intestine, rectum.

MOUTH – Transverse slit lies behind the anterior adductor muscle or below anterior protractor muscle. Surrounded by two pairs of **labial palps**. The **outer palps** of the two sides unite above the mouth to form the **upper lip**. The **inner palps** of the two sides fuse below to form the **lower lip**. The outer surface of the palps is heavily **ciliated**. The lips form a ciliated oral groove, which leads into the mouth. **Jaws and radula** are **absent**. Mouth leads into the oesophagus.

OESOPHAGUS – It is **short, wide, ciliated** tube that extends upwards and backwards and opens into the stomach.

STOMACH – It is **wide, ovoid, sac-like**, **thick walled**, lies dorsally in the visceral mass and surrounded by paired **digestive glands (liver)** and receives many ducts from them. It is divided into **dorsal globular region** and **ventral, narrow distal region**. The dorsal part contains a **sorting area**, prominent **gastric shield** and **pores** of digestive gland. Ventral part contains a **style sac** with gelatinous rod **crystalline style** and intestinal grooves with major and minor **typhlosoles**. Style sac is internally lined by **ciliated epithelium** and contains crystalline style which is secreted by the ciliated epithelium. It is composed of muco proteins and enzymes like **amylase, cellulase, glucogenase** and **lipase**. The cilia rotate the style **clockwise**, like a screw due to which its anterior end is rubbed against chitinous plate called **gastric shield** and sheds its material into the stomach. This material dissolves and yields amylase enzyme to start digestion of **starch** in the stomach. When feeding stops or when the animal is removed from water, the entire crystalline style gradually dissolves.

INTESTINE - It starts from the floor of the stomach infront of the style sac. It first descends into the upper part of the foot where it gets coiled upon itself and then ascends parallel to its descending part. It has two folds called **typhlosoles** at anterior part. It continues as rectum behind.

RECTUM - Posterior, terminal, narrow, straight tube runs backwards through the **pericardium** where ventricle of the heart surrounds it, then passes over the posterior **adductor muscles**. Then bends downwards and opens by anus, into the **exhalant siphon**. It also contains a **typhlosole** which runs mid-ventrally throughout the length of rectum. Typhlosole is meant for increasing the surface of food absorption.

DIGESTIVE GLAND - A pair of **large, irregular, dark-brown** or **green** masses lie around the stomach and composed of highly branched **tubules**. It opens into dorsal part of stomach by number of ducts to discharge the digestive enzymes and to receive partially digested food from the stomach. The glands do not send any enzymes into the stomach, but they function as organs of **intracellular digestion** and absorption.

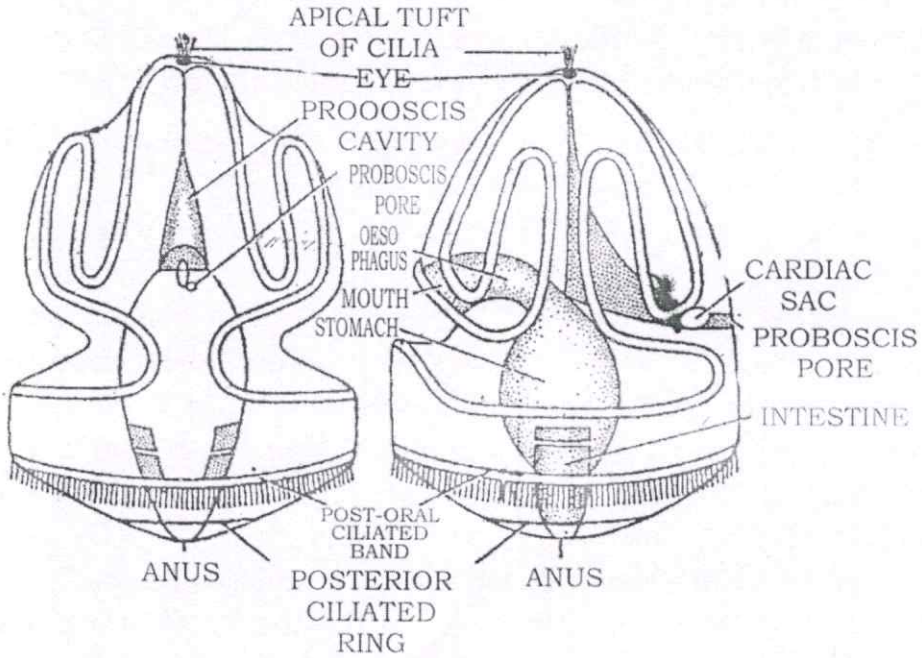
5. Explain the structure of: a) Auricularia larva. b) Tornaria larva.

a) AURICULARIA LARVA 02 marks

It is transparent, pelagic about 0.5mm in length. It is larva of Holothuroidea. It has a large pre-oral lobe; pair of short lateral processes is supported by calcareous particles. A single ciliated band forms pre-oral and anal loops. Larva has a curved gut with sacciform stomach, hydrocoel and left and right somatocoels. Later it becomes barrel shaped and its ciliated band breaks up into separate segments. Later joined by ends, forming 3-5 ciliated rings around the body. Now this larva is called doliolaria larva.

b) TORNARIA LARVA 03 marks

It was first described by J. Muller in 1850, suspected as larva of star fish, later known to belong to *Balanoglossus clavigenus*. It rotates in circles. It's body is oval, clear and glossy and about 3 mm in size. It consists of ventral mouth, posterior anus and larval gut which is differentiated into an oesophagus, stomach and intestine.



Cilia form two bands like anterior ciliary (circumoral) band and posterior ciliated (telotroch) band. Anterior band winds up over the pre-oral surface and forms a post-oral loop and its cilia are short and serve to collect food. Posterior band forms a ring in front of the anus, its cilia are long and serve as locomotor organs. Apical plate is made of thick epidermal cells and consists of a pair of eye spots and a tuft of sensory cilia called apical tuft. Protocoel is in the form of a thin-walled sac opens outside through a hydropore. Pulsatile heart lies at right side of the hydropore. Collar and trunk coeloms appear in the older larva. Larva swims freely, leads a planktonic life feeding on minute organisms and metamorphoses into an adult worm.

6. Give an account of silkworm rearing. **Explanation – 05 marks**

It involves, collection of eggs, incubation of eggs, rearing of larvae, recovery of cocoons and reeling of cocoons.

COLLECTION OF EGGS - Males and females are segregated before mating. Females of one group are kept with another group of males for mating. Within a

few hours the female moth lays eggs inside the bag and dies. This procedure carried out for large scale production of eggs. To collect eggs on egg cards, female silk moth is kept on egg card and covered by black cone shaped, which is open at both ends, with narrow anterior end and broader posterior end is called **Cellule**. After laying the eggs female moth is crushed in a crushing machine and tested for any disease. If that is diseased free the eggs laid by it are called **Disease Free Layings (DFL's).** The eggs are collected and washed repeatedly in distilled water to remove dirt and excreta. The healthy and viable mass of eggs are collected and subjected for incubation.

INCUBATION OF EGGS - The eggs are subjected to incubation after assuring the availability of mulberry leaves. Hatching of the eggs can be accelerated or postponed artificially by proper conditions, which helps in mass scale hatching of eggs simultaneously, which is highly economical. Eggs are spread evenly in sterilized paper trays made of split bamboo at 4^0C. The eggs are periodically moved by a feather so that all eggs can hatch. These seeds and also second instar larvae are supplied to the rearers, depending on the experience of rearers.

REARING OF LARVAE - Cleanliness and hygiene should be maintained while handling the larvae as they are easily vulnerable to infection. The incubator tray with larvae is covered with perforated paper. Tender and finely cut pieces of mulberry leaves are placed over the paper. The young larvae wriggle out through the pores on the paper and begin feeding on the leaves. The mulberry leaves provided to first and second instar larvae should be young and well chopped, later larvae can eat chopped hard leaves also. First 3 stages of larvae are very sensitive and referred to as "**young ones**", rearing of these larvae is known as **Chawki rearing**. Optimum temperature should be **24-28°C** and humidity **80-85%.** The 4th & 5th instars are referred as 'late age'. Rearing of 4th and 5th instar larvae is called **adult rearing**. Optimum temperature and humidity should be **23-25°C and 70-75%** respectively. Rearing houses for both should be separate and should have proper ventilation, disinfected with **2% formalin**. Transferring of 1st instar larvae to other trays by soft brush is called **Brushing**. Trays are covered with wax paper. 1st and 2nd instar larvae are reared in rectangular wooden trays. They undergo moulting and ecdysis 4 times within 25-30 days.

PUPATION AND PRODUCTION OF COCOON - The fully grown fifth instar larva stops feeding and undergoes pupation. It exhibits signs like lifting of its front part of the body and moves it in a circular fashion. Close observation is necessary to notice this change. Worms are identified and mounted on cocoonage called **Chandrike**, which is a rectangular bamboo tray with fixed spiral bamboo tape. The caterpillar will release its silk secretion from the silk gland and begins spinning the silk cocoon around itself. Overcrowding must be prevented; otherwise silk threads of two nearby larvae get entangled and spoil the fibre. In about 9-11 days the spinning will be completed and the cocoons are collected. The cocoons may be preserved immediately after the spinning is over or the chrysalis moult inside may cut the exit hole on the cocoon, which spoils the silk fibre.

7. Write an explanatory note on bee keeping.

PRIMITIVE / INDIGENOUS METHODS - Old method is very crude and unplanned, uncertain. Two types of hives are used like natural wall (fixed) hive and artificial movable hive.

DRAW BACKS - Extracted honey is not pure due to presence of brood cells with larvae, pupae and pollen cells at the time of squeezing. The colony becomes week due to destroy of eggs, so bees have to spend a lot of energy to construct the new hives, in other place and affects the yield and hivation on the same place is only matter of chance. Natural hives may be attacked by enemies like rats, ants, wasps and monkeys or damaged by climatic factors. Changes of improving the race are not possible. The activities of the bees can be controlled but the hazards created by climatic factors cannot be controlled. Crude indigenous method with all these drawbacks still persists in many parts even today. Gradually replaced by a better and scientific modern method.

MODERN METHOD (FRAME HIVE METHOD) - Invented by **Longstroth** in **1951.** The main appliances for modern Longstroth model of hive are a typical artificial movable hive with queen excluder, honey extractor, uncapping knife and other equipments.

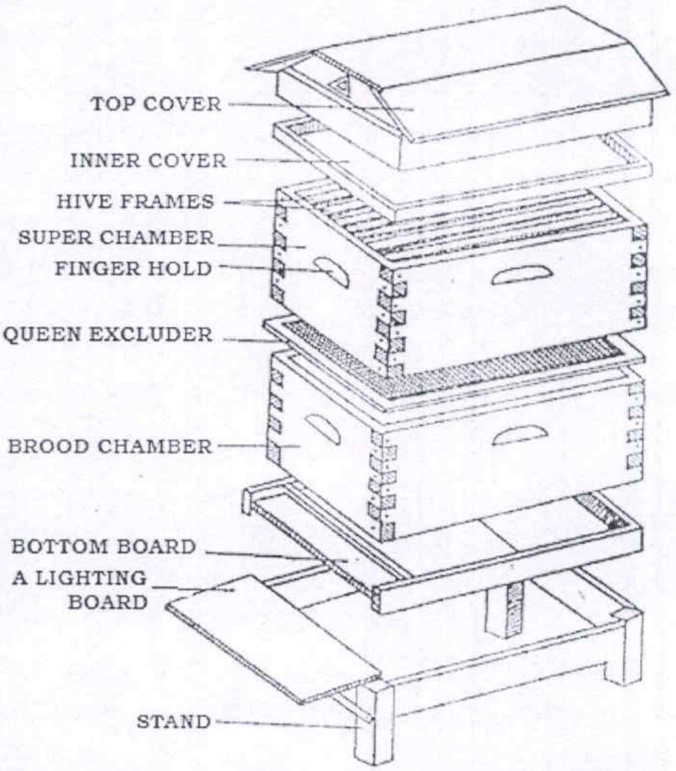
TYPICAL ARTIFICIAL MOVABLE HIVE - Constructed by wooden box based on bee space theory. The size and number of frames vary according to the need. A small space is enough to permit the entrance and exit of workers and drones but queen once placed in hive never comes outside the hive, because the size of pore is only of 3.75 mm but the thorax of queen is 4.3 – 4.5 mm. It can be shifted easily. A typical movable hive has many parts arranged in 2 or 3 tiers. It contains stand, floor board, brood box, hive frames, queen excluder, supers and covers.

a) **Stand** - It is 4 legged basal part of 6-9 inches in height to support the whole hive. It is sloped to remove the rain water quickly from the hive.

b) **Bottom board –** It lies above the stand and forms the proper base for the hive having two gates for entry and exit of worker bees. It is made of two chambers like larger lower chamber called **"brood chamber"** and upper smaller chamber called **"super chamber"** which are separated by a perforated zinc sheet or wire frame with 3.75 mm perforations called **"queen excluder".** Brood chamber is most important part of bee hive. It contains parallel 5-10 frames. Upper ends of frames touching the queen excluder partition and lower ends in vertical position, having hexagonal wax sheets on both sides. These wax sheets are called comb foundations, as these provide the base for construction of comb by the worker bees. Each comb foundation helps in obtaining a regular strong worker brood cell comb which can be used repeatedly.

c) The **queen excluder** is wire gauze or zinc sheet which separates brood chamber from the super chamber. Workers and drones can pass easily through that, but queen with a 4.3 – 4.5 mm thorax cannot pass through that. This prevents queen to lay eggs in super chamber which may create a problem in obtaining pure honey.

d) **Super chamber** - It is like brood chamber without cover and the base. It is smaller and is placed over the queen excluder, provided with many frames with comb foundations to provide additional space for expansion of the hive. The hive may contain 2-3 super chambers depending on its strength.



Different parts of Langstroth frame hive.

e) **Covers** - There are two covers like inner and outer cover. The inner cover is flat board with 1 or 2 oval holes in the centre fitted with bee escapes to allow the bees to go out but do not allow them to re-enter. This mechanism helps to get the supers fully vacated by the bees when honey is to be extracted. The outer cover acts as a roof for the hive, which is made of two sloping zinc sheets protects the bee hive from rains.

PART – D

IV **Answer any TWO of the following:** (2×10=20)

1. Enumerate the general characters of phylum Arthropoda. Give an outline classification of the phylum upto classes with an example for each.

Any 7 characters – 07 marks, classification – 03 marks

- Animals are bilaterally symmetrical, triploblastic and metamerically segmented with organ grade of organization.
- Body shape varies, divided into head, thorax and abdomen. **Cephalothorax.**
- Metameric segmentation or **metamerism.**
- **Cephalization**.
- The entire animal body is covered by exoskeleton which is shed at intervals called **ecdysis or moulting** for growth and development.
- The **jointed appendages** are modified like **jaws, gills, legs** etc to perform various functions. There may be a pair of appendages per segment or less.

- ❖ True coelom is reduced and replaced by a blood filled cavity called **haemocoel**.
- ❖ Digestive system is complete with alimentary canal and accessory digestive glands. Digestion is **extracellular or intercellular.**
- ❖ Respiration - through the general body surface / **gills / book gills /trachea/book lungs**.
- ❖ Circulatory system - open type, with dorsal, **tubular**, **pulsatile**, many chambered heart, arteries and **blood sinuses / haemocoel**.
- ❖ Excretion by either **green / coxal glands / malphigian tubules.**
- ❖ Nervous system is **annelidan type** with dorsal **cerebral ganglia** forming the **brain**, connected with a **nerve ring** to a double, solid, mid ventral **nerve cord**, a pair of ganglia per segment / less due to fusion of adjacent ganglia.
- ❖ Sense organs include simple and **compound eyes, chemo** and **tactile receptors**, **balancing** and **auditory organs**.
- ❖ An endocrine system has been developed, especially in crustacean and insects to control metabolic activities in young stages.
- ❖ Sexes are usually separate with **sexual dimorphism**. Reproductive organs and ducts are paired. Fertilization is internal. **Oviparous / ovoviviparous**.
- ❖ Development is direct / indirect with one / many larval stages, metamorphosis into adults. **Parthenogenesis** is present in some.

CLASSIFICATION.

PHYLUM – ARTHROPODA

Subphyla

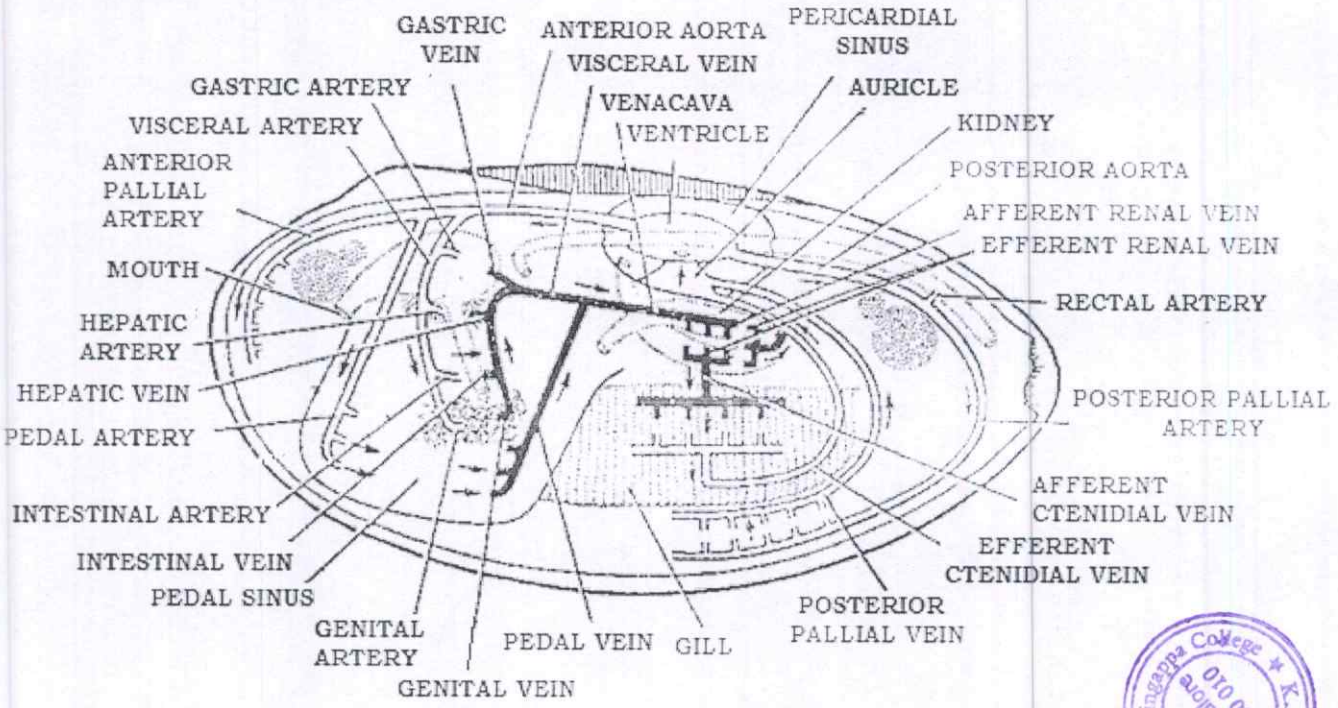
↓	↓	↓	↓
Trilobitomorpha	**Onychophora**	**Mandibulata**	**Chelicera**
↓Class	**↓Class**	**↓Class**	**↓Class**
Trilobita.	**Onychophora.**	**1. Crustacea.**	**1. Merostomata.**
Ex: Triarthrus	Ex: Peripatus	Ex: Crab	Ex: Limulus
Dalmanites		Prawn	Eurypterus
		Lobster	
		2. Myriapoda.	**2. Arachnida.**
		↓Orders	Ex: Scorpion
		a) Chilopoda	Spider
		Ex: Scutigera	Ticks
		Lithobius	Mites
		Scolopendra	
		b) Diplopoda	
		Ex: Spirobolus	
		Julus	
		c) Pauropoda	
		Ex: Pauropus	
		d) Symphyla	
		Ex: Scutigerella	
		3. Insecta.	
		Ex: Honey bee	

2. Describe the circulatory system in Unio with an appropriate diagram.

Diagram – 04 marks, Explanation – 06 marks.

In Unio circulation is open type. It consists of heart, blood vessels and blood. Blood capillaries are absent.

HEART - lies in **pericardium**. **Pericardial cavity** contains **coelomic fluid** and lined by **coelomic epithelium**. Heart lies infront of the **posterior adductor** muscle. Heart wall is **epicardium**. **Endocardium** is **absent.** It is three chambered with **two auricles** and **one ventricle**. The auricles are thin walled, highly distensible, triangular chambers, one on either side of the ventricle. Auricles are attached to the pericardium by thin broad bases and opens into the ventricle by an **auriculo-ventricular aperture**, which is guarded by **valve** permits the passage of blood from auricle into the ventricle. Auricles receive the blood from the **gills, kidney** and **mantle**. The **ventricle** is a large, thick walled, muscular chamber, horizontal tube, wrapped around the rectum. It pumps blood to the body. The muscular heart **beats 20-100** times per minute. The circulation is **slow** for sedentary mode of life of animal. The heart is controlled by **mechanical** and **chemical** means as it lacks nerve supply.



BLOOD VASCULAR SYSTEM.

BLOOD VESSELS - ARTERIES.

Two large arteries arise from the ventricle, both forwards and backwards called **anterior** and **posterior aortae** respectively. **Anterior aorta** arises from anterior end of the **ventricle**, passes forwards over the **rectum** and gives off three important arteries namely **pedal, visceral** and anterior **pallial**. **Pedal artery** supplies blood to the **foot**. **Visceral** artery sends **gastric, hepatic, intestinal**

and **genital arteries** to the **stomach, digestive gland (Liver), intestine** and **gonads** respectively. **Anterior pallial** artery carries blood to the **mantle**. The **posterior aorta** leaves the hind end of the **ventricle** runs backwards under the rectum and sends a **posterior pallial** artery to the **mantle** and a **rectal** artery to the **rectum**. It supplies blood to the **pericardium** and **kidneys** through its fine branches.

SINUSES - Spaces in the connective tissue of organs, without definite walls. Arteries open into these spaces, and then the blood is collected by veins.

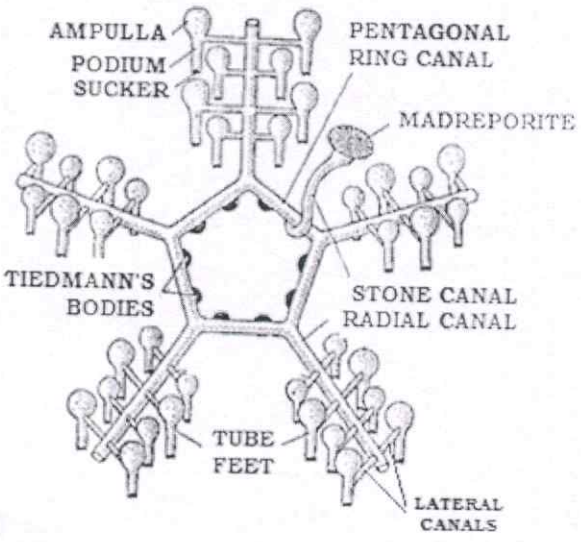
VEINS - These collect blood from the different parts of the body. Visceral vein collects blood from the visceral organs. Pedal vein collects blood from the pedal sinus. Efferent renal vein from the kidney and unite to form two afferent ctenidial veins. An afferent ctenidial vein runs through the central axis of the gill and sends a branch to each gill filament. The blood in the gill is oxygenated. Efferent ctenidial vein collects oxygenated blood from the gill filaments and carry the blood to auricles. Vena cava directly sends deoxygenated blood to the auricles.

BLOOD - It consists of **plasma** and **corpuscles. Plasma** is colourless in some species, where as it is faint blue in others due to presence of copper-containing respiratory pigment (protein) called **haemocyanin**. The **corpuscles** are colourless and **amoeboid leucocytes**. Some of them are **granular** and some are **non-granular** and are **phagocytic** in function. Blood performs the functions like **transportation of food, O_2** to all parts of the body and **nitrogenous wastes** to the **gills, mantle** and **kidneys**, keeping the **tissues moist** and **protection** against foreign micro-organisms.

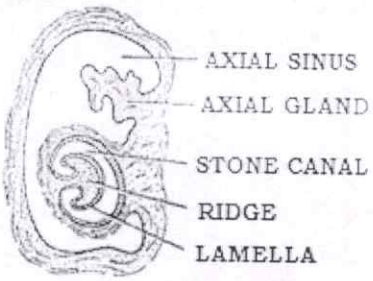
3. Sketch, label and explain the water vascular system in Asterias.

Sketch with 4 labellings – 03 Marks, Explanation – 07 Marks.

MADREPORITE - It is thick, round, sieve like calcareous plate lies on the aboral surface at the base of 2 adjacent arms in the central disc. It has many radiating furrows on the surface with about 250 minute pores. Each pore leads into a pore canal. Pore canals unite to form larger collecting canals, finally lead into a sac like ampulla below the madreporite. Ampulla leads into stone canal.



WATER VASCULAR SYSTEM.



T.S OF AXIAL COMPLEX.

STONE (MADREPORITE) CANAL - "S" shaped tube open into ring canal around the mouth. Its walls are supported by a series of calcareous rings; hence the name is stone canal. Internally lined by ciliated / flagellated cells which draw water into the canal. In young animals it is a simple tube but as it grows a prominent ridge and 2 spirally coiled lamellae develop within its lumen. It is enclosed in coelomic sac (axial sinus) along with an axial organ; these 3 together form the axial complex.

RING CANAL - Wide, pentagonal canal with a ring around the oesophagus. Angles of pentagon lie in the radial positions.

TIEDAMANN'S BODIES / RACEMOSE GLANDS - Small, round, yellowish, glandular sacs open into ring canal on its inner side. Each present between each radius and inter radius, except in one position where the stone canal enters the ring canal, hence there are 9 bodies. Each body consists of many radiating tubules which are lined by ciliated cells. Functions are different according to different workers like filtering devices, enzyme forming bodies, lymphatic glands; probably they produce phagocytic amoebocytes which are released into water vascular system.

POLIAN VESICLES - Pear shaped, thin walled, contractile bladders. Situated along the inter radii and open into ring canal on its outer side. Number varies from 1 – 4 in each inter radius. These probably store water and thus help in regulating presence in the water vascular system.

RADIAL CANALS - These extend from the ring canal upto the tips of arms. Each canal lies below the ambulacral ossicles and terminates as lumen of the terminal tentacle.

LATERAL / PODIAL CANALS - There are 2 rows of lateral canals which are alternately long and short. Each opens into a tube foot, through a small opening which is provided by a valve to prevent back flow of fluid into radial canal.

TUBE FEET - There are 4 rows of tube feet in each arm. Each tube foot has closed, thin walled tube, extends through ambulacral pore, which lies between 2 adjacent ambulacral ossicles.

- Each contains 3 parts
  i. **Ampulla –** Round sac, lies above the ambulacral ossicles and projecting into the coelom.
  ii. **Podium** – middle tubular part, extends through the ambulacral groove.
  iii. **Sucker** – Cup like lower end of the podium.
- Tube feet lined by strong longitudinal muscles, in addition ampullae lined by circular muscles, while podia possess rings of non elastic connective tissue.

FUNCTIONS

- Helps in locomotion by providing a hydraulic pressure mechanism.
- Thin walls of tube feet may serve for exchange respiratory of gases.
- Tube feet also help in attachment of body to the substratum, to handle and capture the food.

4. Write a note on: a) Prawn preservation. b) Pearl culture.

a) PRAWN PRESERVATION Any five steps – 01 mark each

i. **CHILLING AND FREEZING** - Most **effective** and **practical means** of controlling spoilage. Freshly caught prawns should be stored in ice till they are processed for packing and transport. The storage time in which prawns remain in good condition is known as **Shelf time**. The quantity of ice used should be in the proportion of **1:1**, ice to prawn by weight. Ice must be free from **bacteria** and prepared from **chlorinated water**. Refrigerated sea water at **0°C - 1°C** serves as a good **preservative medium**. Faster freezing, done by **jet freezing** in which **cryogenic nitrogen (-320°F)** freezes the product in less than a minute, prevents spoilage quickly and the prawns retain their natural taste. **Peeled prawns** store in a better condition than the **whole prawns**, where as **beheaded prawns** show **intermediate characters**. Stored prawns become **black** in colour within a few days **(melanosis)** by oxidation of enzymatic action, prevented by **glazing** (covering iced prawns with water), also prevent **evaporation** and **loss of taste** and **brighten** the colour of prawns.

ii. **BEACH- DRYING** - It is simplest and the most **widely practiced** method of curing prawns along our coasts. The prawns are spread over the sand for drying by the **solar heat** and marketed as such or after **shelling**.

iii. **PULP- MAKING** - Prawns are **boiled in weak brine**, dried in **sun** over coir mats, packed into **jute bags** and beaten with **clubs**. The shells separate and later removed by **winnowing**. Prawns are reduced to **paste** or **pulp like mass** which has a good market in the **Far East**.

iv. **PICKLING** - Along the **coasts** of **Malabar and Madras**, the prawn pulp obtained after **boiling** and **shelling** is **pickled with vinegar, oil and spices** and marketed as such.

v. **BLANCHING** - It is a process in which fresh prawns are **cleaned** and **dipped in boiling brine** for **1.5 – 3 minutes**, before freezing and packing. **Blanching** is followed by **glazing** (immersing in water, cooled around 2°C with ice). Cooling is done in a chamber with a **blast** of air from a **fan** to reduce the time.

vi. **SMOKING** - Prawns are first boiled in **salt water** followed by **drying in kilns** by burning moist bark. The purpose of this is to impart the particularly **desirable smoked flavour** and **colour** to the prawns.

vii. **SEMI-DRYING** - This process has been developed by the **Madras Fisheries** Department. Cleaned prawns are blanched in brine, shelled by hand, treated by 25% brine, and then half dried in solar heat or by artificial drives. They can be stored for 2 months and if sealed in tins with CO_2 for 8-10 months.

viii. **FREEZING AND CANNING** - Abdomens of larger prawns are frozen directly without being boiled and shelled. Prawns are chilled down to about 40-50° F and then placed in a **"freeze storage"** at 10°F until transportation. Canning is costly and sophisticated method by which prawns can be kept indefinitely without the use of any preservative. Many processes are involved in canning; prawns are cleaned, cooked at high temperature under pressure, and packed in cans or boxes

with the addition of oil for their taste. The cans are then properly sealed airtight and sterilized by heat to kill bacteria so that prawns are no longer liable to decompose.

b) PEARL CULTURE **05 marks**

PREPARATION OF NUCLEUS - Pearl oyster secrets pearl around calcareous materials. **Xanchus** are generally used to prepare the nucleus which is a tiny spherical calcareous bit of molluscan shell, which becomes a pearl. Xancus shells are cut into finger-size and cube shapes with an electric saw. The cubes are grinded to spherical form by placing between two sheets of iron and revolving the sheets. The spheres are smoothened and used as nucleus for insertion into a host oyster body.

INSERTION OF NUCLEUS - It is technical process and sufficient method of **Nishikows**. A piece of mantle of living oyster is cut off and inserted together with a nucleus inside the living tissue of other oyster.

TO PREPARE THE OYSTERS FOR OPERATION - The reared fit oysters are used to induce pearl formation. The mature oysters are artificially induced to release their gametes. The gonads are best suited site for insertion of nucleus for pearl formation. The gonad without gametes is found to give better results. Oysters into which nucleus is to be inserted should be healthy and strong to bear the shocks during operation. To overcome the shocks the ovary and testis are got rid of the gametes. So the oysters are dipped into cold and warm current of water alternately. It initiates the males and females to eject their gametes.

PREPARATION OF GRAFT TISSUE - The graft tissue (a small piece of mantle tissue) about 7 X 0.75 cm is prepared from a mantle of a healthy oyster. The tissue is washed and cleaned to remove the sticky mucous and is kept alive in sea water at 22^{0}C for 48 hours. The outer surface of the graft tissue must be marked as this produces the nacreous layer and must come in contact with the nucleus.

IMPLEMENTATION OF NUCLEUS AND GRAFT TISSUE - The host oyster shell is induced to open by placing it in a tray containing sea water with their dorsal portion directed downward. Within a short time the shell opens. Valves kept open by using shell openers or bamboo wedges. Partly opened shell is fixed on an oyster clamp. The graft tissue with nucleus is kept ready beside this. The mantle is smoothened back with a scapula and the foot and body are exposed. With fine scalpel an incision is made into the epithelium of foot and a slender channel is made into the main mass. Immediately the graft mantle tissue is implanted into the channel and the nucleus is placed over the graft tissue that acts as a bed for the nucleus. Then bamboo peg is removed due to which oyster shells are closed automatically. In a fully grown host oyster 4-5 nucleus can be implanted. Insertion of second nucleus is done in the gonadial tissue on the left side. A well trained technician can operate 25-40 oysters per hour. Operation should not increase beyond 30 minutes, since oysters cannot survive more than one hour of operation.

NURSING (POST-OPERATIONAL CARE) - The operated oysters are placed in wire cages and suspended in water from wooden rafts. Healing of the operated tissue

requires 6-7 days; during this the oysters are left undisturbed. Then they are transferred to culture cages and suspended at a depth of 2-3 m. The oysters normally take 3-6 years for pearl formation, during this the cages are lifted periodically and nursed by removal of all encrusting organisms from the shell and protect them from parasites. The pearl oysters develop best in warm shallow waters at a maximum depth of 14 m.

HARVESTING OF PEARLS - Harvesting period is December to February but it varies according to the climatic conditions of the area. After 3 years of insertion of nucleus, oysters are taken out from the sea and pearls are removed from the shell. Pearls are washed, cleaned with soap solution. Pearls should not be rubbed. Pearls vary in shapes and sizes and colour may be white, cream red or pink red. **Lingha pearl** is best quality pearl, which is obtained from the marine oysters. Pearls of fresh water oysters are of less value.

BANGALORE UNIVERSITY
VI semester B.Sc., Examination, May/June 2019
CBCS Scheme (2014-15 and onwards)

PAPER – VII: ZOOLOGY

GENETICS AND BIOTECHNOLOGY

Scheme of Valuation

Time : 03 Hours **Max.Marks:70**

PART – A

I. Answer **any five** of the following: **5×3=15**

1. Writc a note on phenocopy.

Definition – 01marks, example description – 02 mark

When two different genotypes express the same phenotype due to different environmental conditions, then one is called the phenocopy of other as they differ genotypically.

In Drosophila, the normal body colour is brown and a mutant Drosophila has yellow body colour. When the larvae of brown Drosophila are fed with food rich in silver salts, they develop into yellow flies. These flies are the phenocopies of yellow mutants, but they develop into normal flies with normal food.

2. Mention the Mendel's monohybrid **Ratio - 01 mark each**

a) Phenotypic ratio – **3 : 1**
b) Genotypic ratio - **1 : 2 : 1**
c) Test cross ratio – **1 : 1**

3. What are gynandromorphs? Mention the types.

Explanation – 02 marks, any two types – 01 mark

Individuals who show male characters on some parts of the body and female characters on other parts of the body.These are sterile and also called as **"Gynanders"**.Gynanders are rare. These occur in **Drosophila**, **Butterflies**, **Beetles**, **Wasps**, **Bees**, and Silkworms etc. In moths usually males have large, beautifully coloured wings and females have small, stumps of wings. But in gynanders wings are of male on one side and wings of female on the other side.

During the cleavage of fertilized egg, one of the X chromosomes is left behind in the centre of the spindle so that one of the daughters receives only one X-chromosome and the other receive XX. The part that develops from XO will be male and the other that develops from thc XX cell would be female.

TYPES – Bilateral gynandromorphism, Hemi gynandromorphism and mosaicgynandromorphism

4. Differentiate between spontaneous and induced mutations.

Any three differences – 01 mark each.

SL.NO	SPONTANEOUS MUTATIONS	INDUCED MUTATIONS
01	Sudden naturally occurring.	Artificially occurring mutations.
02	Occur without a known cause.	Occur by subjecting the organism to abnormal environment
03	Occur without the application of any external agent by man	Many radiations, physical conditions and chemicals can cause mutations.
04	Frequencies are quite low	Frequency increased artificially by man
05	It is affected by various intrinsic and extrinsic factors.	It is affected by mutagenic agents.

5. Give the significance of transgenesis.

Any three significances – 01 mark each.

i. Some transgenic animalsare produced for specific economic traits.
ii. Some transgenic animals are produced as disease models. Animals genetically manipulated to exhibit disease symptoms so that effective treatment can be studied.
iii. Transgenic animals are produced to fulfil specialized experiment and or biomedical needs.
iv. The choice of genes for resistance to systemic herbicides is limited to only target site resistances where the herbicide can be translocated to the parasite, inhibiting a metabolic pathway of the parasite. Some target site mutated as well as engineered crops appropriate for parasitic weed control is already marketed in the developed world for other purposes.

6. Define hybridoma technology. Who proposed it?

Definition - 2 Marks, proposed name - 1 mark

Hybridoma technology is a method for producing large numbers of identical antibodies. This process starts by injecting a mouse (or other mammal) with an antigen that provokes an immune response.

George Kohler and Cesal Milstein proposed hybridoma technology.

7. List any three applications of DNA fingerprinting.

Applications - 01 mark each

i. Identifications of criminals, rapists, murders etc.
ii. Solvingpaternity and maternity disputes.
iii. To establish different racial group, evolutionary relashionship.
iv. Identification of mutilated remains charred and decomposed bodies.
v. Authentication of plant seeds.
vi. Forensic wildlife.
vii. DNA sequencing and analysis.

PART – B

II. Answer **any five** of the following: **5×5=25**

1. With reference to the inheritance of comb shape in fowls, a rose comb crossed with walnut comb produces offsprings of which 3/8 are rose comb, 3/8 walnut comb, 1/8 pea comb, 1/8 single comb. Determine the genotype of parents.

Cross – 02 marks, checker board – 02 marks, result – 01 mark.

Parents: Rose comb X Walnut comb

Genotypes: Rrpp X RrPp

Gametes: Rp rp X RP Rp rP rp

F1 generation:

	RP	Rp	rP	rp
Rp	RRPp Walnut	RRpp Rose	RrPp Walnut	Rrpp Rose
rp	RrPp Walnut	Rrpp Rose	rrPp Pea	Rrpp Single

Result: Genotypes of parents **Rose comb – Rrpp, Walnut comb - RrPp**

2. Explain multiple factor inheritance with reference to the inheritance of skin colour in man.

Definition – 1 mark, explanation – 4 marks

Polygenes or multiple factor inheritance is defined as a set of many genes representing the same character and each and every gene will have a small or large effect as if the expression of a character. It means a single character is expressed by the effect of many genes

Ex: **SKIN COLOUR IN MAN.**

The human skin colour is controlled by at least three separately inherited pairs of genes namely Aa, Bb, Cc, located in different chromosomes and inherited independently. The genes for dark colour, A, B and C are incompletely dominant and the darkness of the dominant genes present. A pure Negro has 6 dominant genes (AA, BB, CC) for skin colour. A pure white person has 6 recessive genes (aa, bb, cc) for lack of skin colour.A cross between a pure Negro and a pure white produces F_1 hybrid offspring with the genotype Aa Bb Cc and the skin colour or phenotype mulatto, which is intermediate between the two parents. The F_1 hybrids form 8 kinds of gametes in each sex, giving 64 combinations in F_2 generation, having 7 genotypes and as many phenotypes. The skin colour of F_2 offspring varies according to the number of genes for pigmentation they inherit. Their skin colour ranges from pure black (AA BB CC) in 1/64 individuals through very dark-brown in 6/64 individuals, dark brown in 15/64 individuals, mulatto (Aa Bb Cc) in 20/64 individuals, light brown in 15/64, and very light-brown in 6/64 individuals to pure white (aa bb cc) in 1/64 individuals.Each dominant gene directs the synthesis of the same amount of the melanin pigment; hence the shade of the skin colour is directly proportional to the number of dominant genes present in the individual.

Parents - Negro father X Caucasian mother

Genotypes - AABBCC X aabbcc

Gametes - ABC X abc

F_1 generation - AaBbCc - Mulatto (intermediate)

Self-crossing - AaBbCc father X AaBbCcmother

F2 generation -

	ABC	AbC	aBC	ABc	Abc	abC	aBc	abc
ABC	AABBCC	AABbCC	AaBBCC	AABBCc	AABbCc	AaBbCC	AaBBCc	AaBbCc
AbC	AABbCC	AAbbCC	AaBbCC	AABbCc	AAbbCc	AabbCC	AaBbCc	AabbCc
aBC	AaBBCC	AaBbCC	aaBBCC	AaBBCc	AaBbCc	aaBbCC	aaBBCc	aaBbCc
ABc	AABBCc	AABbCc	AaBBCc	AABBcc	AABbcc	AaBbCc	AaBBcc	AaBbcc
Abc	AABbCc	AAbbCc	AaBbCc	AABbcc	AAbbcc	AabbCc	AaBbcc	Aabbcc
abC	AaBbCC	AabbCC	aaBbCC	AaBbCc	AabbCc	aabbCC	aaBbCc	aabbCc
aBc	AaBBCc	AaBbCc	aaBBCc	AaBBcc	AaBbcc	aaBbCc	aaBBcc	aaBbcc
abc	AaBbCc	AabbCc	aaBbCc	AaBbcc	Aabbcc	aabbCc	aaBbcc	aabbcc

F_2 phenotypic ratio: 1 : 6 : 15 : 20 : 15 : 6 : 1

Phenotypes: 1- Pure dark, 6 – Very dark brown, 15 – Dark brown, 20 – Mulatto, 15 – Light brown, 6 – Very light brown, 1 – Pure white.

3. Write notes on:

a) Erythroblastosis foetalis. **Description - 03 marks** 2½ marks.

Rh incompatibility between foetal and maternal blood results in a disease called "Erythroblastosis foetalis" or "Haemolytic Disease of the new born (HDN) / of the**fetus,** HDFN. Rh incompatibility occurs when Rh^{-ve} mother bears an Rh^{+ve} child (father being Rh^{+ve}). Generally the first Rh^{+ve} child is safe if Rh^{-ve} mother has not had any previous Rh^{+ve} blood transfusion.At later stage of first pregnancy and during delivery, some Rh^{+ve} blood cells of the foetus cross placenta and enter into mother's circulation. The mother's immune system responds by producing antibodies against Rh antigens. The first child is generally safe as enough antibodies are not formed by the time it is delivered.

However during subsequent pregnancies where in the developing foetus will be Rh^{+ve} the anti Rh antibodies enter into foetal circulation and cause agglutination of Rh^{+ve} foetal blood cells (Erythroblast). This may result in premature birth or birth of severely anaemic child.The new born baby also suffers from jaundice due to bilirubin produced as a result of erythroblast destruction. The blood of such new born baby is completely replaced by transfusion of healthy blood immediately after birth.

In order to prevent Erythroblastosis foetalis in Rh^{+ve} new born 72 hours before the child birth or immediately after the delivery of first baby, intra venous anti-D (RhoGam / Rho Gamma Globulin) injection is given to Rh^{-ve} mother to suppress anti Rh antibody production.

b) Free martins. **Description - 02 marks** 2½ marks

Lillie in **1977** reported hormonal influence on sexual characters in cattle.

It is a condition in which a female organism exhibits female characteristics externally, male characteristics internally and sterile characteristics physiologically. Free martins are seen in cattles.

In cattle twins occur frequently. If both the young ones are zygotically of the same sex, they develop normally; if however, one member is a male and the other female then the development of the female is not normal.

During development both the twins are connected by a common umbilical cord.The gonads of the male develop earlier than those of the female. So the male gonads produce male hormones earlier in development.These male hormones reach the female embryo and influence the development of male sex in the female embryo.This results in a sterile inter-sex having female phenotype with sterile male gonads.

4. Lac operon is called inducible operon. Substantiate.

Definition – 01 mark, explanation – 04 marks.

Jacob and monad proposed the operon model largely as a result of their studies of the lac operon of E.coli.It controls the production of enzymes required for the utilization of lactose sugar by the cell.

CONTROL GENES - These include Regulatory genes, Promoter genes and Operator genes.

REGULATOR GENE (R) - It is present beside the promoter gene, codes for repressor protein which could bind at operator and blocks it. So it regulates the movement of RNA polymerase enzyme and thus takes control over the activity of operator gene.

PROMOTER GENE (P) - It is present just beside the operator gene, to this the enzyme RNA polymerase binds. This enzyme is required to initiate the synthesis of mRNA. At this place DNA has **TATAAT** nucleotides in **Prokaryotes,** and this forms **pribnow box**. In **Eukaryotes**TATA nucleotides are present and this forms **Hognese box**.

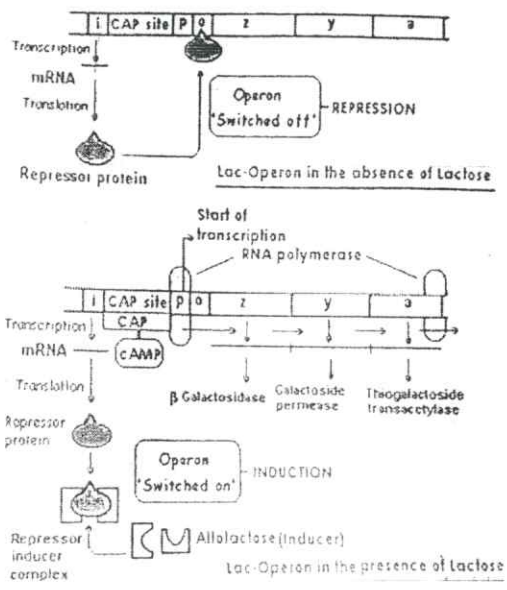
OPERATOR GENE (O) - It is present in between the promoter and structural genes. This regulates the action of structural genes by controlling the activity promoter gene. It is the site of attachment of repressor protein.

STRUCTURAL GENES - These are involved in the synthesis of mRNA to produce a protein, occur close to one another, hence called clustered genes and are designated as z, y, a. Lac–operon in E.coli is an example for inductive operon because; the gene expression is turned on by the addition of lactose (inducer) into the medium. Utilization of lactose by the cell in E.coli needs three enzymes.

- **β-galactosidase**cleaves or converts lactose into **glucose and galactose**.
- **β-galactosidepermease** pumps lactose into the cell, helps in transport of metabolites.
- **β-galactosidetransacetylase** transfers acetyl group from Acetyl Co-A to galactosidase.
- All these three enzymes produced by z, y, and a structural genes respectively in presence of RNA polymerase enzyme, which is bound to promoter region of DNA and it has to move along the structural genes to initiate the synthesis of mRNA for these 3 enzymes.
- The mechanism of Lac-operon can be studied under two steps namely **Switched on and Switched off mechanisms.**

Functioning of Lac-Operon

- In the absence of lactose sugar (inducer) the repressor proteins formed by regulator gene binds to operator gene and "switch off" the operon by blocking the RNA polymerase from transcribing structural genes. This phenomenon is called 'Repression'.
- The repressor has two allosteric sites, one for attaching to operator and other for binding the inducer. When lactose is added in the medium as the sole energy source, some of the lactose molecules of absorbed due to the presence of small quantity of permease.
- The small amount of lactose is converted to the lactose isomer, allolactose and binds with repressor protein causing allosteric change in the protein. The repressor dissociates from the operator and unblocks the operon. Now the operator is free and the operon is "switched on". This phenomenon is called induction.
- The allolactose that binds repressor protein to make it inactive is called 'inducer'. Since the presence of inducer lac operon becomes operational. It is called **inducible operon system.**
- Now the RNA polymerase is free to bind with the promoter gene. The lac promoter on its own is a weak one so that the RNA polymerase does not readily bind to it and initiate transcription.
- The promoter becomes strong only when cat
- Abolite activator protein binds to CAP binding site located adjacent to promoter gene. CAP only attaches to the bonding site. When bond with cAMP (Cyclic Adenosine Monophosphate). The cell produces cAMP only when glucose level is slow.
- When glucose level is low, cAMP binds to CAP which in turn attaches to CAP site making promoter gene strong for RNA polymerase to attach and initiates transcription of all the structural genes resulting in synthesis of polycistronic m-RNA. The m-RNA is translated into enzymes b-galactosidase for lactose breakdown, Permease to induce absorption of lactose and thiogalactosidetransactelyase to transfers acetyl group from Acetyl Co-a to b-galactosidase.



5. Explain the cytoplasmic inheritance of kappa particles in paramecium.

Explanation – 03 Marks, Diagram – 02 Marks.

Kappa particles are self duplicating cytoplasmic particles present in Paramoecium. There are two strains of Paramoecium, namely **killer and sensitive**. The Paramoecium containing kappa particles is called Killer strain. The Paramoecium without kappa particles is called sensitive strain.

Killer strain produces a toxic substance called **paramecin**that kills the other type. The production of paramecin is controlled kappa particles.

Kappa particles multiply during cell division, which is controlled by a dominant **nuclear gene K**. This gene can control only maintenance, existence and production of kappa particles and cannot initiate its production.

These kappa particles are transmitted from one generation to another through the cytoplasm.

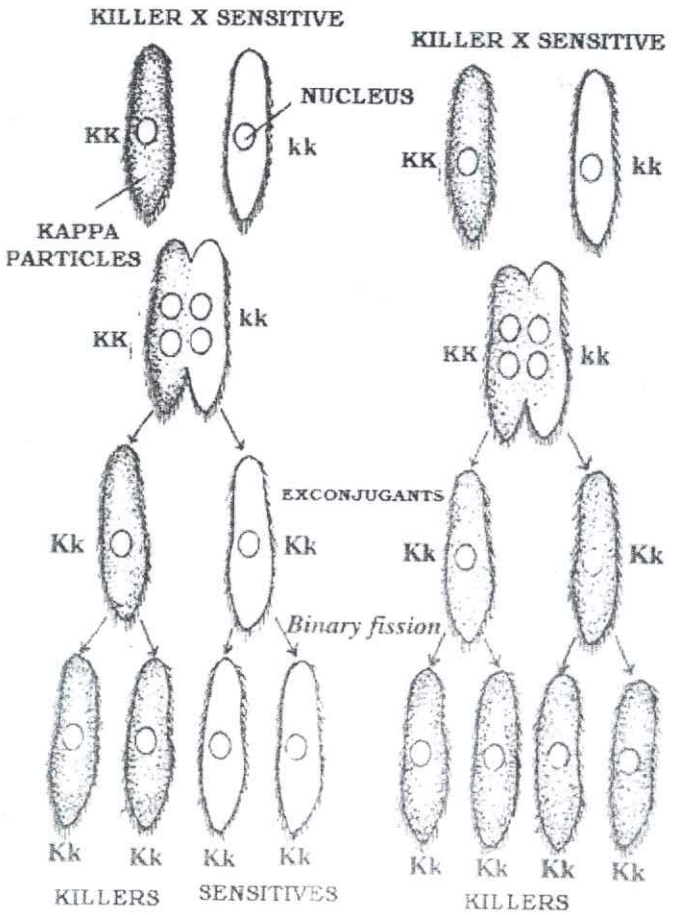
When killers **KK** conjugate with non-killers **kk**, the exconjugants are **Kk**. But development of a particular type depends upon the **duration of cytoplasmic exchange**.

In normal conjugation only nuclear material is exchanged and there is no exchange of cytoplasmic material. Hence each exconjugant gives rise to its own type, i.e killer exconjugant produces killers and non-killer produces non-killers.

Sometimes the conjugation period is prolonged and the cytoplasmic bridge between the two conjugants is larger. In these in addition to the nuclear material, the cytoplasmic materials are also exchanged.

Kappa particles which are present in killers enter the non- killers during cytoplasmic exchange. These kappa particles convert non-killers into killers. So all the offsprings produced by the exconjugants are killer type.

This shows that a Paramoecium becomes a killer when it receives kappa particles and it becomes a sensitive when it does not receive kappa particles.



Conjugation without cytoplasmic exchange.

conjugation with cytoplasmic exchange.

6. List out the differences between surgical and non-surgical embryo transfer.

Any five differences – 01 Mark each.

SL.NO	SURGICAL	NON-SURGICAL
01	Painful	Pain free
02	Long procedure	Short term procedure
03	Incision is made to implant the embryos	Incision is not made
04	Number of embryos implanted can be counted	Cannot be counted
05	Success rate is high comparatively	Success rate is comparatively low.
06	Does not lead to any discomfort.	May lead to discomfort such as cramping, bloating and vaginal discharge
07	Ultrasound is not necessary	Ultrasound is necessary for accuracy to transfer embryos

7. Write notes on:

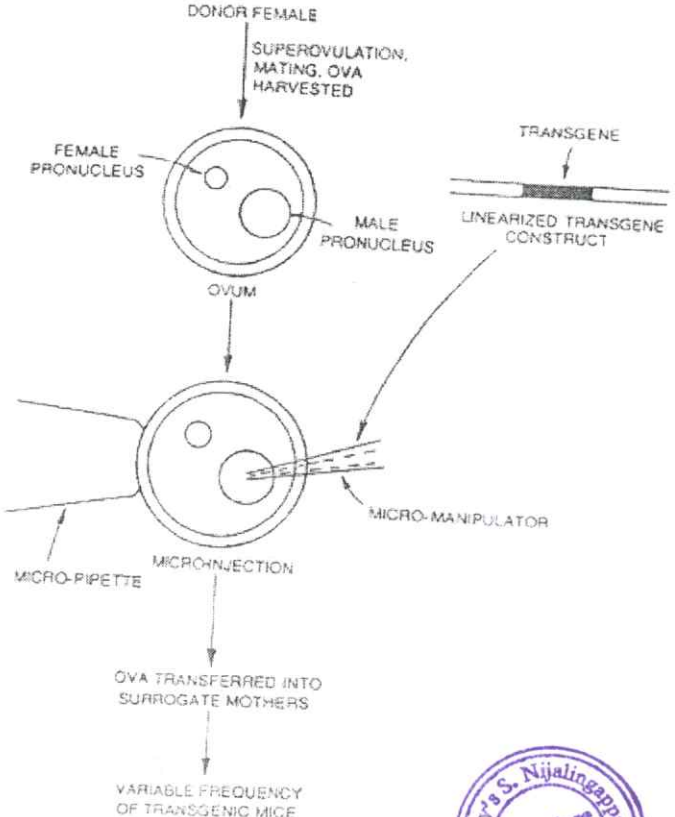
a) Microinjection **Description - 2.5 marks**

DNA solution is injected directly into the nucleus of a cell or into the male pronucleus of a fertilized 1-2 cell ovum. It consists of a low-power stereoscopic dissecting microscope to view the ovum and the entire process and two micromanipulators, one for a glass micropipette to hold the ovum by partial suction and other for a glass injection needle to introduce the DNA into the male pronucleus, due to its large size than the female pronucleus of mammalian ovum. In fish ova, the DNA is injected into the egg cytoplasm.

❖ The general procedure for microinjection is as follows,

1. Donor females are induced to super ovulate using appropriate hormone treatments.
2. Female mice are subjected to a regime of Pregnant Mouse Serum Gonadotrophin (PMSG), which stimulates growth and development of follicles which contain the developing oocytes.
3. The release of these oocytes (ovulation) is induced by subsequent treatment with Human Chorionic Gonadotrophin (HCG).
4. The super ovulated females are then mated with fertile males, and large number of fertilized 1-2 cell ova / embryos is collected from super ovulated females, the ova are then fertilized in vitro.

❖ Transgenics are identified by subjecting the tissue samples to DNA analysis by southern blot hybridizations with the new gene as a probe or by PCR amplification of the new gene.



Advantages.

1. The quantity of DNA delivery can be optimized.
2. DNA delivery is predictable, even into the cell nucleus.
3. Even the smallest cell can be targeted to deliver DNA.

Disadvantages.

1. Requires skilled persons.
2. Only one cell receives DNA per injection.
3. Costly instruments.

b) Electroporation **Description - 2.5 marks**

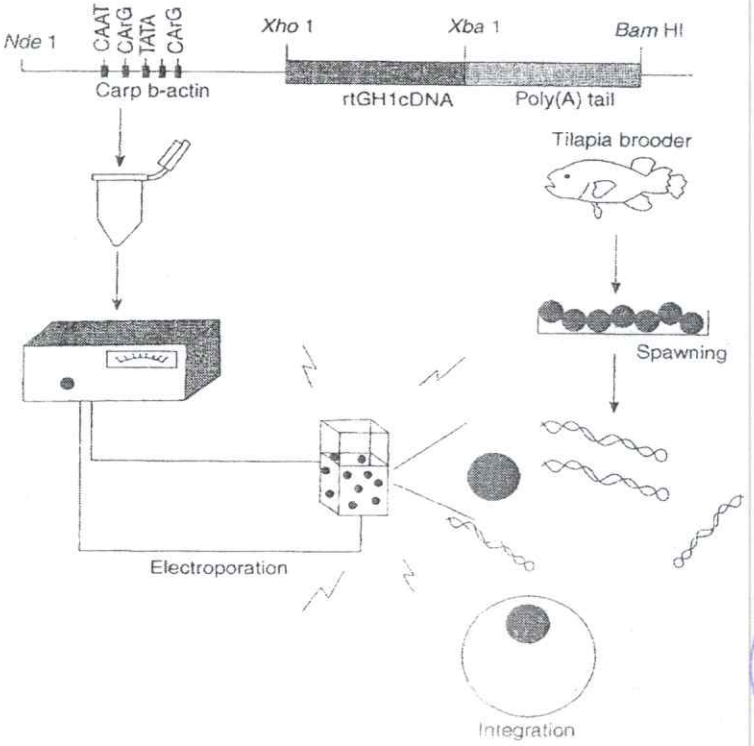
- ❖ It is more suitable technique for the transformation of plant protoplast and animal cells.
- ❖ It is one of the many standard techniques for efficient transformation, which facilitates cells to uptake DNA by reversibly altering the permeability of cell membrane.
- ❖ The transfection mixture with cell and DNA is exposed to a very high voltage gradient (4000-8000 V/cm) for a few milliseconds.
- ❖ This induces transient pores in the cell membranes through which DNA enters the cells.
- ❖ Treatment of cells before electroporation increases the frequency of transfection. This is most likely due to the arrest of cells at metaphase and associated absence of nuclear envelope or to an unusual permeability of the plasma membranes.
- ❖ Linearized DNA is more efficient in transfection than circular DNA.

Advantages.

1. Efficient transformation.
2. Large number of transformed cells obtained.
3. May not require skilled persons.

Disadvantages.

1. Requires protoplast for transformation.
2. Difficulties associated with protoplast regeneration.
3. Risk of obtaining genetic variation in protoplast regenerated plants.



PART – C

III. Answer **any three** of the following: 3×10=30

1. What is sex-linked inheritance? Explain it with reference to eye colour in Drosophila.

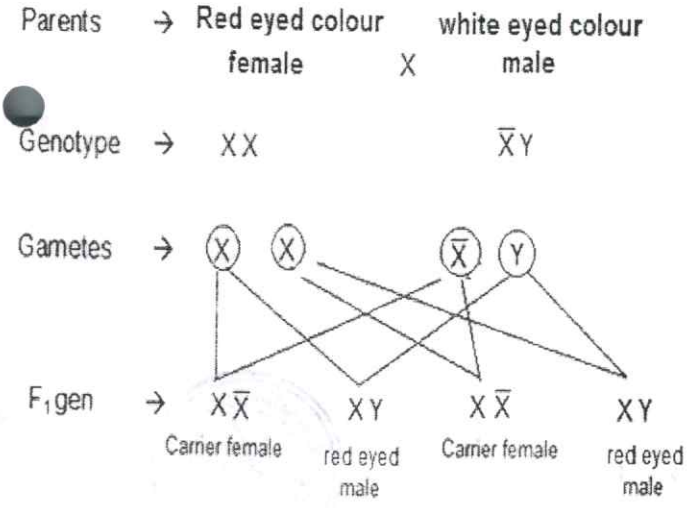
Definition – 01 mark, F_1 generation – 03 marks, F_2 generation – 04 marks and Explanation – 02 marks. Schematic representation – 04 Marks

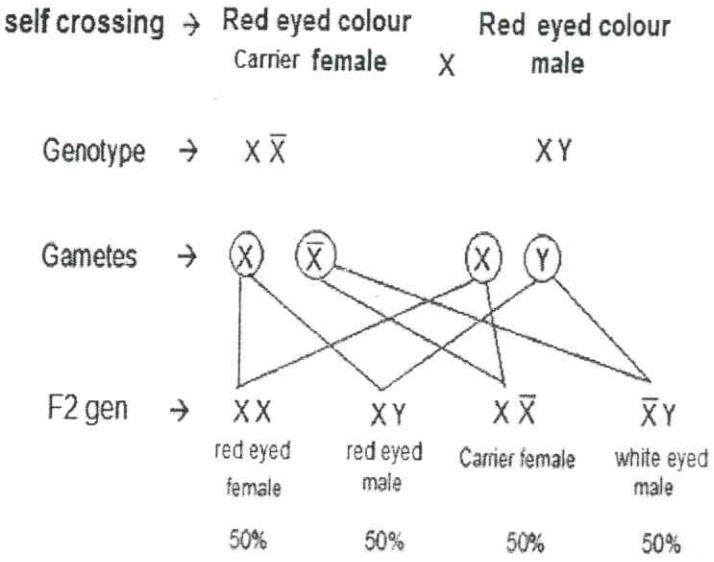
The mode of transmission of somatic characters from parents to offsprings through X chromosome is called sex linked inheritance. It was discovered by Morgan in 1910.
Ex: eye colour in Drosophila

White eye colour is asex linked character. In drosophila, the normal eye colour is red and red colour is autosomal character. White eye colour is seen only in some. Both red eye colour and white eye colour will have normal vision. White eye colour in Drosophila is a recessive character expressed by the recessive gene present on the X chromosome. It requires 2 genes one on each X chromosomes to express the character in female. But in case of male, one gene on one X chromosome expresses the character.

When a drosophila with red eye colour is crossed with male drosophila having white eye colour, in F1 generation, all offsprings are produced with red eye colour. But females are carriers of white eye colour. Further, when F1 offsprings are self crossed, in F2 generation all the females are with red eye colour but 50% of them are carriers, 50% of males are normal red eye colour and other 50% of males are with white eye colour.

In thc above example, white eye colour in drosophila is asex linked character is transmitted from P1 male to F2 male through F1 male. This is called as criss-cross inheritance or skip generation inheritance.





2. Write notes on:

a) Down's syndrome **Description - 05 Marks**

Discovered by Dr. John Langdon Down in 1866.It is an autosomal chromosomal anomaly observed in both male and female. The sufferers will have **47 chromosomes** in all their body cells due to the presence of extra 21st autosome due to abnormal meiotic division during ovum formation. Fertilization of such an egg with normal sperm results in trisomy-21 hence also called 21st – trisomy syndrome. The incidence of these increases with the agc of mother. Mothers around 40-45 years of age have a high risk of having babies with Down's syndrome. It is the human birth defect with occurrence of **one out of 660 births.**

Geneticconstituent is **45A+XX, 45A+XY.**

Symptoms.

Severe mental retardation.Epicanthic fold of skin in the eyelid like that of **mongoloid race.**Prominent forehead, flattened nose bridge and oval mongoloid face.Habitually open mouth, protruding tongue and lower lips.Short stature, obese body.Short and broad webbed neck.The hands are short and broad with short fingers. Short thick limbs with widc gap between the first and second toes.Low muscular strength in infants **(Hypotonia).**Low IQ (25-50) with mental retardation hence called **Mongoloid Idiocy**.Sensitivity for the infection of digestive and respiratory systems.Congenital heart defects.

b) Phenylketonuria **Description - 05 Marks**

It is an inborn error in the metabolism of an aromatic amino acid Phenylalanine. Phenylalanine is an essential amino acid which should be in the dietary protein form. Phenylalanine undergoes any one of the given 3 steps in the human body.

- It can be incorporated into cellular protein
- It can be converted into phenyl pyruvic acid
- It can be converted into tyrosine

The conversion of phenyl alanine into tyrosine takes place in the liver cells by an enzyme phenyl alanine hydroxylase. Tyrosine is converted into 3 – 4 dihydroxy phenyl alanine (DOPA) by another enzyme. DOPA serves a precursor for the hormone adrenaline and nor-adrenaline, thyroxine and melanin pigment. Excess of tyrosine is degraded into H_2O and Co_2. **The defective gene is located on chromosome 12.**

When recessive genes ppare present in homozygous condition then less or no phenyl alanine hydroxylase enzyme is produced. It blocks the conversion of phenylalanine into tyrosine. As a result, excess of phenylalanine is accumulated and abnormal amount of it is converted into phenyl pyruvic acid, which accumulates in the body cells in larger amounts. Much of it is excreted in urine and some of it diffuses into blood. The normal level of phenyl pyruvic acid is 1 – 2mg / 100 mL of blood. If it exceeds 15-64 mg for 100 mL of blood then it leads to phenylketonuria.

Symptoms:

Brain damage, Mental retardness, IQ is reduced to 20. Weakness in feet, Difficult to make ankle steady, Seizures, Microcephaly (small head size), Skin rashes, Stunted growth, Hyperactivity, "Musty" body odor from the excess phenylalanine, Fair skin, hair, and eyes (phenylalanine is linked to melanin production). PKU's are commonly called as Phenylpyruvate idiots or Inbeciles.

3. Give an account of physical and chemical mutagens.

PHYSICAL MUTAGENS. **Description – 4 marks**

- Radiations like α, β and fast and slow neutrons, Ultra Violet rays have been found to be mutagenic.
- Ionizing radiations such as X-rays, gamma rays and alpha particles may cause DNA breakage and other damages.
- Ultraviolet radiations with wavelength above 260 nm are absorbed strongly by bases, producing pyrimidine dimers, which can cause error in replication if left uncorrected.
- Radioactive decay, such as ^{14}C in DNA which decays into nitrogen.

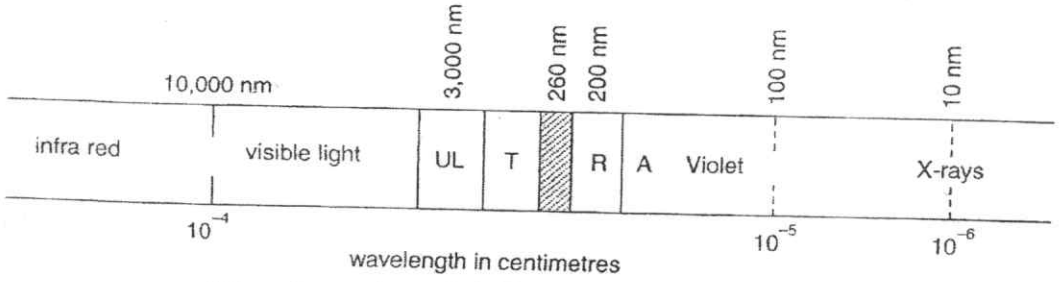
Ionizing radiations

- Ionizing radiations like X-rays and Gamma rays penetrate deeper tissues than visible and UV light due to their short wavelength.
- Zirkle in 1930 showed that in plants the nucleus is more sensitive to ionizing radiation than the cytoplasm.
- DNA is more affected. The purines are less sensitive than pyrimidines (thymine is most sensitive). By depolarizing DNA ionizing radiations prevent DNA replication and stop cell division.
- Large doses of ionizing radiation destroy thymine, uracil and cytosine in aqueous solutions.
- On August 6, 1945 atomic bomb exploded over Hiroshima, killing about 78000 people. On August 9, a second atomic bomb was exploded over the city of Nagasaki. A number of individuals who had received extensive radiation had no children for several years. Many of the survivors have shown visible chromosome abnormalities such as breaks and translocations. Persons over 30 years of age who had received more than 200 rads of radiation were found to be more sensitive to radiation than persons of the younger age

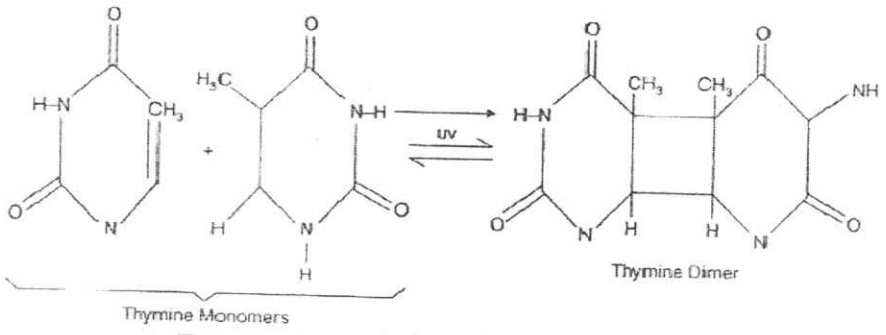
group. About 2% of survivors developed leukemia within the following decades. The children survivors have not shown a detectable increase in genetic abnormalities.

UV Radiation.

- E.Altenberg was first to show that UV radiation can induce mutations.
- UV rays have longer wavelengths than X-rays and gamma rays, hence cannot penetrate tissues as deeply.
- Their mutagenic action is limited to bacteria, fungal spores or other free cells whose genetic material lies very near the radiated surface.
- Wavelengths of 260 nm are absorbed by the particular bases like thymine of DNA, may cause mutation (thymine dimmers). Ozone layer absorbs most radiation below 290 nm.
- Two thymines join at their 4 and 5 positions of their residues like TT, cytosine (CC). uridine (UU) or two different pyrimidines (CT) to form a dimer. When cytosine is exposed to UV a molecule of water is added across the double bond between the 4th and 5th carbon atoms.



Wavelengths of different types of rays.



Formation of thymine dimmers.

- When heated or exposed to acidic conditions, the hydrated photoproduct can revert to the original form.
- If allowed to remain as such long enough, the hydrogen bonds between the pyrimidine and purine on the complementary strand break, leading to strand separation in that region.
- Both dimerisation and hydration of double stranded DNA affect DNA replication.

CHEMICAL MUTAGENS. Description – 6 marks

A DNA adduct (at center) of benzo[*a*]pyrene, the major **mutagen** in tobacco smoke.

- A large number of chemicals may interact directly with DNA. However, many such as PAHs, aromatic amines, benzene are not necessarily mutagenic by themselves, but through metabolic processes in cells they produce mutagenic compounds.
- Reactive oxygen species (ROS) - These may be superoxide, hydroxyl radicals and hydrogen peroxide, and large number of these highly reactive species are generated by normal cellular processes, for example as a by-products of mitochondrial electron transport, or lipid peroxidation. A number of mutagens may also generate these ROS.
- Deaminating agents such as nitrous acid.
- Polycyclic aromatic hydrocarbon (PAH).
- Alkylating agents such as ethylnitrosourea. The compounds transfer methyl or ethyl group to bases or the backbone phosphate groups. Guanine when alkylated may be

mispaired with thiamine. Some may cause DNA crosslinking and breakages. Nitrosamines are an important group of mutagens found in tobacco, and may also be formed in in smoked meats and fish via the interaction of amines in food with nitrites added as preservatives. Other alkylating agents include mustard gas and vinyl chloride.

- Aromatic amines and amides have been associated with carcinogenesis since 1895 when German physician Ludwig Rehn observed high incidence of bladder cancer among workers in German synthetic aromatic amine dye industry. 2-Acetylaminofluorene, originally used as a pesticide but may also be found in cooked meat, may cause cancer of the bladder, liver, car, intestine, thyroid and breast.
- Alkaloid from plants, such as those from Vinca species, may be converted by metabolic processes into the active mutagen or carcinogen
- Bromine and some compounds that contain bromine in their chemical structure
- Sodium azide, an azide salt that is a common reagent in organic synthesis and a component in many car airbag systems
- Psoralen combined with ultraviolet radiation causes DNA cross-linking and hence chromosome breakage
- Benzene, an industrial solvent and precursor in the production of drugs, plastics, synthetic rubber and dyes.

Intercalating agents

- Intercalating agents such as ethidium bromide and proflavine are molecules that may insert between bases in DNA, causing frame shift mutation during replication.
- Some such as daunorubicin may block transcription and replication, making them highly toxic to proliferating cells.

Metals

- Many metals, such as arsenic, cadmium, chromium, nickel and their compounds may be mutagenic; they may however act via different mechanisms.
- Arsenic, chromium, iron, and nickel may be associated with the production of reactive oxygen species, and some of these may also alter the fidelity of DNA replication.
- Nickel may also be linked to DNA hypermethylation and histonedeacetylation, while cadmium may inhibit DNA mismatch repair.

4. Explain the positive and negative aspects of eugenics.

Eugenics deals with the application of laws of genetics for improvement of human race.
Types - positive and negative eugenics

a) **Positive eugenics** **Any 5 – 1 mark each**

It is a constructive measure which increases the rate of children of parents with most desirable characters. According to Huller individuals with desirable traits should be allowed to produce more no. of children than others. The suggested sperm bank and artificial insemination methods to increase pregnancy of such people. The following some of the positive eugenic method are:

- **Immigration**: It is one of the important factor that may affect the frequency of defective gene in a population. Then influences evolutionary changes admitting immigrants like professionals, academics, scientists etc, & excluding feeble minding idiots, epileptics, alcoholics etc. people with good characters are welcome with open encouraged and given all type of benefits so that the whole society will improve from their contribution.
- **Subsidising to the fit**: This is one of the best methods of positive eugenics. Individuals going to the assets to the society in terms of their characters to the given more privilege so that they need not struggle to obtain requirements of life. They should be encouraged to produce more no. of children to increase the desired population in children. Such individuals can contribute a lot to the society.
- **Early marriages**: Its often seen that ambitious individuals marry quite a late in their age as they would be devoting the best part of the youth in realizing their ambitious. Genetic studies of late marriages have indicate that children born out of late marriages are not genetically strong.

- **Education**: Knowledge of fundamental principles of genetics with special reference to human heredity and an appreciation of desirable attitudes and ideas undoubtedly effect action of young person in choice of their mates. It is mainly carried out in schools, temples, print media, TV etc.
- **Other methods**: It is possible to increase the desirable characters in population by gene therapy, organ transplantation by observing amniotic fluid etc.

b) Negative eugenics **Any 5 – 1 mark each**

According to the negative eugenics, the approach for improvement of human race is based on eliminating undesirable traits of the society. It includes following ways –

- ✓ **Segregation:** Sexual segregation of undesirable individuals to prevent propagation of undesirable genes. For example persons with serious hereditary diseases, criminal records and low IQ should not be permitted to marry normal intelligent people.
- ✓ **Birth control or sterilization:** This is most effective way of preventing the persons of low eugenics value from contributing to children. The sterilization procedure for female is called tubectomy, where the fallopian tubule is cut and ligated to prevent the ovum from passing to uterus. The sterilization procedure for male is called vasectomy where the ductus deferens is cut and ligated to prevent the sperm moving out of the testis.
- ✓ **Consanguineous marriages**: These are nothing but cousins marriages. These marriages lead to production of children with more defective characters. Most of the harmful threats are recessive as such they are expressed only in homozygous condition. All these recessive characters are likely to express in children of parents for related closely.
- ✓ **Education**: A knowledge of fundamental principles of genetics with special reference to human heredity and an appreciation of desirable attitudes and ideas indoubtablly effect action of young person in choice of their motto. It's mainly carried out in schools, temples, print media, TV, Radio etc and likely to express in children of parents for related closely.
- ✓ **Genetic Counselling**: It is the discussion or interview between the members in relation to their specific problem. Counsellors clarify their doubts and ill effects of hereditary diseases in their children. So that they can avoid genetic disease in their progeny. In developed countries like USA person with MD and PhD in genetics are appointed as official genetic counselling.

5. Explain:

a) Artificial insemination (AI) **Description – 5 marks**

It is a process by which the semen is collected from a desired bull by artificial manner and it is introduced into the reproductive system of desired cow. The semen is collected from desired bull usually by artificial vagina method. Semen collected is diluted by adding yolk or milk. Penicillin and streptomycin are added to reduce bacterial growth and stored in liquid nitrogen at 196^{0}C for long time. It is supplied to rural places in small vials. This is then inseminated into the uterus of desired cow with the help of catheter.

Advantages:

- Improvement of genetic features of the cattle herd by using the semen of genetically superior bulls.
- AI can be less expensive than natural device.
- The semen obtained from a single ejaculate can be used to fertilize thousands of cows.
- The semen of any breed can be introduced into the cow for conception.
- It eliminates certain cattle diseases.
- Semen collected from desired bull can be preserved for long time.
- Wastage of semen can be avoided.
- Frozen semen can be transported in vials to the distant places and used.
- Availability of semen in all the times for insemination.

b) In-vivo gene therapy **Description – 5 marks**

In vivo method of gene transfer involves the transfer of cloned genes directly into the tissues of the patient.

This is done in case of tissues whose individual cells cannot be cultured *in vitro* in sufficient numbers (like brain cells) and/or where re-implantation of the cultured cells in the patient is not efficient. Liposomes and certain viral vectors are employed for this purpose because of lack of any other mode of selection. In case of viral vectors such type of cultured cells were often used which have been infected with the recombinant retrovirus *in vitro* to produce modified viral vectors regularly.These cultured cells will be called as vector-producing cells (VPCs)). The VPCs transfer the gene to surrounding disease cells. The efficiency of gene transfer and expression determines the success of this approach, because of the lack of any way for selection and amplification of cells which take up and express the foreign gene.

6. What are stem cells? Explain the types, sources and their applications.

Definition – 01 mark, types – 03 marks, sources – 01 mark, applications – 05 marks.

Stem cells are biological unspecialized or undifferentiated cells which do not have any tissue-specific structures that allow them to perform specialized functions.

TYPES: In mammals these are of two types namely embryonic and adult stem cells.

1. **EMBRYONIC STEM CELLS** – These are derived from inner cell mass of 3-5 days old hollow blastocyst in human beings. These can be further differentiated into following types.
   - **Fetal stem cells** - Are taken from the germ-line tissues that will make up the gonads of aborted fetuses.
   - **Umbilical cord stem cells** – Umbilical cord blood contains stem cells similar to those found in bone marrow.
   - **Placenta derived stem cells** – Up to ten times as many stem cells can be harvested from a placenta as from cord blood.
   - **Totipotent** are derived from early means 1-3 days embryos. Each cell can develop into a new individual.
   - **Pluripotent** cells are derived from 5-14 days blastocyst. These cells can form over 200 any cell types.
   - **Multipotent** cells are derived from foetal and cord blood. These cells can differentiate but form a number of other tissues.
2. **ADULT STEM CELLS –** These are found in many organs and tissues. These are very few in number in each tissue. These reside in a specific area ofeach tissue and may remain non-dividing for many years until activated by tissue injury or disease.

SOURCES:

§ Embryonic stem cells can be taken from **inner cell mass** of **blastocyst**, foetal stem cells from **germ-line tissues** of **aborted fetuses**, **placental blood** or **umbilical cord** blood just after birth.

§ In human beings, adult stem cells are present in bone marrow, brain, peripheral blood, blood vessels, adipose tissue, skeletal muscles, skin and liver.

APPLICATIONS:

1. Embryonic stem cellsdifferentiate and give rise to multiple specialized cell types that make up skin, lung, heart, brain or other tissues.
2. Studies of human embryonic stem cells may yield information about the complex events that occur during human development, particularly the differentiation of different cell types.
3. Adult stem cells generate replacements for cells that are lost through wear and tear, injury or disease.
4. Adult stem cells are frequently used in medical therapies. Scientists now believe that these form the basis for treating various diseases like diabetes, Parkinson's disease, heart diseases, Alzheimer's disease, stroke, burns, osteoarthritis etc.
5. Cancer, birth defects etc occur due to abnormal cell division and differentiation. Better understanding of the molecular and genetic controls of these processes will held to establish causes of these diseases and also new strategies for therapy.

BANGALORE UNIVERSITY

I semester B.Sc., Examination, Nov / Dec 2018

Paper – I: Zoology
Non - Chordata

SCHEME OF VALUATION

Paper Setter

Dr. U. GANESH
Dept. of Zoology
M.E.S.Degree College
Bangalore

BANGALORE UNIVERSITY

I Semester B.Sc. Examination November/ December 2018

CBCS (Freshers) 2018 only

ZOOLOGY (Paper I) Non- Chordata

TIME: 3 Hours Max, Marks: 70

Instructions: 1) Draw **neat** labelled diagrams **wherever** necessary.
2) Answer should be completely in **English** or **Kannada**

PART - A

I. Answer the following (1 x 10 = 10)

1. **Define eucoelom.**
   Ans: The space between the body wall and the gut which is lined by mesoderm is called as eucoleom
2. **Where do you find triploblastic condition**
   Ans: Platyhelminthes and onwards. Either any specific example or phylum name
3. **Name the structure that regulate osmoregulation in fresh water protozoan**
   Ans: Contractile vacuole
4. **What are spicules ?**
   Ans: Skeletal or supporting structure of sponges
5. **What is free swimming ciliated larva of coelenterates called ?**
   Ans: Planula larva
6. **Name the excretory organs in platyhelminthes.**
   Ans: Flame cell or protonephridia
7. **Give the scientific name of Indian earthworm**
   Ans: *Pheretima posthuma*
8. **Define parasitism.**
   Ans: It is a relationship between two organisms in which one called parasite is benefited and other called host is harmed.
9. **Mention the causative organism of kala-Azar**
   Ans: *Leishmania donovani*
10. ***Taenia solium* is called pork tapeworm why?**
    Ans: *Taenia solium* is called pork tapeworm because the intermediate or secondary host is pig

PART - B

II . Answer any five of the following (3 x 5 = 15)

1. **Define bilateral symmetry citing a suitable example.**
   Definition – 2 marks, example – 1 mark

Ans: Bilateral symmetry is defined as, the body can be divisible into identical two halves in only one plane. Ex: Platyhelminthes to mammals except adult echinoderms.

2. **Differentiate between cellular and organ level of body organization.**
   Definition – 1 mark each, example – ½ mark each

Ans: Cellular level of body organization: In an organism only the cells exhibits the division of labour for performing specialized functions. Ex: Sponges

Organ level of organization: In this type the tissues are together to form organs and organs are join together to form organ systems to perform functions. Ex: All animals after coelenterates.

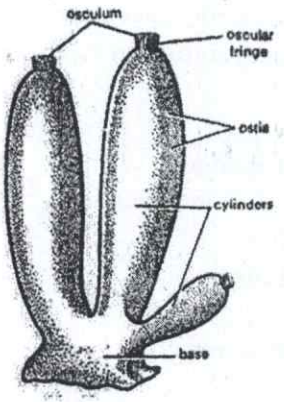
3. Give the significance of conjugation in *paramecium.*
Significance – 1 mark each

Ans: The significance of conjugation has been discussed very much but still it is uncertain. The following significance are attributed to conjugation.

a. Rejuvenation – In paramoecium continuous binary fission leads to loss of vigour and vitality and enter the senile decay. Conjugation helps in restore the lost vigour for asexual reproduction.
b. Nuclear reorganization – Continuous binary fission leads to loss of potentialities of performing metabolic activities by macronucleus. The replacement of new macronucleus brings renewed vigour and vitality to accelerate metabolic activities.
c. Hereditary variation – Exchange of nuclear material during conjugation brings variation in genetic material.

4. Sketch and labelled the externals of Sycon

Ans: Diagram - 1mark , Any four labeling - ½ mark each.



Sycon

5. Assign the following to their respective class
Class - 1 mark each

Ans: A) *Taenia* - class Cestoda B) *Dugesia* - class Turbellaria C) *Fasciola* - class Trematoda

6. Name any three larval stage of *Fasciola hepatica*
Any three stages – 1 mark each

Ans: 1) Meracidium 2) Sporocyst larva 3) Redia 4) Cercaria 5) Metacercaria

7. List the parasitic adaptation in leech
Any three adaptations - 1mark each

Ans: Habitat , Habit, Shape, Slime glands, suckers, jaws ,suctorial pharynx, hirudin, spacious crop, slow digestion, sense organs, hermaphroditism, development.

PART - C

III . Answer any five of the following **(5x 5 = 25)**

1. Define metamerism. Differentiate between pseudo metamerism and true metamerism.
Definition - 1 mark, difference - 4 marks

Ans: Metamerism or segmentation is the linear division of the body in to similar parts, each with a set of representative of all the systems – a pair of ganglia, of nephridia, of gonads,
Paired nerves and blood vessels and parts of muscular and digestive system.
Pseudometamerism - The segmentation which is superficial and begins with the cuticle and proceeds inwards to varying extent is called Pseudometamerism. This type of segment not contain all the systems.
Example :- Platyhelminthes

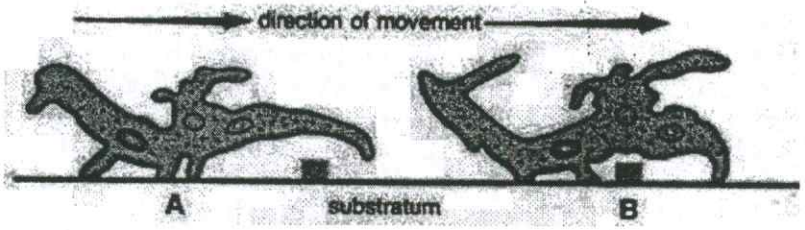
True metamerism - True segmentation is also known as mesodermal segmentation. Here the segmentation of the mesoderm is basis. It leads to the segmentation of the outer parts also. Each segmentation consist of all vital systems Example :-Annelida.

2. Explain amoeboid movement of locomotion in protozoa.

Explanation - 4 marks, Diagram - 1 mark

Ans: Amoeboid movement is characteristic of all Sarcodina, and certain mastigophora and Sporozoa. Amoeboid movement is considering as simplest type of movement, accomplished by the formation of changeable processes known as pseudopodia. Pseudopodia is formed by the streaming flow of cytoplasm in the direction of the movement. The streaming movement of endoplasm called cyclosis. It occur in very slow pace and often in an irregular direction, without proceeding long in one direction. The mechanism of amoeboid movement is not very clearly known but many theories put forward to explain the formation of pseudopodia.

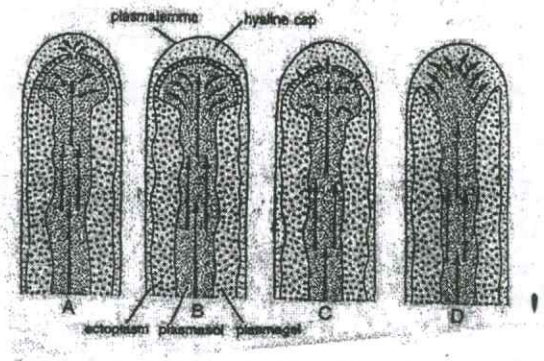
Walking movement theory: According to Dellinger (1906), the amoebae from side and it can be noted that, during locomotion, the main part of body remains lifted from the substratum and supported on tips of pseudopodia. Thus, amoebae virtually "walk on pseudopodia", just as higher animals move on their legs. He explained that amoeba extends a pseudopodium free in water and swings it about. As the pseudopodium strikes an object, it sticks to it. This causes contraction of an endoplasmic fibrous network of contractile elements, pulling the whole body mass close to the pseudopodium. Thus the animal gradually walks about on the pseudopodia formed in the direction of locomotion.



Sol-Gel theory : This theory put forward by Hymen and supported by Pantin and Mast. According to this theory, during amoeboid movement the colloidal protoplasm changes from a sol or fluid state to solid or gel state, and vice versa. According to Mast during amoeboid movement, four primary processes occur simultaneously.

- The plasmalemma attaches to the substratum.
- The plasmagel undergoes solation at the posterior end.
- The plasmasol flows forward and undergoes gelation at anterior end.
- The plasmagel at the posterior end contracts.

Thus the plasmasol continuously moves anteriorly in to the budding pseudopodium so that body gradually move forward. This movement is also known as sol-gel movement.



3. **Sketch and label**

A. Amphiblastula larva - Diagram - 1 mark, any three labeling - ½ mark each

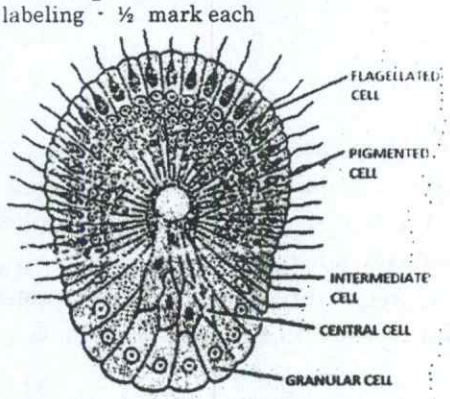
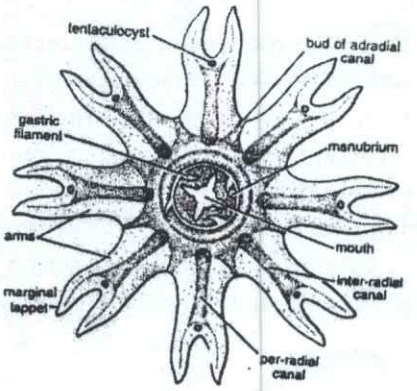


Fig. 97 AMPHIBLASTULA LARVA

B. Ephyra larva -- Diagram - 1 mark, any three labeling - ½ mark each



Ephyra larva

4. **Give an account of affinities of ctenophora.**

Any 10 affinities - ½ mark each

Ans: Ctenophora is a small phylum of marine animals and members are commonly known as Sea walnuts or comb jellies. Ctenophora shows affinities with both coelenterata and platyhelminthes.

A) Affinities with Coelenterata.

- Biradial symmetry.
- Body parts are arranged along with oral – aboral axis.
- Presence of gelatinous mesoglea.
- Tissue grade.
- Single GVC.
- Diffuse nerve network.
- Presence of statocysts
- Endodermal origin of gonads

B) Affinities with Platyhelminthes.

- Dorsoventrally flattened body.
- Crawling mode of life.
- Ciliated ectoderm.
- Presence of lobed GVC in embryo.
- Gelatinous mesenchyme with muscle fiber and cell.
- Segmentation is similar during early stage of development

5. **List any five unique characters of phylum nematode.**

Any five characters - 1mark each

Ans: Organ grade of organization

- Unsegmented body
- Presence of thin cuticle
- Syncytial epithelium
- Longitudinal muscle cord
- Absence of cilia
- Acoelomate
- Complete digestive system
- Poorly developed sense organ, It is in the form of small papillae and amphids on two body ends.
- Sexual dimorphism.

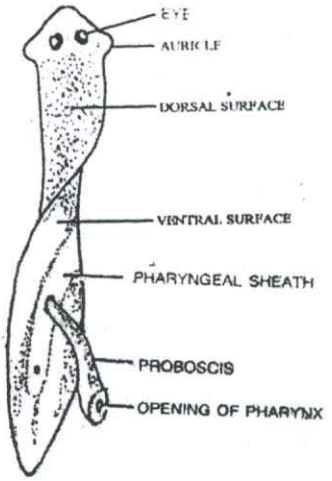
6. **Describe the externals of Planaria with neat labelled diagram**

Explanation - 3 marks, Diagram - 2 marks

Ans: Dugesia is commonly called as Planaria.

- It is freshwater form, free living, found in streams, ponds, lakes, hidden under the stones.
- Body is thin, flat and elongated, measures about 15mm in length.
- The dorsal surface of the body is slightly convex and the ventral surface is flat.

- At the anterior end of the body is the head which is triangular in shape, with lateral projections called the auricles.
- On the dorsal surface of the head, a pair of eyes are present.
- Below the head is a constriction called the neck, followed by the elongated body.
- Mouth is present on the ventral surface in the middle of the body with a protrusible pharynx.
- At the margins of the dorsal surface, there are several excretory openings called the nephridiopores.
- Anus is absent.
- Gonopore is situated below the mouth.
- They are hermaphrodites and characterized by a very high power of regeneration.



Planaria

7. **Give the occurrence , mode of transmission, disease caused and preventive measure of *Wuchereria bancrofti***

Ans: Occurrence : The adult worm lives in the lymph glands and lymph passages of man.
Mode of transmission: Infection occurs through the female mosquito (Culex or Aedes).
Disease caused: It causes a disease called Filariasis / Elephantiasis.
Prevention measures:

- Eradication of microfilariae by giving hetazon, arsenic compounds.
- Eradication of mosquitoes.
- Protection from mosquito bites.

Part-D

IV. Answer any Two of the following : **(2 X 10 = 20)**

1. **Explain :**

(a) Holozoic nutrition in protozoa

Definition – 1 mark, explanation with example – 4 marks

Ans: Majority of Protozoan's are holozoic, i.e., like animals feed on solid food. The food of Protozoa consists of microorganisms like bacteria, diatoms, rotifers, crustacean larvae, other protozoans, algae, small fragments of large animals and plants, etc. This mode of nutrition essentially involves the processes like ,ingestion, digestion, absorption and egestion of undigested residues. Ex: Amoeba, Paramecium

The different processes involved in the holozoic nutrition are:
1.Ingestion: Ingestion is the process of taking food in the body. Amoeba is a unicellular animal, so it doesn't have a mouth for ingestion of food. Amoeba ingests the food by encircling it by forming pseudopodia. When the food is completely encircled , the food is engulfed in the form of a bag called food vacuole.

2. Digestion: Digestion is the process of breaking the large and insoluble molecules in small and water soluble molecules. In amoeba, several digestive enzymes react on the food present in the food vacuoles and break it down into simple and soluble molecules.

3. Absorption: The food digested by digestive enzymes is then absorbed in the cytoplasm by the process of diffusion. While the undigested food remains in the food vacuole. If a large amount of food is absorbed by amoeba, the excess food is stored in the cytoplasm in the form of glycogen and lipids.

4. Assimilation: During this step the food absorbed by the cytoplasm is used to obtain energy, growth and repair. This process of utilizing absorbed food for obtaining energy, repair and growth is called assimilation.

5. Egestion: When a sufficient amount of undigested food gets collected in the food vacuole, it is thrown out of the body by rupturing cell membrane. The process of removal of undigested food from the body is called egestion.

(b) Syconoid type of canal system.

Description - 3 marks, diagram - 2 marks

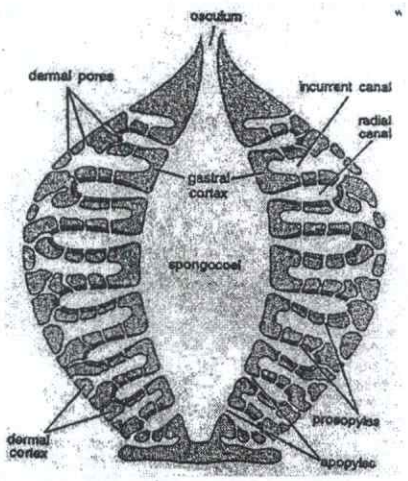
Ans: Derived from asconoid type by further folding of body wall. Body wall is very thick and folded. Mesenchyma is well developed. Ostia may lead into radial canals. The radial canals alone lined by choanocytes. The spongocoel is narrow and line by pinacocytes. Osculum is single.

There are three grades in the syconoid canal system:

a. Grade I: ostia ⟶ incurrent canals ⟶ inter ostia ⟶ spongocoel ⟶ osculum. ex. Sycetta.

b. Grade II: ostia ⟶ incurrent canals ⟶ prosopyles ⟶ radial canals ⟶ prosopyles excurrent canals ⟶ gastral Ostia ⟶ spongocoel ⟶ osculum. ex. Scypha

c. Grade III : It is complicated, dermal cortex is very thick, incurrent canals narrow and long branched and anatomies. Ex. Grantia



Syconoid canal system

2. Enumerate the general character of phylum coelenterata. Classify the phylum upto classes with an example each.

Characters - 7 marks, class - 1/2 mark, example - /2 mark

Ans: Also called Cnidarians

- Exclusively aquatic forms, mostly marine, some are freshwater forms.
- Radial or biradial symmetry, diploblastic and tissue grade of organization.
- Acoelomates
- Solitary or colonial.
- Body is made up of two layers – outer ectoderm and inner endoderm and in between is gelatinous layer – mesoglea
- Body wall of some composed of calcium carbonate. e.g. corals.
- Gastro-vascular cavity, Digestion is both intra cellular and extra cellular
- Exhibits Polymorphism – Polyp or medusa.
- Respiration and excretion is by diffusion
- Circulatory system – absent

- Nervous system – diffused network
- Presence cnidoblasts /stinging cells/ nematocytes. Which helps in capturing prey, anchorage and defence
- Reproduction is by both asexual and sexual.
- Metagenesis or alternation of generation.
- Asexual reproduction by budding and fission. Sexual reproduction is by production of gametes.
- Indirect development includes larval stage - planula larva

a. Class: Hydrozoa. Ex. Hydra
b. Class: scyphozoa. Ex . Aurelia
c. Class: Anthozoa. Ex. Fungia

3. With the help of a neat labeled diagram explain the excretory system of earthworm.
Explanation – 5 marks, diagram – 5 marks

Ans: The Excretory system of the earthworm comprises of microscopic coiled tubules called the nephridia. These nephridia are seen in all segments except the first two. The nephridia is a coiled tube, one end of which is funnel like called nephrostome, and the other end opens by the nephridiopore.

Nephridia are of three types according to their location in the body:

1. Septal nephridia
2. Integumentary nephridia
3. Pharyngeal nephridia.

1. Septal Nephridia:
These are found on the septa of 15th segments to the posterior end of the body. Each septum bears nephridia on both the surfaces arranged in semicircles around the intestine, two rows of nephridia are present in front of the septum and two behind it. Each segment possesses 80 to 100 septal nephridia except the 15th segment which has only 40 to 50 nephridia.

Structure: The septal nephridia may be considered typical of all the nephridia of Pheretima. Each septal nephridium consists of nephrostome, neck, body of nephridium and the terminal duct.

(i) Nephrostome: It is also known as ciliated funnel or nephridiostome. It is the proximal flattened funnel-shaped structure of the nephridium lying in the coelom. It has an elliptical mouth-like opening leading into an intracellular canal of the large central cell, the margins of the opening are surrounded by a large upper lip and a smaller lower lip. The lips are provided with several rows of small ciliated marginal cells and the central canal is also ciliated.

(ii) Neck: The nephrostome leads into a short and narrow ciliated canal forming the neck. It joins the nephrostome to the body of nephridium.

(iii) Body of Nephridium: The body of nephridium has two parts a short straight lobe and a long twisted loop. The loop is formed by two limbs— the proximal limb and the distal limb.

Both these limbs are twisted spirally around each other, the number of twists varies from nine to thirteen. The neck of nephridium and the terminal duct join together and remain connected with the proximal limb of the twisted loop, while the distal limb becomes the straight lobe.

Internally the nephridium is made of a connective tissue matrix having long coiled nephridial duct forming loops. There are four such canals in the straight lobe, three in the lower part and two in the upper part of the limbs of twisted loop. Two canals of the straight lobe out of the four are ciliated like the ciliated canal of the neck.

(iv) Terminal Duct: It is short and narrow with a terminal excretory duct. It joins the nephridium with septal excretory canal.

Relation of septal nephridia with intestine: The nephridia hang freely in the coelom and are attached only by their terminal ducts. They open by their terminal ducts into two septal excretory canals lying on the posterior surface of the septum, one on each side of the intestine, each begins ventrally but dorsally it opens in the supra-intestinal excretory duct of its own side.

The supra-intestinal excretory ducts are two parallel longitudinal canals lying above the gut and below the dorsal vessel These excretory ducts begin from the 15th segment and run to the last segment, they communicate with each other for a short space behind each septum, then either the right or the left duct opens by a ductule into the lumeno of the intestine near the septum.

Thus, each segment has one such opening into the intestine of either the left or the right supra-intestinal excretory duct. The waste collected by the nephridia is discharged through the excretory canals and ducts into the lumen of the intestine. Such nephridia opening into the intestine are called enteronephric nephridia.

2. Integumentary Nephridia:

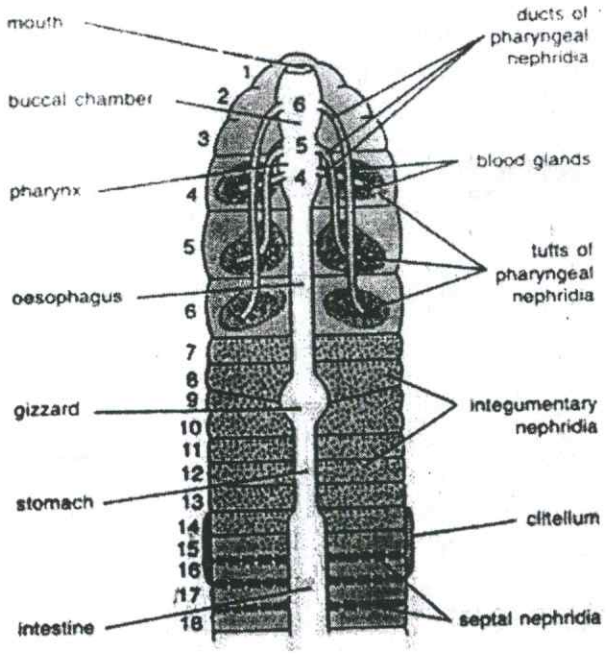
In each segment of the body from 7th to the last segment, numerous nephridia are found attached inside the lining of the body wall. These are called integumentary nephridia which are about 200-250 in each segment except the segment of the clitellar region where they number 2,000-2,500 in each segment.These nephridia are small-sized, without nephrostome and without any opening into the coelom. Hence, they are called closed type of nephridia. Each integumentary nephridium is V-shaped with a short straight lobe and a twisted loop, its lumen has two ciliated canals. Each nephridium opens by a nephridiopore on the outer surface of the body wall directly. Since the integumentary nephridia discharge the excretory wastes directly outside, hence, they are called exonephric nephridia.

3. Pharyngeal Nephridia:

These nephridia lie in three paired tufts, one on either side of the anterior region of the alimentary canal in the segments 4th, 5th and 6th. The tufts of pharyngeal nephridia also contain blood glands.

Each pharyngeal nephridium is about the size of a septal nephridium but it is of the closed type having no funnel or nephrostome. It has a short straight lobe and a spirally twisted loop, its lumen has ciliated canals. Ductules arise from each nephridium and unite to form a single thick-walled duct on each side in each segment.

The two ducts of nephridia of segment 6th open into the buccal cavity in segment 2nd and the paired ducts of nephridia of segments 4th and 5th open into the pharynx in segment 4th. These nephridia also discharge their wastes into the alimentary canal and are, therefore, enteronephric but such enteronephric nephridia which open into the anterior region of the alimentary canal (buccal cavity and pharynx) are called peptonephridia because they may have taken the function of digestive glands.



Excretory system of earthworm

4. Give an account on life history of Entameoba histolytica.

Explanation – 5 marks , diagram – 5 marks

Ans: It was first discovered by Lambi (1859). It is worldwide in distribution. It is an intestinal endoparasite of man, occurs in mucous and submucous layers of large intestine. It feeds on the tissues of the intestinal wall and often produces severe ulcers and abcesses and may spread to the liver, lungs, brain and other organs.

It releases proteolytic substance called histolysin which dissolves mucous lining of intestine. It feeds on RBC, dissolved tissues and bacteria. It causes amoebiasis or amoebic dysentery usually it lies in the gut wall.

Morphology and lifecycle:

It is a microscopic parasitic amoeba. It passes through three distinct morphological stages.

a. Trophozoite
b. Pre-cystic
c. Cystic stage

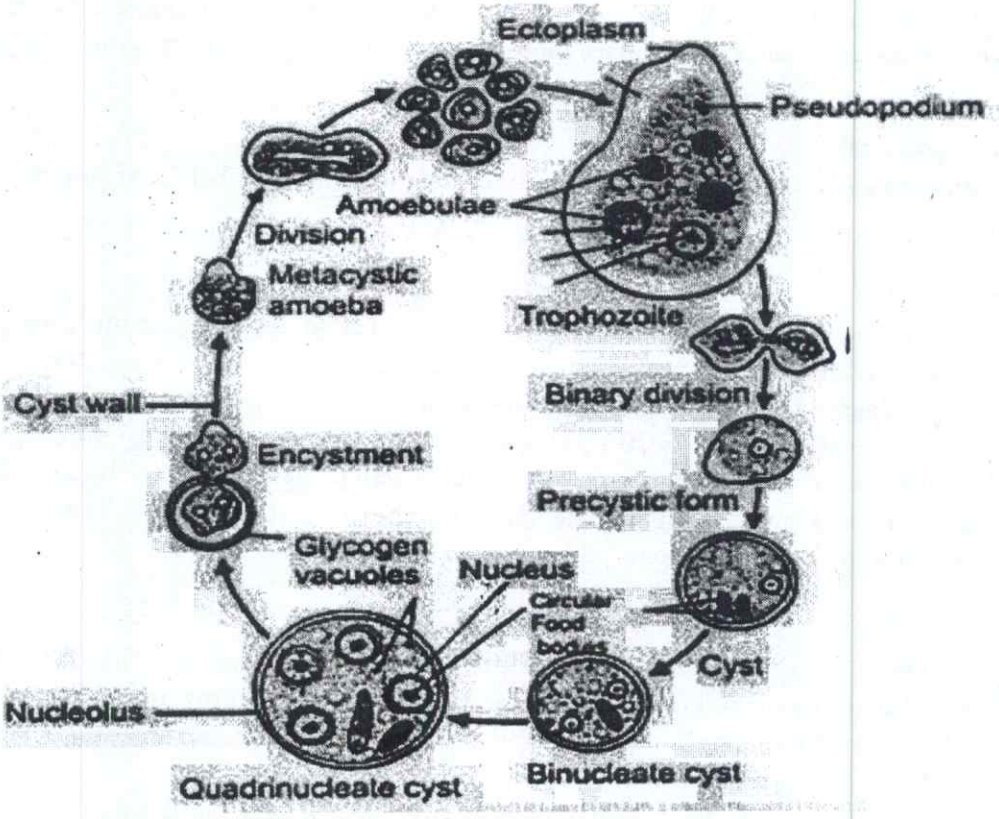
Trophozoite: It is also called trophic or magna form. It is an active, motile, growing, feeding pathogenic form. It is colourless, transparent, irregular mass measuring 20-30micron in diameter. It is covered by plasmalemma. Cytoplasm is differentiated into outer clear ectoplasm and inner endoplasm. Endoplasm consists of nucleus, food vacuoles (RBC present in Food vacuoles). It has single pseudopodium (lopodium). It reproduces asexually. No sexual reproduction. It undergoes binary fission. These trophozoites undergo encystment. They become smaller, spherical with cyst wall. They stop feeding and moving. Food vacuoles are absent. Chromatid bodies are present.

Life cycle:

- Entamoeba histolytica feeds on the tissue of the intestinal wall and multiplies rapidly by binary fission. Most of the daughter cells start feeding on the RBC and soon grow in size.
- But some of them remains small (15-20 μ) and retreat into the human intestine. These forms are small, rounded and sluggish and are known as pre-cystic forms.
- Before encystment, the parasites round up, eliminate food vacuoles and accumulates considerable amount of food materials in the form of glycogen and chromatid granules.

- Each parasite secretes a thin, rounded, resistant, colourless and transparent cyst wall round it. It varies in size from 12 – 15 μ in diameter. This cytoplasm is clear and contains black rod-like chromatid bodies with rounded ends. Reserve food materials are in the form of diffused glycogen granules. Presence of chromatid bodies is the characteristics of cyst. They occur either singly or in multiples (2 or 3). It is called uninucleate cyst.
- The nucleus divides into two in the cyst called binucleated cyst (Karyokinesis) and it divides once again to form tetranucleate cyst.
- At this stage, the cyst is infective to a new host. Encysted forms pass out with the faecal matter of the host.
- It remains viable in the environment for 3 months. If the favourable condition occurs, infection of fresh human host takes place by swallowing the infective cysts with contaminated food and drinks. Contamination of food and drinks is brought about by house flies, cockroaches and food handlers. These carry cysts from faeces to the foods. Food handlers are also responsible for the contamination of food through touching dirty fingers carrying the cysts under the nails.
- The infective cysts pass into the lower portion of the small intestine of the new host. The enzyme trypsin dissolves the cyst wall.
- Tetranucleate cyst emerges through a minute pore of the cyst wall. The process is called excystation.
- It forms into tetranucleate metacystic form and produces a new generation of trophozoites by a series of nuclear division (karyokinesis) followed by cytoplasmic division (cytokinesis), which results in the production of 8 uninucleate ameobulae. These are called metacystic trophozoites.
- The metacystic trophozoites feeds on the contents of the intestine and grow into trophozoites. They stay in the lumen for particular period. They attack the wall of intestine and life cycle starts again.

Life cycle of Entameoba histolytica



BANGALORE CENTRAL UNIVERSITY EXAMINATIONS

I SEMESTER B.Sc. EXAMINATION, DECEMBER 2018

(CBCS 2018-19 and Onwards)

ZOOLOGY

NON-CHORDATA

Time:3hours **SCHEME OF EVALUATION** Max.Marks:70

PART-A

I. Answer the following: (10 * 1=10)

1. **Define Eucoelom.**
   The organism that has fluid-filled body cavity, which is lined on both sides by mesoderm.

2. **Mention the function of Contractile vacuole.**
   Regulate water concentration inside the cell / water-balancing structures / osmoregulation.

3. **Mention any two types of cells found in Sycon.**
   a) Pinacocytes- which form pinacoderm / dermal epithelium
   b) Choanocytes- which form gastroderm / gastral epithelium

4. **What is Metagenesis?**
   The alteration between asexual and sexual reproduction form is known as Metagenesis.

5. **What are Colloblasts?**
   Colloblasts are adhesive cells found on the tentacles of Ctenophores.
   They are used to capture prey.

6. **Which type of body organisation is found in Nematodes?**
   Organ-grade of body organisation

7. **What are Setae?**
   Setae are elongated, s shaped structures made up of chitin and protein. They are locomotory organs of Oligochaeta.

8. **Name the disease caused by Entamoeba histolytica**
   It causes a disease amoebic dysentery (bloody diarrhoea). The infection is referred to as amebiasis.

9. **In humans, where does the filarial worm reside?**
   The filarial worms are present in lymph vessels and lymph nodes.

10. **Give the name of vector which transmits Leishmania.**
    Insect vector sand-flies

PART-B

II. Answer any five of the following: (5*3=15)

1. Define body symmetry. Mention any two types with examples

Definition- 1 mark+ 2 types with examples- 2 marks.

Definition- It is an imaginary axis, around which the different body parts are arranged in a definite manner so as to give definite slope and size to the animal.

Types with examples: 1) Radial symmetry, eg: Coelenterates
2) Bilateral symmetry, eg: Platyhelminths to chordates.
3) Biradial symmetry, e.g.: Ctenophora (comb jellies)
4) Asymmetrical symmetry, eg: Sponges, Protozoa (amoeba)
5) Spherical symmetry, eg: Radiolarian protozoa

2. Define conjugation. Mention its significance.

Definition: 1mark+ 2 significance: 2 marks

Conjugation is a type of sexual reproduction in which there is a temporary union of two protozoa of the same species for an exchange of nuclear material without the fusion of their cytoplasm. eg: Paramecium

Significance:

1. Conjugation serves as a process of rejuvenation i.e. it gives vigour and physiological efficiency to the organism.
2. Nuclear reorganisation brings about the vitality of the individuals
3. Hereditary variations- the fusion of pronuclei facilitates exchange of nuclear material. This brings the new combinations of heritable characters from two different individuals and better adaptability to the new conditions of life.
4. There is no distinction of sex, yet the active migratory pro-nucleus is regarded as male and the stationary pro-nucleus as the female.

3. Write the functions of: a) Archeocytes b) Scleroblasts c) Choanocytes

Each 1 mark

a) **Archeocytes:** Are amoebocytes in sponges which transport food and waste substances. They also give rise to sex cells and gemmules.
b) **Scleroblasts**: Are amoebocytes in sponges which secrete spicules
c) **Choanocytes:** Helps in feeding and maintain water current in the body by beating of their flagella

4. What is coral reef? Mention any two types with examples.

Definition 1 mark+ 2 types with examples- 2marks

Coral reefs are ridges/ mounds of limestone often of enormous size extended up in the sea to the surface of water.

Types :

1) **Fringing reef/shore reefs**, eg: They are seen around an island or forming a border around land masses that face the sea.
2) **Barrier reef,** eg: Great barrier reef on the north-east coast of Australia.
3) **Atoll reef**, eg: Aldabra in the Indian ocean
   Bikine in the Pacific Ocean
   Islands of Bermuda

5. **Mention occurrence, disease caused and mode of transmission of Fasciola hepatica .**

Each 1 mark

Occurrence: lives in the bile duct of the liver of sheep.
Disease caused: Liver rot/ Fascioliasis
Mode of transmission: The host (sheep, goat) gets infection by grazing on grass and other vegetation, where metacercaria cysts are attached. The intermediate host is snail.

6. **Give the economic importance of leech.**

1mark for each importance

Leeches are of great importance as their activities are harmful as well as beneficial to animals.

1) Leeches are used in medicine for bloodletting.
2) The salivary glands of leeches produce a kind of substance called hirudin, which is used as an anticoagulant.
3) Leeches are a popular live bait to use when angling.
4) They are used in treatment of tonsillitis and piles.
5) They are also useful to man as they destroy rodents which are harmful to agriculture.
6) They are used as a drug to cure loss/greying of hair and other symptoms of old age.

7. **Enumerate any six parasitic adaptations of flatworms.**

0.5 marks for each

1) Presence of organs of attachment i.e. suckers, scolex etc, to the host
2) A cuticle covers the body surface which provides resistance to enzymes, bile juice and alkaline medium.
3) Flat body helps in living in narrow spaces of the body of host.
4) Absence of locomotory structures.
5) The power of anaerobic respiration enables it to live in the intestine which is oxygen free.
6) Productions of enormous number of eggs and resistant covering shell/ capsule provides protection from unfavourable environmental conditions.

Part C

III. Answer any five of the following: (5x5=25)

1. **What are germ layers? Explain the types based on the number of layers with examples**

Definition: 2 marks + 2 Types with example: 3 marks

A germ layer is a primary layer of cells forming during embryogenesis, which gives rise to the tissues and organs through a process of organogenesis.

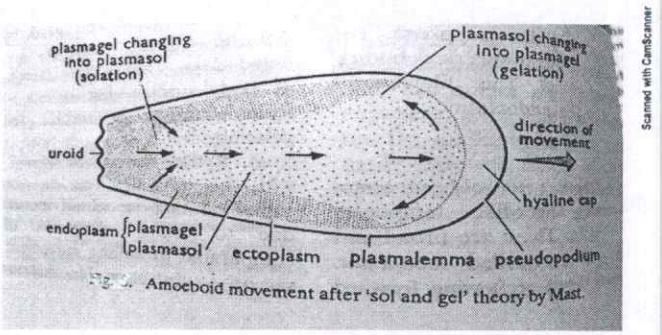
Based on the number of germ layers, there are two types i.e.,

a) **Diploblastic animals:** The body wall is made up of two layers i.e., ectoderm and endoderm
e.g.: Animals with radial symmetry – Cnidarians

b) **Triploblastic animals:** The body wall is made up of three layers i.e., ectoderm, mesoderm and endoderm
e.g.: Animals with bilateral symmetry – Platyhelminthes to Chordates

2. **Explain Sol-gel theory of locomotion in Amoeba**

Diagram: 2 marks + Description: 3 marks

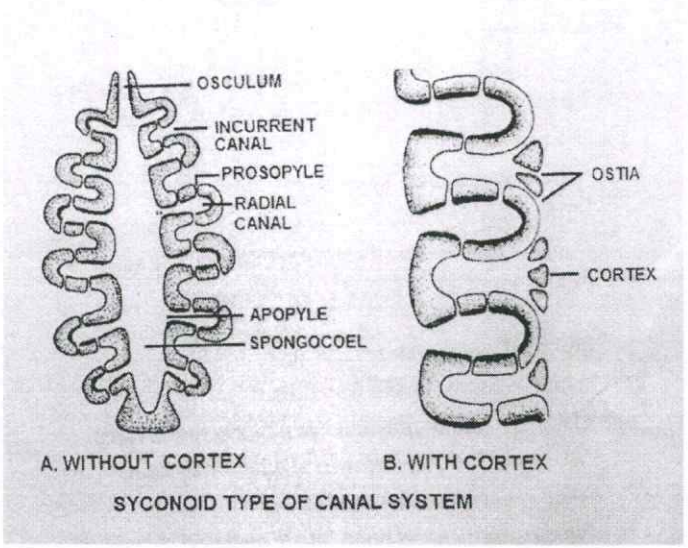


Amoeboid movement after 'sol and gel' theory by Mast.

- This theory was advocated by Hyman and later supported by Pantin. It is supposed to be the best to explain the locomotion in Amoeba.
- This theory is based on the reversible change of protoplasm from "sol" to "gel" state
- According to this theory, amoeboid movement is brought about by four processes i.e.,
    i. Attachment of amoeba to the substratum by plasmalemma
    ii. Gelation of plasmasol at the anterior end advancing pseudopodia
    iii. Solution of plasmagel at the posterior end and receding pseudopodia
    iv. Contractions of plasmagel tube at the posterior end to drive the plasmasol forwards, this results in an elongated shape of the animal and a forward extension of the anterior end to bring about locomotion

3. **Describe the Syconoid type of canal system in Sponges**

Diagram: 2 marks + Description: 3 marks



SYCONOID TYPE OF CANAL SYSTEM

There are two types of syconoid type of canal systems i.e.,

There are two types i.e., Syconoid type **without cortex** and **with cortex**

i. It is found in Sycetta. Here the spongocoel is produced into finger-like out growths called radial canals. Radial canals are lined by choanocytes. Spongocoel is lined by endopinacocytes
Flow of water is as follows:
In current canal → prosopyle → radial canal → Apopyle → spongocoel → osculum

ii. Found in Sycon. Here the epidermis and mesenchyme spreads over the outer surface forming cortex. The increment canals open to the outside by minute pores, the dermal ostia.
Flow of water is as follows:
Dermal Ostia → Incurrent canal → prosopyle → radial canal → Apopyle → spongocoel → Osculum

4. **Describe the structure of Ephyra larva**

Diagram: 2 marks + Description: 3 marks

- The Ephyra is a young medusoid form. It has eight notched lobes/arms which are pre-radial and inner radial
- Each lobe has two exaggerated marginal lappets with a deep groove between them having a short tentacle which becomes the tentaculocyst
- An Ephyra larva bears a short stomach/gastric cavity with a short manubrium and four-sided mouth on its sub-umbrellar surface
- The gastric cavity grows into the lobes to form branched pre-radial and inter-radial canals

- Four pairs of gastric filaments form in the inter-radial
- The Ephyra metamorphoses into Aurelia

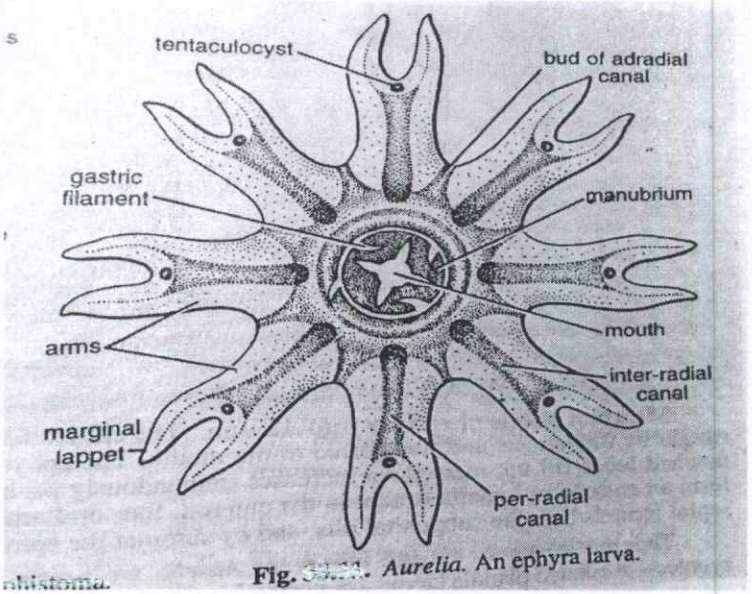


Fig. [illegible]. *Aurelia.* An ephyra larva.

5.

a) Enumerate any five general characters of Phylum Platyhelminthes

0·5 mark for each character

- They are free-living, commensal or parasitic forms
- Tissue-organ grade of body organization i.e., body cells aggregate into definite tissues and tissues make up organs
- Triploblastic, Bilateral symmetrical, Acoelomate animals
- Body is unsegmented, dorsoventrally flattened
- Digestive system branched and incomplete without anus
- Circulatory, respiratory systems are absent
- Excretory system includes protonephridia (flame cells)
- Nervous system ladder-like, a pair of ganglia with longitudinal nerve cords connected by transverse nerves
- Mostly monoecious, Fertilization internal, Development is direct OR indirect with a complicated life cycle involving many larvae and hosts

b) Explain food and feeding mechanism in Pheretima.

Food: 1 mark + Mechanism: 1·5 marks

- The food of the earthworm is organic matter/humus, such as decaying leaves, dead animals and some worms found in the soil. It also feeds on grasses, seeds and algae

Mechanism:

- They ingest food by sucking action of the pharynx
- From mouth, food passes into the buccal cavity and from there into the pharynx, where it mixes with digestive juice secreted by the salivary glands
- The passage of food into the alimentary canal is affected by peristaltic movements
- From the pharynx, food passes into the oesophagus. The food is then ground in the gizzard by the movement of the muscular walls and digested completely in the intestine

6. Write a note on the Vermicompost.

Definition: 2 marks + Applications: 3 marks

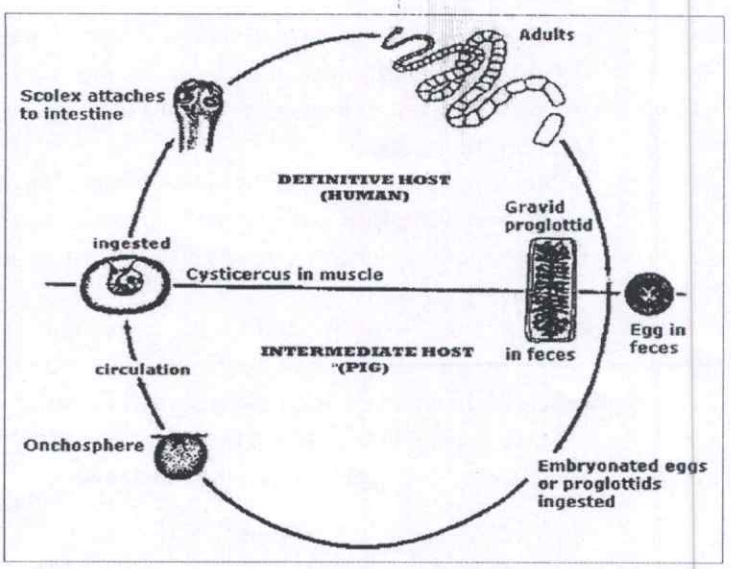
- Vermiculture is a process of breeding and rearing earthworks in controlled conditions. The culturing of worms is the part of production of vermicompost
- Using proper species of earthworms, excellent quality of compost can be produced in a short period of time. In India perionyx excavatus earthworms are used for vermicomposting
- Vermicompost is a physically, chemically and biologically degraded organic material produced by earthworms which consists mainly of digested soil and organic matter
- It is rich in all major microconstituents, such as nitrogen, phosphorous, magnesium, zinc, calcium, etc., The percentage of N:P:K is more in vermi compost

i. It restores microbial population.
ii. Improves soil aeration, soil texture and water holding capacity in the soil
iii. Enriches soil with microorganisms, adding enzymes e.g., phosphatase, cellulase
iv. Enhances germination, plant growth and crop yield
v. Vermicompost is also applied for treatment of sewage sludge. A variation of the process is vermifiltration, which is to remove organic matter, pathogens and oxygen demand from waste water

7. Give an account of life cycle of Taenia solium.

Diagram-2marks + description-3marks

Egg ➡ Onchosphere/ Hexacanth embryo ➡ Cysticercus or bladder worm ➡ Adult worm.



- The gravid proglottid becomes detached with eggs and passes out of the host along with the faeces.
- Further development depends on the eggs being ingested by a pig, which serve as the intermediate host. (eggs develop in the pig)
- The embryo in the egg consists of a ball of cells with six minute hooks called Onchosphere/ Hexacanth embryo.
- If a pig chances to pick up the eggs, the shell is dissolved in the stomach and the larvae are set free. With the help of hooks, the larva bores through the intestinal wall and enters into a blood vessel, then to the muscles.
- In the muscle, they produce a large ovoid bladder known as the bladder worm or **Cysticerus.** Cyst develops around it.
- The Cysticerus enters the man (final host) along the improperly cooked pork. In the intestine, the cyst is dissolved by digestive juices. In the small intestine they turn inside out.
- So, the suckers and hooks come to lie outside, and attached to the intestinal wall and develops in to adult tapeworm.

PART D

IV. Answer any TWO of the following **(2*10=20)**

1. **Enumerate the general characters of phylum protozoa. Classify up to class with an example each.** **Characters 6 marks + classification with example 4marks**

- Microscopic, unicellular with protoplasmic grade of organisation.
- They are mostly aquatic, found in fresh, sea waters and damp places.
- Body is naked or covered by pellicle and some are provided with exoskeletons or shells.
- Body symmetry is bilateral, radial or spherical or none.
- Locomotory organelles are finger-like pseudopodia or whip-like flagella or hair like cilia or absent.

- Nutrition is holozoic, holophytic, saprozoic or parasitic. Digestion occurs intracellularly inside food vacuoles.
- Respiration through general surface or through contractile vacuoles which serve mainly for osmoregulation.
- Reproduction asexual by binary or multiple fission and budding. Sexual by conjugation of adults (hologamy) or by fusion of gametes (syngamy)
- Life history often complicated with alternation of asexual and sexual phases.
- Encystment commonly occurs to help in dispersal as well as to resist unfavourable conditions of food, temperature and moisture.

Classification:

The phylum protozoa are divided into two sub-phyla

- **Subphylum A: Plasmodroma** –
- locomotory organelles are flagella, pseudopodia or none.
- One type of nuclei.

It has the following classes:

Class1: Mastigophore – locomotion by one to many flagella. E.g. Euglena

Class2: Sarcodina – locomotion is by pseudopodia. E.g. Amoeba

Class3: Sporozoa - no locomotory organs. All parasitic spore formation is common. E.g. Plasmodium

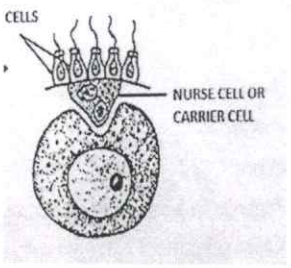
Subphylum B: Ciliophora

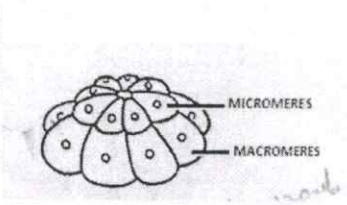
- Cilia are locomotory organelles.
- Two types of nuclei.

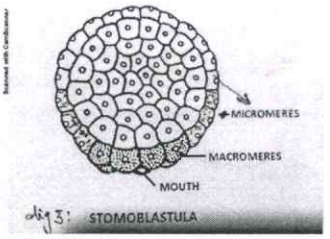
It has the following class:

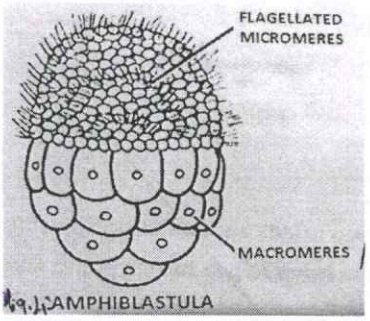
Class 4: Ciliata- locomotion is by hair like cilia. E.g. Paramecium.

2. a) Explain sexual reproduction in Sycon. **Diagram-2 marks + Description-3 marks**









- Sycon is a bisexual protogynous sponge. Cross fertilisation occurs. Development is indirect with Amphiblastula larva.
- In sexual reproduction the following important events occurs:

1. **Gametogenesis and fertilisation:** the gametes developed from amoebocytes called Archaeocytes. Sometimes sperms are derived from choanocytes. Fertilisation is internal and cross. The sperm comes in contact of collar cells lying adjacent to egg and it captures the sperm. The collar cell loses its collar and flagellum and become carrier cell or nurse cell. The ovum receive carrier cell and it fuses results in a zygote.
2. **Embrogeny:** Zygote undergoes holoblastic cleavage results in formation of micro and macromeres. The micromere acquires flagella on their inner surface. Macromeres become rounded and granular. Then embryo develops blastocoel to become stomoblastula
3. **Stomoblastulla:** It is a multicellular embryo made up of flagellated micromeres and large rounded macromeres. It encloses blastocoel and it has opening mouth in the centre of macromeres. It develops into amphiblastulla.
4. **Amphiblastulla**: It is a free-swimming larva. One half of the embryo is flagellated micromeres and the other half non-flagellated granular cells. This larva passes out of the sponge through osculum and swims freely for a few hours. Then it undergoes gastrulation and develops into didermic gastrula with an opening blastopore
5. **Metamorphosis:** gastrula stage of embryo fixes to the substratum and develops into a cylinder. Free end develops an osculum. Ostia are formed on the body. The flagellated cells give rise to choanocytes, archaeocytes and amoebocytes. Non-flagellated cells give rise to dermal epithelium. Mesenchyme develops. The young sponge now called **Olynthus,** which develops into adult sycon by developing radial canals.

b) Describe the nervous system of planaria with a neat labelled diagram.

Diagram- 2marks + Description 3marks

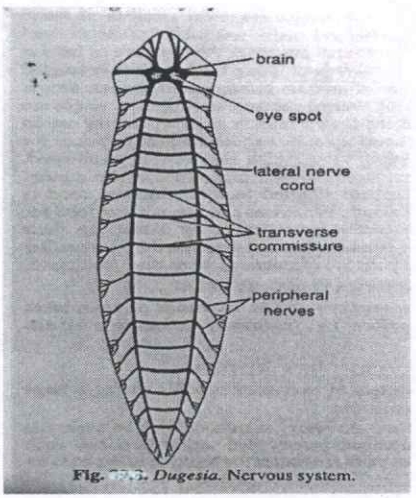
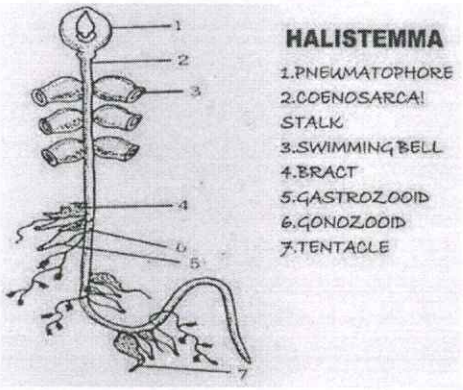


Fig. 19.3. *Dugesia.* Nervous system.

The nervous system of planaria is the primitive type called the ladder type. It consists of brain; nerve cords constitute central nervous system and peripheral nerves originating from CNS.

1. **Brain:** It is made up of bilobed cerebral ganglion.
2. **Nerve cords:** From the brain rise two lateral longitudinal nerve cords, which extends to the posterior end along the ventral side of the body.
3. **Peripheral nerves:** From each lobe of brain arise numerous peripheral nerves which supply the various sense organs.
   From nerve cord arises numerous branched nerves on both the sides along its length. Towards the inner side they form transverse commissures or connectives.

3. What is polymorphism? Describe the phenomenon with reference to Halistemma.
Definition-1marks + Diagram-2marks + Description-6marks



Def: When a single organism or species is represented by more than one kind of individual or zooid, which differ in form of functions is said to be polymorphic and the phenomenon is termed polymorphism.

- Halistemma is a marine, pelagic colonial Coelenterata of class Hydrozoa, which exhibit high degree of polymorphism.
- It consists of more than five types of zooids, which are specialised for different functions i.e. some capture prey, some are defensive, some propel the colony through water, other develop sexual products and so on.
- It has a float/ pneumatophore at the top which is bladder like zooid helps in buoys and a trailing stem called coenosarc, which bears a number of zooids of different types. They are
  1. **Nectocalyces**- They resemble medusae in having, a velum, a canal system. The manubrium, tentacles and sense organs are absent. They propel the colony in water there by help in locomotion.
  2. **Hydrophyllium / bract-** flat, leaf-like and they cover the underlying zooids and protects them.
  3. **Gonozooids-** These are reproductive zooids of the colony. They bear clusters of gonophores, which are dioecious, without much and serving the reproductive function.
  4. **Dactylozooids-** These are also called taster, looking like a mouthless manubrium with mouth, having nutritive function in ingesting the prey.
     At its base, there is a tentacle with branches bearing numerous batteries of nematocysts, serving to paralyze the prey.

- The colony is divided into two parts.
  The upper part bearing the float and the bells is distinguished as the Nectosome.
  The lower part with zooids is called Siphonosome . In the Siphonosome, the members are grouped together in gathering of things termed Cormidia .

4) Write notes on

a) Septal nephridium of pheretima

Diagram-2marks+Description-3marks

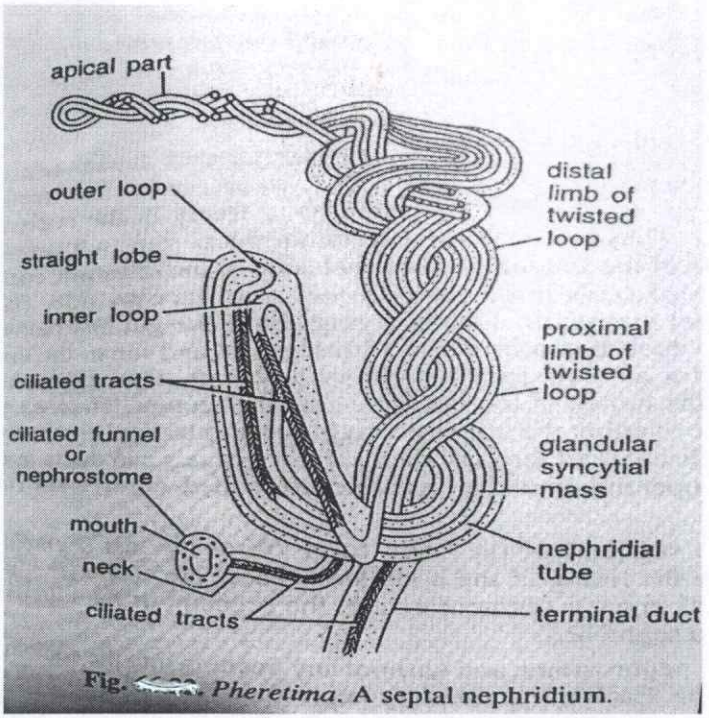


Fig. *Pheretima*. A septal nephridium.

- These are the largest nephridia of pheretima, found situated on the intersegmental septum behind 15th segment.
- A typical septal nephridium consists of Nephrostome, neck, body and terminal duct
- **Nephrostome:** It is a ciliated funnel (nephridiostome) communicating with the coelom. It has a mouth-like opening surrounded by lips which are surrounded by several rows of ciliated marginal cells.
- **Body:** Nephrostome leads into the main body of nephridium through a narrow, ciliated tube-like neck. The body consists of 2 parts, a short straight lobe and a long twisted lobe with a narrow apical part. The twisted lobe consists of a proximal limb and a distal limb.
- **Terminal duct:** The distal limb of the nephridium ends in a short, narrow duct called terminal duct, which joins with the excretory canal.

b) Miracidium larva:

Diagram-2marks + Description-3marks

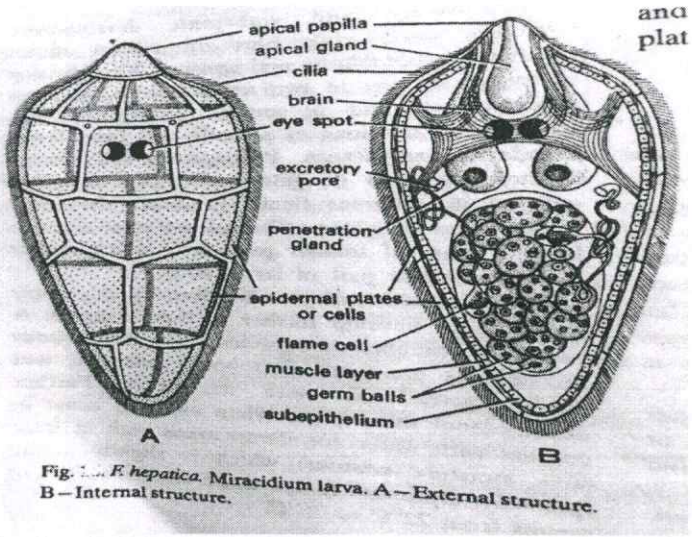


Fig. ... *F. hepatica.* Miracidium larva. A – External structure. B – Internal structure.

- It is the first larval stage in the life cycle of Fasciola hepatica. It is a minute, free swimming, oval and elongated structure covered with flat ciliated epidermal cells/ plates.
- Anteriorly it has a conical apical papilla, opening into it is an apical gland.
- On either side of the apical gland is a bag like penetration gland. At the base of the apical papilla there is brain, which is X-shaped and over which a pair of eyes are situated.
- There is a pair of flame cells/ protonephridia, which are excretory organs and their ducts open to the outside laterally in the posterior of the body.
- Some germ cells are present towards posterior.
- After getting a suitable host the larva enters the pulmonary sac of the Snail, then enters the digestive gland where it forms a Sporocyst.

BANGALORE UNIVERSITY, VI Semester B.Sc Examination, May/June 2018
CBCS (Fresh+Repeaters) (2016-17 and onwards)
ZOOLOGY - VIII, Animal Physiology and Techniques in Biology
SCHEME OF VALUATION

Max.Marks: 70

PART-A

Answer any **FIVE** of the following: **(5x3=15)**

1. **Haldane effect** a property of Hb, described by John Scott **Haldane**. Oxygenation of blood in the lungs displaces CO_2 from Hb, increases the removal of CO_2. Oxygenated blood has a reduced affinity for CO_2 & deoxygenated Hb has increased capacity to bind & carry CO_2.

2. **Ureotelism**- urea is the main nitrogenous waste material. Animals showing **ureotelism** are called ureotelic animals. Egs. Elasmobranchs, Latimeria, Amphibians, Mammals. Urea H_2O Eg. 1+1+1

3. An **electrical synapse** is a mechanical and electrically conductive link between two neighboring neurons formed at a narrow gap between the pre- and postsynaptic neurons known as a gap junction allows passage of ions, no neurotransmitters, fast transmission without synaptic delay, simultaneous stimulation for coordinated contraction.

4. **Thyroxine functions:** Regulates basal metabolic rate, digestion, oxygen intake, cellular metabolism (protein synthesis, lipid metabolism), heart and muscle function, growth and development, brain development and maintenance of bones. 3x1

5. **Causes of obesity:** Genetics, Family, lifestyle, overeating, physical inactivity, metabolism, behaviour, culture, Unhealthy diet, Medical problems, certain medication, age. 6x0.5

6. **Significance of fixative:** preservation of biological tissues from decay, terminates biochemical reactions, increase the treated tissues' mechanical strength or stability, for preparation of thin, stained sections. rapid penetration, ability to change the soluble cell contents to insoluble substances so that they will remain in their original position. Protect tissues against shrinkage and distortion during subsequent treatment. Changing the refractive index of the cell/organelles so that they can be seen in the light microscope. 3x1

7. **Gel electrophoresis applications**: to separate DNA, RNA and proteins for DNA Analysis, Protein and Antibody Interactions, Testing Antibiotics, Determination of sequence. DNA fragments are separated according to their size and Proteins based to their size and their charge. DNA can be separated by electrophoresis to: Visualize bands of a molecular marker to genotype. Verify amplification by PCR or sequencing reactions, Check the quality and quantity of genomic DNA after DNA extraction, Separate DNA fragments to clone a specific band 3x1

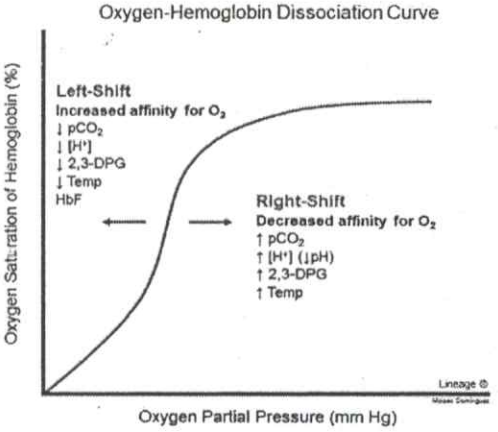
PART-B

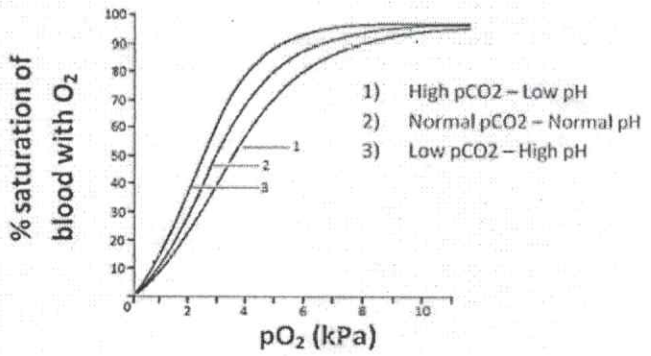
Answer any **FIVE** of the following **(5x5=25)**

1. **Gastrin** in the stomach, stimulates gastric glands to secrete pepsinogen & HCL. **Cholecystokinin** in duodenum stimulates release of digestive enzymes in pancreas & emptying of bile in gallbladder. **Secretin** in small intestine stimulates duodenual, pancreatic & biliary tract secretions. **Motilin & Bombesin, Vasoactive intestinal** 5x1

polypeptide (ion & H_2O secret^n), **Gastric Inhibitory peptide, Enterogastrone** (stops gastric secret^n).

2. **Oxygen dissociation curve** : to understand transport and release of O_2. It relates to O_2 saturation and partial pressure of O_2 in the blood, and is determined by "Hb affinity for O_2"; -how readily Hb acquires and releases O_2 molecules. Effect of CO_2: H_2CO_3 H^+, HCO_3^-, ODC shift to right, O_2 released. 2½+2½





3. **Physiology of vision:** Photoreceptor cells- Rods and Cones in Retina, have photosensitive pigments; Rhodopsin is present in rods. Scotopsin and 11-cis-retinal compose it. Iodopsin is photochemical pigment of cones. Photopsin and 11-cis-retinal compose it. Opsin pigments contain a cofactor **retinal**. related to vitamin A. When a photon hits retinal: a *cis* (11-*cis*-retinal) to a *trans* (all-*trans*-retinal) conformation - **photoisomerization**. Activation of retinal and the opsin proteins result in activation of a G protein, releases less neurotransmitter into the outer synaptic layer of the retina. Until the retinal molecule is changed back to the 11-*cis*-retinal shape, the opsin cannot respond to light energy, which is called bleaching. The photoisomerization is reversed by a series of enzymatic changes so that the retinal responds to more light energy. The absorbance of rhodopsin in the rods is much more sensitive than in the cone opsins; specifically, rods are sensitive to vision in low light conditions, and cones are sensitive to brighter conditions. In normal sunlight, rhodopsin will be constantly bleached while the cones are active. In a darkened room, there is not enough light to activate cone opsins, and vision is entirely dependent on rods. Rods are so sensitive to light that a single photon can result in an action potential from a rod's corresponding retinal ganglion cell. 1 1 1

Rhodopsin cycle: rhodopsin under the influence of light converts to prelumirhodopsin – lumirhodopsin – metaphodopsin I - metaphodopsin II – opsin – rhodopsin. Metarhodopsin II converts also to all-transretinal (vitamin A) – II cis-retinal – rhodopsin. If a person remains in bright light for a long time, photochemicals in rods and cones reduce to all-transretinal and opsins. Most all-transretinal converts to all-transretinol (vitamin A). So, sensitivity of eye to light gets decreased. This is light adaptation. If a person remains in dark for a long time, all vitamin A convert to 11-cis retinal and then to photochemicals. Sensitivity of eye to light gets increased. This is dark adaptation. 1 1

4. **Hormonal Control of metamorphosis in insects:** The molting process is initiated in the brain, where **neurosecretory cells** release **prothoracicotropic hormone** (PTTH) in response to neural, hormonal, or environmental factors. PTTH stimulates the production of **ecdysone** by the **prothoracic glands**.

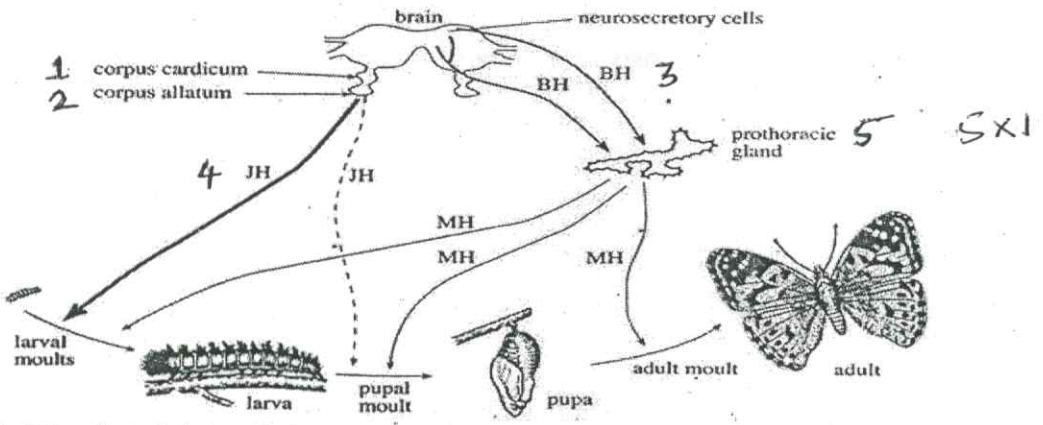


Fig. 2.96 : Classical scheme of the hormonal control of moulting and metamorphosis in a holometabolous insect. BH = Brain hormone, JH = Juvenile hormone, MH = Moulting hormone.

5. Osmoregulation in Salmon : Marine water: dehydrating effects - drinks several liters/day, takes in a lot of NaCl, salt-loading problem. kidneys' urine production rates drop and the urine is concentrated. Na^+-Cl^- ATPase molecules 'pump' Na^+ and Cl^- out into the salt water flowing over the gills, Cl secreting cells in gills excrete Cl, Mg and SO_4 absorbed in intestine is excreted with feces. 2½

Fresh water- salmon doesn't drink at all. The only water it consumes is when it feeds, kidneys produce large volumes of dilute urine to remove excess water, the Na^+-Cl^- ATPase molecules 'pump' Na^+ and Cl^- *out* of the water flowing over the gills and *into* the salmon's blood. Salts lost by urine are recovered by chloride absorbing cells. 2½

6. Electron Microscopy: uses a beam of **electrons** to create an image of the specimen. Capable of higher magnifications and has a greater resolving power to see much smaller objects in finer detail. Working **Principle**: An **electron microscope uses** an '**electron** beam' to produce the image of the object and magnification is obtained by 'electromagnetic fields'; TEM and SEM

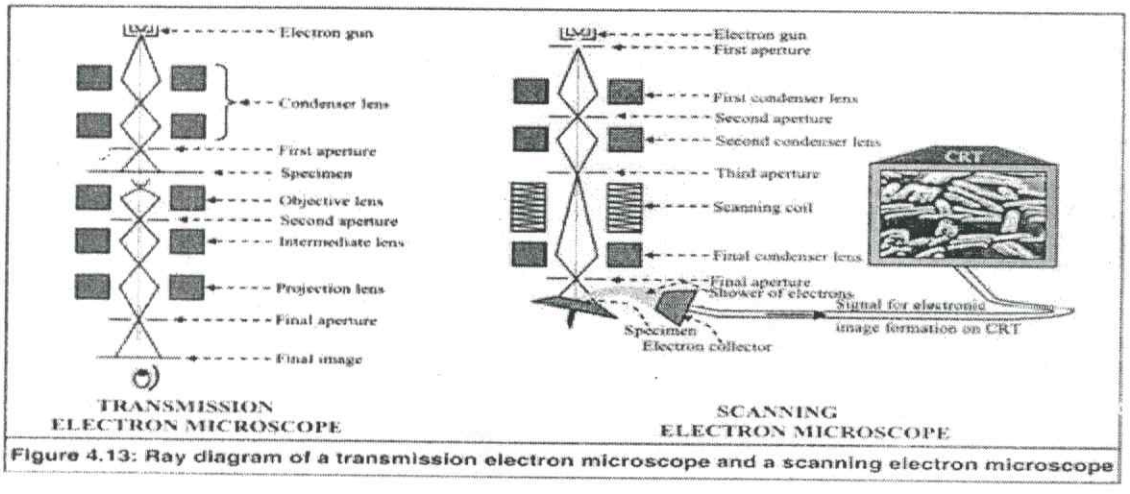


Figure 4.13: Ray diagram of a transmission electron microscope and a scanning electron microscope

7. Principle: Autoradiography is the bio-analytical technique used to visualize the distribution of radioactive labelled substance with radioisotope in a biological sample." 2½

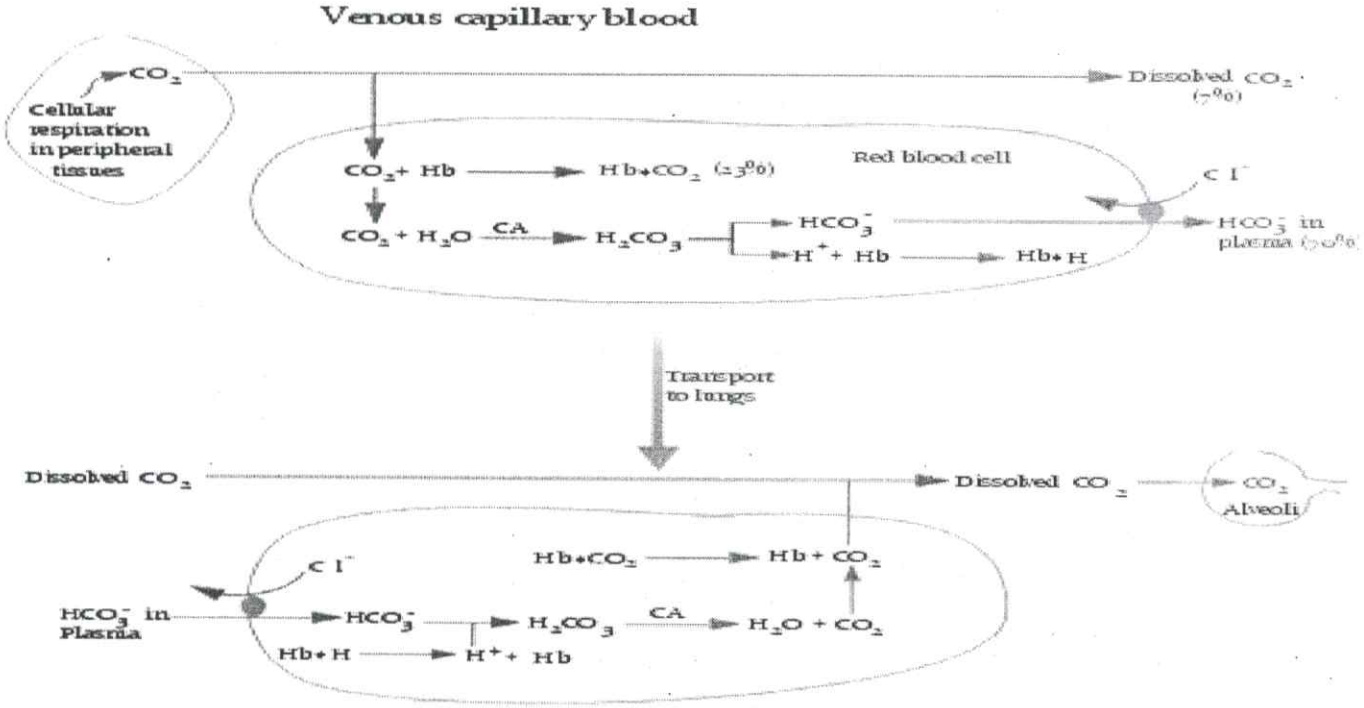
Applications: In biology, this technique may be used to determine the tissue (or cell) localization of a radioactive substance, introduced into a metabolic pathway, bound to a receptor or enzyme, or hybridized to a nucleic acid. It is used extensively to study the binding 2½

of a variety of small molecules such as peptides, drugs and hormones to a variety of target sites in cells and tissues. The number of conserved subunits in chromosomes was demonstrated using autoradiography. Many important observations have been made on macromolecular metabolism, synthesis and secretion using these techniques. The method has also been successfully applied to the study of virus particles and nucleic acids.

PART-C

Answer ant **THREE** of the following **(3x10=30)**

1. Carbon dioxide is **transported** in the **blood** from the tissue to the lungs in three ways: (i) dissolved in solution; (ii) buffered with water as carbonic acid; (iii) bound to proteins, particularly haemoglobin. Approximately 75% of **carbon dioxide** is **transport** in the red **blood** cell and 25% in the plasma.



Carbon dioxide transport in blood

2. Sliding filament theory 6+4

The **sliding filament theory** - muscles contract to produce force. the actin and myosin **filaments** within the sarcomeres of muscle fibres bind to create cross-bridges and slide past one another, creating a contraction.Each myosin cross bridge must attach and reattach many times during a single contraction - crossbridge cycling

Power Stroke - Attachment of the myosin cross bridge to actin requires energy: Breakdown of ATP into ADP and P provides the energy required for pulling on the actin myofilament ; ATP-ase catalyzes the breakdown of ATP

Rigor – low-energy, strong bond between myosin and actin

ADP and P are released from the myosin head thus breaking the bond between the myosin crossbridge and actin - Now the muscle is in a state of relaxation
Cocking - Upon completion of the pulling mechanism, another ATP attaches to the myosin crossbridge Preparation for another crossbridge cycle

3. a) **Neurotransmitters** - chemical messenger which transmits signals across a chemical synapse, from one neuron to another neuron, muscle cell, or gland cell. Neurotransmitters are released from synaptic vesicles in synapses into the synaptic cleft, and received by neurotransmitter receptors on the target cells. 200 chemical messengers have been identified. Acetyl Choline, Amino acids: glutamate, aspartate, D-serine, γ-aminobutyric acid (GABA), glycine; Gasotransmitters: nitric oxide, carbon monoxide, hydrogen sulphide Monoamines: dopamine, norepinephrine, epinephrine, histamine, serotonin. 5
b) Heat loss in homeotherms: Radiation, Evaporation, Convection, Conduction, Sweating, 5

4. Positive feedback mechanism: the output enhances the original stimulus. Examples: child birth. During labor, a hormone called oxytocin is released that intensifies and speeds up contractions, positive feedback accelerates the clotting process until a blood clot forms and stops the bleeding. 2+6 2+4+4

5. The anterior pituitary gland secretes six **hormones**. 5x2

Adrenocorticotropic hormone - adrenal glands to secrete steroid hormones [cortisol]
Growth hormone: regulates growth, metabolism and body composition
Luteinising hormone & follicle stimulating hormone: ovaries/testes- sex hormone production & maturity of gametes
Prolactin: stimulates milk production
Thyroid stimulating hormone: stimulates the thyroid gland to secrete thyroid hormones.

6. a) Diabetes mellitus: disorder of carbohydrate metabolism, impaired ability of the body to produce or respond to insulin and thereby maintain proper levels of glucose in the blood. **Insulin,** hormone that regulates the level of glucose in the blood and that is produced by the beta cells of the islets of Langerhans in the pancreas. Insulin is secreted when the level of blood glucose rises—as after a meal. When the level of blood glucose falls; secretion of insulin stops, the liver releases glucose into the blood. 5

b) Immunoassay is a technique which incorporates the binding reaction of a target substance (antigen) with an antibody. Antibodies are basically immunoglobins that bind to different natural and synthetic antigens in the body such as carbohydrates, lipids, proteins and nucleic acids. Tests used to detect or quantify a specific substance, the **analyte**, in a **blood** or body fluid sample, using an immunological reaction. Immunoassays are highly **sensitive** and specific. Their high specificity results from the use of **antibodies** and **purified** antigens as reagents. 5

BANGALORE UNIVERSITY

V Semester B.Sc. Examination, Nov./Dec.2018

(CBCS) (Freshers and Repeaters) (2016-17 and onwards)

ZOOLOGY Paper – V

Environmental Biology and Ethology

SCHEME OF EVALUATION

Time: 3 Hours **Max. Marks: 70**

PART-A

III. Answer any five of the following: (5 X 3=15)

1. What is autecology? Give an example. **(Definition= 2 marks; any example =1 mark)**

Autecology is the subdivision of ecology which deals with the ecological study of an individual organism or particular species of organism in relation to its environment with respect to its life history, behaviour, population dynamics, adaptation etc. thereby concentrating on the finer details of a particular organism in its environment. For example, autecological study of Indian Pea fowl Pavo cristatus in Kuduremuch or study of a human being in relation to its environment.

2. Write a note on net primary productivity. **(Explanation= 3 marks)**

Net primary productivity (NPP) is the total rate of photosynthesis excluding organic matter used up during respiration. It is also called net assimilation.
NPP=GPP-R where, GPP is the gross primary productivity and R is energy used in respiration.

3 Briefly explain antibiosis with a suitable example. **(Explanation = 2 marks; any example =1 mark)**

Antibiosis is a negative inter -specific interaction between two species, A and B, where species 'A' produces a harmful chemical substance or change the environmental conditions so that species 'B' cannot survive. The term "antibiosis" also refers to the complete or partial inhibition or death of one organism by another.

There is a production of some chemical substance or environmental conditions as a result of metabolic pathway. None of them derives any benefit. This phenomenon is well known among microbial world. For example: 1. Production of **antibiotics such as** penicillin, streptomycin etc., produced by bacteria or fungi are used in medicine to fight against infections caused by growth of other microorganism. 2. Leaves of bushy plant Halogeton glomeratus produces oxalic acid which is toxic to goats that eat them.

4. Define pesticides. Give two examples. **(Definition = 2 marks; any two examples =1 mark)**

Pesticides are chemical substances/ compounds intended for preventing, destroying, repelling or mitigating any pest. It can be any chemical or biological agent that through its effect kills or discourages target pests such as insects, rodents, fungi and unwanted plants (weeds). Pesticides are used in public health to kill vectors of disease, such as mosquitoes, and in agriculture, to kill pests that damage crops. Pesticides can be grouped according to the types of pests which they kill. For example, Insecticides – insects; Herbicides - plants. Rodenticides - rodents (rats and mice); Bactericides – bacteria; Fungicides – fungi; Larvicides - larvae.

5 Give a brief account of land filling. **(General information =3 mark)**

A landfilling is an engineered/improved form of open dumping. It is the method of disposing of refuse, solid and hazardous waste on land without causing any nuisance to public health. Landfills for individual waste constituents such as combustion ash, asbestos and other similar wastes are known as monofills. But garbage in a landfill does decompose, albeit slowly and in a sealed, oxygen-free environment.
Three of the most common types of landfills are:

- Municipal Solid Waste Landfills.
- Industrial Waste Landfills.
- Hazardous Waste Landfills.

6. What are instincts? Give an example. **(Definition = 2 marks; any example =1 mark)**

Instincts are complex stereotyped behavior patterns which are innate, inherited, un learnt and adaptive. Typically remains unaltered by experience, appears in response to a restricted range of stimuli and without prior opportunity for practice. This is a genetically programmed behavior characteristic of the species.
Examples:

1. The orb spider **building** the web.
2. Gull chicks instinctively peck at **the red dot** on the parent's lower bill, a behavior that induces the parent to regurgitate food into the chick's mouth.
3. Reproductive behaviour of male 3 spined stickle back is made up of migratory, territorial, fighting, nesting and mating instinctive acts.
4. Nest building in birds.

7. Mention three diagnostic features of biological clocks. **(Any three features 3 marks)**

1. Biological clock / circadian rhythm must persist in laboratory under conditions of continuous light/ total darkness and under constant temperature.
2. It must be able to express itself in constant light-dark conditions as free running rhythm, showing periods close to but not equal to 24 hours.
3. Its free running period must be able to compensate for changes in the surrounding temperatures.
4. It is known to be entrained by light -dark and temperature cycles.
5. It must be able to shift and reset its phase in response to a change in light and dark conditions, and to temperature or chemical disturbances.
6. Circadian rhythms can influence sleep-wake cycles, hormone release, eating habits and digestion, body temperature, and other important bodily functions. **Biological clocks** that run fast or slow can result in disrupted or abnormal circadian rhythms. It may change with the change of place and may also change with age.

PART-B

II Answer <u>any five</u> of the following: (5X5=25)

1. Discuss soil as an abiotic factor. **(Formation & composition-2 marks & profile 3 marks)**

Soil is a complex system of living and nonliving matter consisting of organic and non-living substances. It is the shallow upper layer of the land surface of the earth which by weathering of underlying rocks, intimate association of organic matter and with living organisms has become suitable place for plants and animals. Thus, soil is a very significant ecological/ abiotic

factor as it provides a suitable medium for plants and animals to live and thrive in. Soil provides anchorage for plant roots, a habitat for soil microorganisms, sites for burrowing animals, and materials for in-dwindling members of the biota. The soil supports complex fauna of protozoans, nematodes, worms, crustaceans, arachnids, burrowing insects and numerous vertebrates inhabit the soil. Lizards, snakes, moles and several rodents live in the soil by burrowing into it.

Soil is formed by the cumulative action of

1. Fragmentation, that is the mechanical breakdown of rocks into smaller pieces due to weathering.
2. Corrosion that is the interaction of chemicals present in the soil.
3. Organic matter formed due to decay and dis integration of dead plants and animals by microorganisms.

Soil profile: In vertical section of earth crust (6 feet depth) soil is classified into different horizons OR horizontal layers viz., O horizon (organic), and three minerals (A, B, C horizons). O horizon is the surface layer of fresh or partially decomposed organic materials / humus.

A- horizon is the top soil where plant roots are formed, living and partially decomposed organic matter is found. E horizon, the zone of leaching where the area has organic or suspended material.

B- horizon is the sub soil, lies below horizon A having alluvial concentration of silicates, clay, iron, aluminum. It has unique colors.

C- C- horizon is the layer found below B horizon and above the surface of weathered parent rock. It is light in color, has partially broken down inorganic material.

Bed rock: is the region of consolidated parent rock. It is the lower most layer and is impermeable.

Soil consists of particles of various sizes and classified as sandy, silt, clayey, loamy, coarse and fine textured and humus. The soil has unique flora and fauna and classified as microflora and micro fauna, meso fauna and macro fauna.

It possesses a number of physical characteristics viz., density, porosity, temperature, water, gasses etc. mineral nutrients, air spaces. Soil also has a number of chemical compounds like Al, Si, Ca, Mg, Fe, Na, smaller amounts of B, Mn, Cu, Zn, Mo, Co etc. organic matter, the humus having amino acids, proteins, purines, pyrimidines/ hexose sugars, methyl sugars, fats, waxes, resins, lignin, and some pigments.

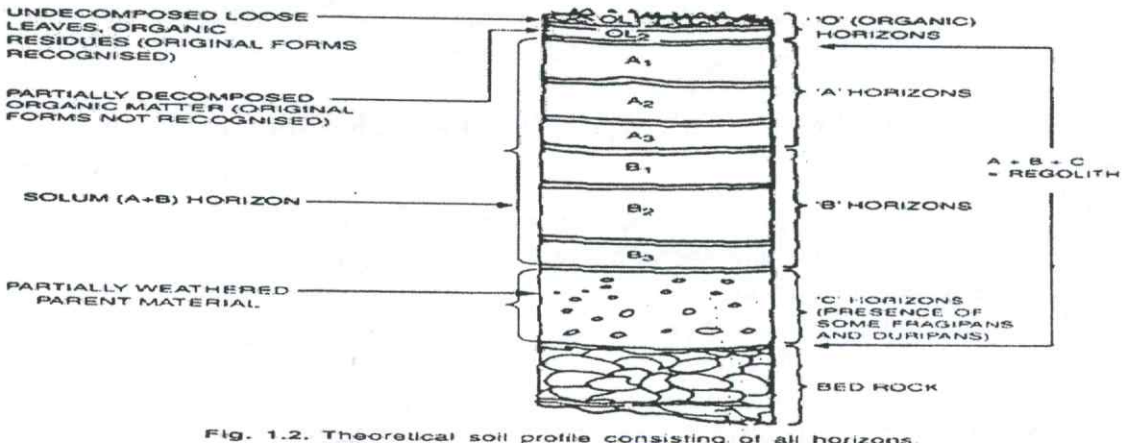


Fig. 1.2. Theoretical soil profile consisting of all horizons.

2. With respect to population ecology explain: a) Density b) Biotic potential

1. Population density

(Definition with Illustration 2.5 marks)

It is defined as the population size with reference to the unit space at a given time. Different species, of course, exist at different densities in their environments, and the same species may be able to achieve one density in one environment and another in a different environment. It is expressed in terms of number as 40 deer in a herd in an area of two acres of forest or 250 trees per acre and in terms of biomass, dry weight or total DNA and RNA as well. Population density can be differentiated into crude density and specific or ecological density.

Crude density is the total number of individuals or total biomass in a given area. For example, the number of deers in a forest of two acres. Specific or ecological density is the total number or the total biomass per unit of habitat. Although the forest is large all the deers may not spread over five acres, they may be actually living within half the acre of home range as that area has abundant food and water. Population density can change and the rate of increase of population density can also be known.

2. Biotic Potential

(Definition with Illustration 2.5 marks)

The term biotic potential was first proposed by Chapman in the year 1928.

Biotic potential is the maximum reproductive power of a population under ideal conditions. It can be defined as the inherent property of an individual to reproduce and tremendously increase in number. Populations must have all the resources if they need to survive.

Factors influencing biotic potential include the reproductive capacity of the individual, the number and age of individuals in the population, life span of the individual, different physical conditions of the environment and the population density.

Examples of biotic potential: If a pair of houseflies produce one generation in every two weeks, they could have 391,000,000 descendants at the end of one year.

Some bacteria reproduce about every 20 minutes. At this rate, 72 generations could be produced in 24 hours. The number of individuals produced would be enough to cover the entire surface of the earth to a depth of over 20 centimeters.
The biotitc potential of a population can be calculated as follows:

$\Delta N/N\,\Delta t = rN$ under ideal conditions; where 'r' reproductive potential of each individual and N is the number of individuals present at that time.

3. What is ecological succession? Explain the same with respect to hydrosere.

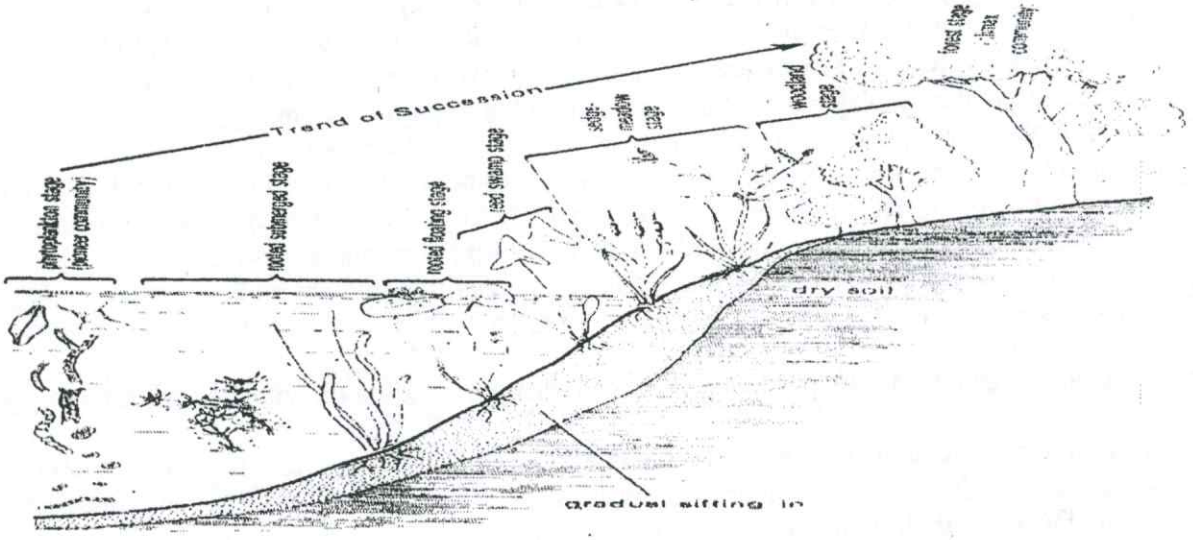
(Def: 1mark & explanation 4 marks)

Ecological succession is the replacement of one type of seral community by another at a single location over a period of time, the whole series of communities which develop in a given area is called sere; the transitory communities are called seral or pioneer stages while the final stable and mature community is called the climax community.

Clements (1916) **defined** succession as the natural process by which the same locality becomes successively colonized by different groups of communities of plants. It is the universal process of directional change in vegetation during ecological time.

It can be recognized by the progressive change in the species composition of the community. Succession occurring on substrate that either have had no previous plant cover or that contain no organic matter is called primary succession. e.g., new exposed rock area, sand dunes, new islands, deltas, shores or recent lava flow and the succession occurring where there has already been a plant cover or previous growth and some kind of developed soil such as in abandoned crop fields or forest clearings is called secondary succession.

A good example of succession is the **hydrosere or hydrach succession**, in which a pond and its communities are converted into a land community.



In the initial stage phytoplanktons such as blue green algae, green algae, diatoms and bacteria are the pioneer colonizers. They are consumed by zooplanktons like amoeba, euglena, paramecium etc. and some small fishes. Gradually these organisms die and increase the content of dead organic matter in the pond. This is utilized by bacteria and fungi and release minerals after decomposition. The nutrient rich mud then supports growth of rooted hydrophytes such as Hydrilla, Vallisneria, Elodea, Ceratophyllum etc. in the shallow water zone.

The submerged stage is also inhabited by the animals such as dragon flies, may flies, crustaceans like cyclops, cypris, daphnia etc. The hydrophytes die and are decomposed by microbes thus releasing nutrients. In addition to this due to silting the water depth of the pond is reduced and at the margin of the pond grow rooted floating vegetation, ex. Nelumbo nucifera Trapa Monochoria etc. In floating stage, faunal living space is increased and diversified animals like hydras, frogs, salamanders, snails, beetles etc. live in these areas. Some turtles, snakes also invade the ponds.

Gradually the depth of the pond decreases due to evaporation and the deposition of organic matter and the concentration of the nutrients increases. Free floating plants such as Azolla, Pistia, Lemna, Wolffia, Spirodella etc. Increase in number becoz of high nutrient availability. Later gradually their dead parts fill up the pond eco system, resulting in the further buildup of the substratum. At this stage, pond becomes a swampy eco system. The reed swamp sps. such as scirpus or bul rushes, Typha or cattail, reed grass, sedges etc. invade the pond and latter are gradually replaced by mesic community as the water depth is greatly reduced. Eventually land plants such as shrubs like salix and cormes and trees like populous and Almus invade ending in climax community such as deciduous forests. In association with change in water depth and vegetation, the aquatic fauna also changes and ultimately gets replaced by land animals.

4. Enumerate the detrimental effects of lead and arsenic. **(Detrimental effects each type 2.5marks each)**

Detrimental effects of lead—Lead/Pb poisoning is a medical condition called plumbism, caused by increased levels of the heavy metal Lead in the body. The routes of exposure include contaminated air through automobile exhaust and gasoline, water, soil, food and consumer products. Occupational exposure is a common cause of lead poisoning in adults.

1. It interferes with a variety of body processes and is toxic to many organs and tissues such as the heart, bones, intestines, kidneys, reproductive as well as nervous system; the main targets being the hematopoietic system and the nervous system.
2. Several of the enzymes involved in the synthesis of heme are sensitive to inhibition by lead.
3. Even at low levels of exposure, children may show hyperactivity, head ache, memory loss, decreased attention span, mental deficiencies, and impaired vision.
4. At higher levels, encephalopathy may occur in both children and adults.
5. In adults, when the level of lead in blood goes above 40ug/dl and 50-60ug/dl in children conditions like neuropsychiatric effect, anemia, short term memory loss, numbness, sleep problems, slurred speech. and lead hue of skin with pallor may result.
6. Lead damages the arterioles and capillaries, resulting in cerebral edema and neuronal degeneration. Clinically this damage manifests itself as ataxia, stupor, coma, and convulsions.
7. Lead contributes to the production of free radicals damaging the vital organs of the body.

Detrimental effects of Arsenic: Arsenic and its compounds are potent poisons. Generally, the levels of arsenic in air and water are low, and the major source of human exposure is food/ ground water with high arsenic concentrations.

1. In certain parts of Taiwan and South America, however, the water contains high levels and the inhabitants often suffer from dermal hyperkeratosis and hyperpigmentation.
2. Higher levels of exposure result in a more serious condition; gangrene of the lower extremities or "Blackfoot disease." and skin Cancer. Approximately 80% of arsenic compounds are used in pesticides. Other uses include glassware, paints, and pigments. Arsine gas is used in the semiconductor industry., a colorless gas formed by the action of acids on arsenic, and is the most toxic form.
3. Microorganisms in the environment convert arsenic to dimethylarsenate, which can accumulate in fish and shellfish, providing a source for human exposure.
4. Arsenite *(As+3)* compounds are lipid soluble and can be absorbed following ingestion, inhalation, or skin contact. Within 24 hours of absorption, arsenic distributes all over the body, where it binds to SH groups of tissue proteins. Only a small amount crosses the blood-brain barrier.
5. Arsenic may also replace phosphorus in bone tissue and be stored for years.
6. After acute poisoning, severe GI gastrointestinal symptoms occur within 30 minutes to 2 hrs. such as vomiting, watery and bloody diarrhea, severe abdominal pain.
7. Long term exposure may also cause cancers of urinary bladder and lungs, development defects, diabetes, pulmonary disease and cardiovascular diseases.

5. What is GIS? List the applications. **(Expansion and definition =1 mark; any four applications 4 marks).**

GIS is Geographic Information System, a powerful tool which has potential to organize complex spatial environment with tabular relationships. The major emphasis on developing digital spatial data base is to design to capture, store, manipulate, analyze and manage all the types of geographic data -The widespread collection and integration of imagery into GIS has been made possible through remote sensing. The images provide information about various physical and

biological resources and their state of degradation like water logging, desertification, deforestation urbanize areas, river and canal network, mineral and energy reserves.

Applications

GIS technologies have been applied to diverse fields to assist experts and professionals in analyzing various types of geospatial data and dealing with complex situations.

1.To detect changes from images taken at different times.
2.To analyze the health of biomass using spectral analysis- biodiversity GIS
3. For the agricultural environment Management-Agricultural GIS.
4. For Horticultural crop wild relatives –Horticultural GIS.
5. Biomass analysis at coastal areas–Coastal ecological information investigation system.
6. For analysis of wild life system-wild creature data survey system.
7. For transport system –Farm roads and bridges information system.
8. For canal and irrigation system-mobile irrigation survey system.

GIS also focused on risk management, pollution, and monitoring.

Disaster Assessment Hurricane Katrina & Rita 2004 Tsunami,

1. Atmospheric Modeling
    a) Aerosols
    b) Air pollution
    c) Climate change
2. Ocean
    d) Topography
    e) Currents.

6. Give an account of imprinting. **(Definition 1mark, illustration with example 4 marks)**

A simple and specialized form of learning that can occur only during a specific period early in the life of an animal and cannot be changed once it occurs is called Imprinting. It is easily observed in young geese and ducks, which have no innate recognition of their mother. Instead, these birds are genetically programmed to follow the first moving object they see during a short period immediately after they hatch.

Imprinting usually takes place soon after hatching or birth, and often results in a fixed attachment, difficult to change. It is irreversible and restricted to a brief period, called critical period soon after hatching. e.g. Chicks hatch with an innate tendency to approach and follow their mother. They have already imprinted on her vocalizations. After hatching (9 24-36hrs). they imprint on her visual appearance. Geese and ducklings form social attachments shortly after birth.

Konrad Z. Lorenz in 1937 illustrated the phenomenon of imprinting by conducting the following expt. If a duckling is hatched in the presence of a large green box containing a ticking alarm clock, it will follow the movement of the box along a trolley wire. After some exposure to the box, the duckling will follow it rather than its own mother or other birds. Thus, in this manner, the duckling could be imprinted upon any suitable moving object, animal/person. It must depend on some special condition of the nervous system prevailing only early development, called critical period. If the bird is not imprinted upon during this period, it never gets imprinted at all.

Lorenz also found that goslings deprived of their parents would follow him and use him as a substitute parent. Bowlby,1973 studied imprinting behavior in humans and concluded the critical period for imprinting to be from 18months to 3yrs and separation or

lack of adequate mother figure during this period may lead to an increased risk of psychological disturbance in adolescence and later life.

There is a great survival/adaptive value to this behavior, as the young must follow their mother as she leads them to water, helps them find food, teach how to fly, and keeps them out of danger. However, the young will follow any object they see during this period just as they would their mother—including toy wagons, boxes, and balloons. Once the young birds imprint on an object, they prefer to follow it, even when given the opportunity to follow a member of their own species.

7. Write an explanatory note on parental care in fishes. (Any Five methods –with an example 5 mark)

There are many fishes which exhibit definite parental care. Various methods have been evolved for affording care to fertilized eggs and young by one or both the sexes. Fishes that produce limited number of eggs have evolved various grades of parental care behaviour:

1. Formation of nests; Different types of nests are formed by various species. for e.g.
   a) The male darters select suitable places and each defend its own domain. The female constructs a basin like depression and releases the eggs which are promptly fertilized.
   b) The sun fishes scoop out a shallow basin like nest, from the bottom of which all pebbles are carefully removed by the male who guards the eggs till they hatch.
   c) Fresh water fish Heterotis make a nest by clearing the space among aquatic vegetation. 4. Gymnarchus constructs a floating nest.
   d) Protopterus scoops out a hole in the mud of a swamp, surrounded by long aquatic weeds and grasses. The male prepares the nest and guards the eggs.
   e) Amia constructs a crude circular nest from vegetation The young leave the nest under the protection of their father.
   f) In three spined stickle back, male collects pieces of roots and stalks of aquatic plants which are joined together by a sticky secretion produced by the kidney of male, nest is a shallow barrel –shaped structure. When the nest is ready, the male drags mature females into the nests for laying eggs. After laying eggs the female swims away and the male keeps guard over the fertilized eggs and young fries.
   g) The male fighting fish Betta. makes a nest by blowing bubbles of air and sticky mucous, which adhere together to form a floating mass of foam. The male collects the fertilized eggs in his mouth, gives them a coating of mucus and sticks them to the under surface of the foamy nest.

2. Mouth cavity as a shelter. .1 Many female Chichlids protect their eggs by carrying them in their mouth.to ensure safety and also perfect aeration. 2 Males of most marine catfishes show similar habits of carrying the eggs in oral cavity until hatching.

3. Depositing eggs in masses of definite forms. 1. In yellow Perches in which the nests are not build, the eggs are held together by a membrane and form long floating bands, so that the eggs are not scattered away. 2. In pholis / butter fish, the eggs are rolled into a rounded ball, and one of the parents mostly male, guard the egg-ball by coiling around it.

4. Formation of integumentary cups: In cat fish, *Platystacus*, the skin of lower surface of female body becomes soft and spongy during breeding season. As soon as the eggs are fertilized, the female presses her body against the eggs in such a manner that each egg becomes attached to the spongy skin by a small, stalked cup and remains in this position till hatching.

5.Placement of eggs in brood pouch: 1 In pipe fish and the hippocampus, the care of eggs and fries is undertaken by males. Brood pouches are formed on the lower surface of the males, and the females, transfer the eggs into them after an elaborate courtship. 2 In family Soleno stomidaethe female keeps the eggs in pouch formed by the pelvic fins, the inside of the chamber has numerous long filaments which aid in keeping the eggs in position.

6.Viviparity: In order to provide for highest degree of egg protection, some fishes have evolved truly internal incubation in live-bearing fishes. E.g. some sharks, cyprinids etc.

7.Special devices: 1. The males of Kurtus bears a long hook projecting from the fore head. the egg mass is produced in two bunches connected by a string and this string becomes attached to the hook in such a way that one bunch of eggs hangs on either side as the male swims about in water. 2. The eggs of Rhodeus are deposited in the mantle cavity of fresh water mussels by the female whose oviduct is drawn out in the form of a long tube acting like ovipositor.

Parental care involves not only caring for the eggs but also protection of hatchlings in varied ways. In Tilapia the hatchlings, when threatened seeks the shelter of mother s oral cavity. The male pipe fish, *Siphonostoma*, provides protection to the hatchlings in his brood pouch.

PART-C

III. Answer any three of the following: **(3X10=30)**

1. Define ecological niche. Explain the types with examples. (Def 1 mark; 3types with illustration 3 marks each)

Ecological niche. The term Niche describes the professional status of an organism. The term is an all-inclusive term to describe the organism, its features, its functional status, its position in the ecosystem, how it gets energy and how it interacts with the organisms around it and with the environment. The term niche was for the first time used by Joseph Grinnel in 1917 to explain microhabitats of California thrashers. According to him "Niche is the ultimate distributional unit, within which each species is held by its structural and instinctive limitations. No two species in the same general territory can occupy for long identically the same ecological niche". An ecological niche is a term that includes not only the physical space occupied by the organism but also its fundamental role in the community.

Types of Niches:

a). Spatial/ habitat niche b). Trophic niche c). Multidimensional or Hyper volume niche.

a) Spatial /Habitat Niche

It refers to the physical space occupied by the living organism. The organisms live together in the same habitat but they occupy specific spaces / microhabitats. The organisms belong to the same genera but differ in their spatial niches. For example, O Neil described the spatial niches of seven different species of millipedes. They are scavengers, seen around a log in the same general habitat, the forest floor of a maple- oak forest.

b) Trophic niche

It is associated with nutritive(trophic) aspect of the organism. The concept of Trophic niche was given by Elton. Sometimes two sps. may live in the same habitat but they occupy different trophic niches because of differences in food habits. For example,

1. In Galapagos Islands, several species of birds demonstrate trophic niche. These birds feed on different food diets although they live in same general habitat. Some birds (tree finches) are frugivorous, others are insectivorous as well as seed- eaters.

2. House sparrow – *Passer domesticus* and common crow – *Corvus splendens* live in close association with human beings and they occupy the same habitat. They differ in their choice of food, occupy different trophic niches. The sparrow feeds on grains and kitchen wastes and the crow is a scavenger, feeds on the dead rats, young chicks, eggs, termites and locusts apart from foodstuffs like chapattis and rice.
3. Aquatic bugs *Notonecta* and *Corixa* live in the same pond but occupy different trophic niches. *Notonecta* is an active predator that swims about grasping and eating other small animals while *Corixa* is a scavenger feeding on decaying vegetation.

C) Multidimensional or hyper volume niche

The concept of this niche was given by GE Hutchinson in the year 1957. According to him the niche could be visualized as a multidimensional space of hyper volume within which the organism or a group of organisms can survive indefinitely becoz the environment is conducive. It refers to the position of the organism in its environmental gradients of moisture or humidity, wind, temperature, pH etc.

Hutchinson further divided this niche into Fundamental niche and Realized niche.

Fundamental niche is the maximum space occupied by the organism when it is not under any constraints as there are no predators or competitors. This situation will not occur in nature.

Example; a deer living in a luxuriant green forest area without any constraints of competition or predation.

Realized niche is a smaller space or hyper volume occupied by the organism under constraints of competition and predation. This situation occurs in nature. It is a space within the fundamental niche. Example: the deer has to survive with competitors and hide from predators. The space now occupied by the deer becomes reduced.

2. Give a detailed account of the causes, effects and mitigation of greenhouse effect.
(Def 1 mark; causes-2 marks, effects-5 marks and mitigation 2 marks)

Definition: The trapping of heat from the sun by certain pollutant gases in the atmosphere leading to a rise in the earth s average temperature is known as greenhouse effect. These gases viz., CO2, CH4, N2O, CFCs, O3 and to some extent water vapors act like glass panels in the green house hence, are called greenhouse gases.

In normal circumstances, the temperature on the surface of the earth is maintained by the energy balance of the sun rays that strikes the planet earth and the heat is radiated back into space. But, when there is increase in the amount of CO2 and other greenhouse gases, these prevent the heat from being radiated out into space, results in global warming which refers to an increase in the earth's average temperature, causing changes in climate. During the past 4.65 billon years of its history, earth has warmed many times. But at present it is facing a rapid warming mainly due to human activities. The average temperature of earth is about 590F (150C). During the last century this average has risen by about 10F. By the year 2100, it is believed that the rise would be between 2.5 and 10.40F. This will cause dramatic changes such as rise in sea level, changes in rainfall patterns, wide range of impacts on plants, wildlife and humans.

Causes Mostly anthropogenic that is by human activities viz., increased use of fossil fuel mainly petroleum products and coal, nuclear power plants, deforestation, change in land use etc. has increased CO2 concentration in the atmosphere, the main gas contributing to greenhouse effect.

Effects of Global warming: -

1. Rise in sea level; An increase in temp. of the earth would cause melting of glaciers/polar ice caps and thermal expansion of water leading to increase in sea level, submerging low lying coastal areas. It is estimated that if all the ice on the earth melts, about 200ft of water would be added to the surface of all oceans.
2. Effects on fresh water resources: Due to rise in sea level, salt water may encroach the low lying areas resulting in wastage of fresh water reservoirs and spoil underground water.
3. Acidification of oceans :1/3rd of CO2 emitted is taken up by oceans, which dissolves in sea water forming carbonic acid causing acidification and change in pH.
4. Due to rise in temp. the dissolving power of oxygen in oceans may decline.
5. Effect on crop yield: Crop yield depends on CO2, water and temperature. Higher temp. influences the water regime on earth. It results in increased rate of evaporation of water reducing ground water level. Higher temperature may also result in more incidences of pests, parasites and predators for crops. Low latitude areas are at higher risk, having decreased crop production.
6. Effects on weather and climate: Increase in temperature of the earth increases its moisture carrying capacity. Warming of troposphere causes cooling of stratosphere. This changes the rainfall pattern producing droughts in some areas and floods in some other areas. Effects on human health: An increase in earth s temp. will lead to spread of tropical diseases. Diseases such as erythromelalgia, a vascular disease, infectious diseases both new and re emerging
7. Mosquito- borne diseases like malaria, elephantiasis, yellow fever and dengue fever.in areas that have experienced extreme flooding/ storms and drought.
8. Heat waves yet another impact of warming global tempt., result in dehydration and heat stroke.
9. The warming oceans become the breeding ground for toxic algal blooms which may cause cholera.
10. Animals will find it difficult to adjust to the changed environment and will tend to migrate towards the poles or higher elevations

Mitigation of greenhouse effect:

1. Reduce the use of fossil fuels.
2. Recycle the conventional sources of energy such as solar, tidal etc.
3. Reforestation should be increased
4. Reducing deforestation.
5. Fuel consumption to be lessened.
6. Check on human population explosion.
7. Carbon tax and issue of permits.
8. Use of efficiency standards in energy utilities.
9. Technology transfer to developing Nations.

3. Sun and wind are non-conventional renewable sources of energy- Justify.

(Each type explanation 5 marks)

Energy is one of the key resources for the sustenance of life in modern world. Living orgs. require a continuous supply of energy for their life activities like growth, metabolism and reproduction. It can be obtained from various resources.

There are two major classes of natural energy resources namely

1. Renewable
2. Non- renewable

Renewable energy resources are the natural resources that are unlimited, non-degradable, replaceable, directly available and immediately accessible. E.g. Solar, Tidal, Wind, Geothermal, Biogas, Biodiesel etc. They are called as Non – conventional energy.

SOLAR ENERGY;

The source of this energy type is the sunlight. It is the high potential renewable source of energy. In India for about 250-300 days the useful sunlight is available with 1648-2108 KWh/m2/yr. Energy used in conversion of radiant energy into heat, mechanical, electrical, and chemical energy.

Uses:

1. It is used for pumping water in remote areas in many parts of the world.
2. It is used in desalination plants at sea shore areas.
3. Used to power TV, Radio stations, Light houses, driers.
4. Used to power Public transport and small gadgets like calculators, watches etc.
5. Used as solar cookers for *cooking*. in water heaters and air heaters.
6. Used to heat residential homes, and in various other systems.

Advantages:

1. Simple and natural renewable energy source.
2. Power source is SUN-is absolutely cost free.
3. Produces no pollution.
4. Technology of energy usage is cost effective.
5. Require less maintenance.
6. Most systems have life span of 30-40 yrs.

Dis advantages:

1. Limited energy output as sun light show frequency and intensity variations.
2. Installation is quite expensive.
3. Systems do not work during cloudy and rainy seasons as well as in polluted areas.

WIND ENERGY.

Wind is the movement of air across the earth from areas of high pressure to low. The sun rays falling on the equator heats up the air which rises as cold polar air sinks. This sets up the basic pattern of wind circulation. Kinetic energy in wind is used to run wind mills/ turbines to harness energy. Wind turbines are devices that convert kinetic energy from wind to mechanical energy. Later, the mechanical energy is used to produce electricity by wind power plants. Average annual wind density is 3KW/m2/day in peninsular areas, coastal and ghat regions. During winter more than 10KW/m2/day of energy is produced by wind.

Uses: 1. Power to light lamps at residences near sea shores, hill stations and remote areas.
2. Production of electricity

Advantages:

1. Renewable, inexhaustible, on- conventional resource of energy
2. It is free and easy to capture efficiently
3. The production of energy lowers greenhouse gases and other pollutants.
4. Installation of turbines occupies small area of land.
5. In remote areas wind mills can be employed to generate electricity.
6. The land around wind mills can be used for agriculture.

Disadvantages:

1. Wind energy is un reliable energy resource as the winds are uncertain.
2. It can be harnessed only where wind velocity is high ;15-20 km/hr.

3. Its efficiency is very less compared to fossil fuel power plants.
4. Requires expensive storage during peak production times. And turbines are very noisy.
5. Birds may get killed or injured when they fly into turbines.

4. Write notes on: a) Red data book b) Biosphere reserves

(Each type explanation 5 marks)

a) A) **Red data book** **(Def 1 Mark + Expl. 4 marks)**

The Red data book is the state document established for documenting rare and endangered species of animals, plants and fungi as well as some local sub species that exist within the territory of the state or country. This book is maintained by IUCN-
The International Union for Conservation of Nature, established in the year 1965.It is the world's wide inventory center of the global conservation status of biological species. It contains the complete list of **threatened** species. These can be grouped into vulnerable, endangered and critically endangered.

The Red Data Book contains color-coded information sheets, which are arranged according to the dangerous species. The black colored sheet for species which are extinct, red colored sheet for species that are more dangerous, amber colored for those species, which is getting attacked by other species, white colored for very rare species, green colored for non-dangerous species and grey colored for the species that are intimated to be vulnerable, endangered, or rare. The extinct, dangerous, unknown and non-dangerous are the three main categories. IUCN has listed 132sps. of plants and animals as critically endangered from India. Leopard cat, Ibex, pangolin, olive ridley sea turtle, lion tailed macaque, Indian wild ass, Nilgiri langur, Hoolock Gibbon, Ganges river Dolphin, black buck antelope, babbar sher/Asiatic lion, the great Indian Bustard etc., are the endangered animals in India.

The Advantage of the red data book.

1. It helps in identifying all animals, birds and other species, about their extinct and endangered species.
2. It is used to evaluate the total wild animals' population present.
3. The data available in this book can be used to evaluate the taxa at the global level.
4. With the help of this book, we can estimate the risk of taxa becoming globally extinct.
5. The red book has the complete information about all endangered animals, plants and other species.

The Disadvantage of the red data book.

1. The information available in the red data book is incomplete. Many species both extinct and present are not updated in this book. The criteria applied here is only within the territory of the state.
2. This book maintains the complete record of all animals, plants and other species but has no information about the microbes.

b) b) Biosphere Reserves: **(Def 1 Mark + Expl. 4 marks)**

Biosphere reserves are specified areas where there is controlled land utilization for specific activity in specified zones. they are large protected areas of usually 5000 SQ Km. India has 16 of them and the Nilgiri bioreserve is the first. It has three zones viz., a) core, b) buffer and c) transition zone.

a) The core zone is innermost/ central zone and form sanctum sanctorum. Here no human activity is permitted to maintain its ecological integrity and diversity. It is open strictly to scientists, research workers and conservation authorities.

b) The buffer zone lies between the core and transition zone where limited human activity is permitted. It includes watershed areas, along with specific habitats to be conserved -in its original form and is

protected from non- native plants animals. Here controlled exploitation of natural resources is possible. It also meets the research and educational needs of the society.

c) The transition zone /manipulation zone is the outer zone where lot of human activity is permitted. It includes forestry zone tourism zone, agriculture zone, fishery and recreation zones.
The biosphere reserves concept was evolved by Man and biosphere programme of UNESCO in 1971.

The objectives of this programme are:
1. Conserve biodiversity for ecological evidences.
2. Safe guard genetic diversity for the process of evolution to act upon.
3. Provide opportunity for environmental education and training.
4. Promote international co -operation.
5. Provide natural areas for basic and applied research in ecology and other fields like population dynamics and genetics, land use management, evolutionary biology etc.

In India National MAB committee has identified I2 sites as potential areas of biosphere reserves; the recent ones being silent valley and western Ghats in Kerala, Tamil Nadu and Karnataka.

5. **Discuss social behaviour in honey bees.** **(Detailed explanation 10 marks)**

Honey bees belong to the family Apidae. They have developed one of the most highly organized societies. They form and live in permanent colonies in the form of beehives which are found overhanging from rocks, tall buildings or from branches of trees and show division of labour. The colonies of honey bees are perennial and a good colony of honey bee may consist of 50,000 to 80,000 individuals. The colonies are trimorphic comprising of one fertile female or the queen, a few hundreds of male bees or drones and the rest are sterile females or workers.

The queen lays the eggs which develop into new workers, drones and queens. She also emits a complex series of chemical secretions, the **pheromones** that regulate much of the behaviour of the workers. Both queen and workers are genetically diploid. Queens, however, are fed with a special rich larval food; a white, foamy, yoghurt-like **royal jelly**.
Drones are genetically haploid and are produced by the laying of unfertilized eggs by parthenogenesis

Different castes

A. Worker:

The worker honey bee is the smallest member of the colony. It is black or brown in color and its mouth parts are of the rasping and lapping type, to facilitate the collection of nectar and pollen. The legs are covered with hair and are adapted for gathering pollen.

A worker honey bee lives for about 6 weeks as an adult and her activities are to some extent synchronized with her physiology. She spends the first three days in cleaning the cells and then begins feeding the older larvae with a mixture of pollen and honey. She picks up from the storage cells of the hive. The workers then start secreting the so-called royal jelly, and from about the 6th to the 14th day of her life she feeds this secretion to the younger larvae and any queen larvae in the hive. For a brief period, the royal jelly is fed to all larvae, but those that will become the queen are fed with royal jelly throughout their larval period. Form the 10th day onwards, the worker's wax-secreting glands on the abdomen become active and, at the same time, the pharyngeal glands begin to regress. The workers then gradually change their behaviour from feeding larvae to cell construction.

B. Drone:

Drones are intermediate in size but considerably stouter and broader. They possess large eyes, small pointed mandibles and lack wax-producing glands, pollen-collecting apparatus and sting. The drones do not do any work and, if not fed by the workers, they die. They exist only to mate with the queen.

C. Queen:
The queen being the only fertile female of the hive, have immensely developed ovaries. The queen is elongated with a long tapering abdomen with comparatively shorter wings and legs. She has pointed mandibles and shorter mouth parts and sting with no barbs. She alone lays eggs and is the mother of almost all the members of the hive. She lives for several successive years lying about 1-200 eggs a day and about 15 lakh eggs during her life time. When a hive of honey bees prepares to swarm or when an old queen becomes weak, the regulating pheromones of the queen also become weak. This serves as a signal for workers to begin raising a new queen.

Swarming:
Swarming takes place during the spring or early summer. This relieves over-crowding and also provides a means of finding new colonies. Prior to a swarm, a large number of queen and drone cells are constructed. Then on a clear day the old queen leaves the hive with a group of old workers and drones.

Bee-hive: The bee-hive consists of two layers of hexagonal chambers or cells made by the bee's wax secreted from the abdomen of the worker bees. Before the wax is used, it is masticated and mixed with secretions of cephalic glands to convert it into a plastic substance.

The bee-hive consists of two types of cells:
1. Storage cells which contains honey and pollen, usually built near the top.
2. Brood cells generally occupy the lower and central portions.
They are of three types and differ in shape and size:
(i) Worker cells are small like the honey cells.
(ii) Drone cells are slightly larger.
(iii) Queen cells are enormous, cylindrical or vase-shaped in structure. Once used these cells cannot be used again.

Language of Honey Bees

Honey bees communicate about the location of food resources when these sources are too distant to be located easily by individual bees by performing the dances, which have important accompanying sounds and are mainly of two forms. The form having the most informational richness is the waggle dance; discovered by **Von Frisch** in 1950, while the other is the round dance. Bees most commonly execute these dances when a forager has returned from a rich source, carrying either nectar in her stomach or pollen grains packed in basket like spaces formed by hairs on her legs.

1. The **waggle dance** is performed roughly in the pattern of a figure-eight made against the vertical surface of the hive. At first the scout bee makes a semicircular walk and then a straight rush followed by another semicircular walk to complete the circle. The straight rush indicates the direction of the food. Diagonals indicate the angles towards or away from the sun and the frequency of the dance indicates the distance.

2. The **round dance** is performed to communicate about the location of source of food, when a worker bee discovers a source of food, close to hive within 50 meters consisting of small circles made first in one direction and then in the reverse direction on the comb when she returns.

The aforesaid explanation on social behaviour of honey bees clearly illustrates the involvement of division of labour and physical differentiation towards building up of a successful society ensuring

survival of the race. The chemical communication plays an important role not only in regulating the behaviour, but also in adaptive regulation of population structure in the colony.

6. Explain: a) Eco-location in bats b) Role of pheromones in insects

(Each type explanation 5 marks)

c) Eco-location in bats. **(Def 1 Mark + Expl. 4 marks)**

Echo location is the use of high frequency sound waves and echoes to determine where objects are in space. Donald Griffin 1915-2003, a Zoologist, first discovered how bats navigate and also used the term echo-location for the first time. Bats use echolocation to navigate and find food in the dark. To echolocate bats send out the pulses of high frequency sound waves from the mouth or nose which strikes objects and reflect back to the animals in the form of echoes. They listen to echoes and detect and use the information to locate, identify and capture the prey. / to figure out where the object is, how big it is and its shape. Using echolocation bats can detect objects as thin as a human hair in complete darkness. It allows bats to find insects the size of mosquitoes. Humans cannot hear ultra-sonic sounds made by echo-locating bats, but some insects such as some moths, beetles and cricket can.

During flight, bats emit short ultrasonic pulses 5 to 15 milli.sec in duration in a narrow directed beam from the mouth or nose. Each pulse is frequency modulated, being highest at the beginning, up to 100,000 Hz (hertz, cycles per second), and sweeps down to perhaps 30,000 Hz at the end. Sounds of this frequency are ultrasonic to human ears, which have an upper limit of about 20,000 Hz. When bats are searching for prey, they produce about 10 pulses per second. If prey is detected, the rate increases rapidly up to 200 pulses per second in the final phase of approach and capture. Pulses are spaced so the echo of each is received before the next pulse is emitted, an adaptation that prevents jamming. Because transmission-to-reception time decreases as a bat approaches an object, it can increase pulse frequency to obtain more information about an object. Pulse length is also shortened as a bat nears an object.

d) Role of pheromones in insects

(Def 1 Mark + Any 4 functions 4 marks)

PHEROMONES are Chemical substances which, when released into an animal's surroundings, influence the behaviour or development of other individuals of same species. Karlson and Luscher (1959) initially proposed the term pheromone.

Like hormones, pheromones are effective in minute quantities. Known functions of various pheromones include attraction of the opposite sex, release of certain behavior patterns (for example, aggregation pheromones to enable mass attack of bark beetles on a tree or for overwintering of ladybug beetles), to fend off aggression, to mark trails and territories, and to signal alarms. Social insects, such as bees, ants, wasps, and termites, can recognize a nest mate—or an alien in the nest—by means of identification pheromones. Pheromones determine caste in termites and to some extent in ants and bees. They are a primary integrating force in populations of social insects.

In insects pheromones may function in the following way:

1. **As sex attractants:** The queen bee attracts drone by releasing pheromones from two glands – mandibular and Nassanoff's. The secretion of pheromones from these two glands serves her to rule over a colony of 6,000-8,000 individuals for a period of 5 to 7 years. The male Emperor moth (*Endia parvonia*) can detect the sex attractant of the female as far as 13kms, although the female carries less than 0-001 part of a milligram. Bombykol is sex attractant pheromone produced by female silkworm moth, which is received by male antenna several kilometers away.

2. **As alarm pheromones (distress pheromones/death pheromones)** Distress pheromones are highly volatile. If one is stung by a bee and if by reflex the bee is killed, then the stinging of dead bee may release alarm and distress pheromones, which triggers a mass attack from the hive. In social insects the alarm pheromones perform three main functions:
   a. To alert the colony
   b. To release aggression
   c. To mark the target to be attacked

3. **Trail or recruitment pheromones**; Many species of ants lay scent trails by which they are able to find their way that is they function as navigational aids to locate food and to communicate to other workers.
4. **Primer or developmental pheromones**: These are chemicals that trigger a change in the developmental events and control social structure of the colony seen in ants, bees and wasps. The Queen substance produced by the mandibular glands of the queens of hymenopteran social insects inhibits the ovarian development in the worker castes. Hence most of them are sterile.
5. **Aggregation pheromone**; These function in defense against predators, mate selection etc. secreted by the worker caste of bees or ants to identify the other members of the colony and move in groups whether consisting of one sex or both sexes. This chemical is produced or released during feeding, formation of new colonies kin recognition or maintaining cohesion of swarms during flights e.g., aphids,ants,bees,termites, weevils etc.

V SEMESTER B.Sc. EXAMINATION NOV/DEC 2018

ZOOLOGY PAPER-V

DEVELOPMENTAL BIOLOGY AND ORGANIC EVOLUTION

PART-A

I.ANSWER ANY FIVE 5X3=15

1.Give the views of ovistsand animaliculists

views of ovists and animaliculists- each 1.5 marks

Existence of a preformed miniature organism,**homunculus** in ovum or sperm (preformation theory).Preformationists are distinguished into two schools of thoughts, ovists and animaliculists.

ovists-Swanmerdam and Bonnet believed that homunculus was present in ova which when stimulated by seminal fluid develops into an organism.

animaliculists-Leeuwenhock ,Hartsoekar believed that homunculus existed in the head of sperm, sperm was the seed and the egg the soil in which the seed was planted.

2. What are secondary egg membranes?Give an ex.

Egg mn.-2 marks, any one ex. -1mark

It is the membrane, which surround and protect the egg. Secreted outside the primary egg membrane by the ovarian tissues such as follicle cells (the cells found around the developing oocytes). These membranes are usually tough and impermeable.

ex. chorion of the insect,ascidian and cyclostome eggs; corona radiate of mammalian eggs.

3.Define oviparity citing an ex.

Definition-2,any one ex.-1

oviparity is the phenomenon of laying eggs with little or no embryonic development within the mother ex.insects, most fishes,amphibians, mostreptiles, birds,platypus, echidna.

4. Explain the role of fertilizin and antifertilizin in fertilization.

Process of fertilization (Lillie, 1914) begins with the movement of sperm towards the egg.It is believed that the eggs and the sperms of some animals like sea urchins are chemically attracted to one another. The plasma membrane of sperm head contains an acidic protein of low molecular weight called antifertilizin. Antifertilizin acts as the specific receptor for fertilizin molecule(glycoprotein) found in the jelly coats and egg membranes of unfertilized egg. The eggs and sperms of each species secrete a specific type of fertilizin and antifertilizin. This ensures fertilization between the gametes of thesame species.

5. With reference to embryonic induction define a)inducer b) Evocator c)responder

Embryonic induction is a process where in a group of cells produce the chemical substance which induces another group of cells to develop into a structure not formed by that group of cells at normal conditions.

organizer or inducer -the group of cells which produce the chemical substance.

Evocator – is the chemical substance produced by the inducer (neural inductor).

responder- is the group of cells responding to the evaocater.

Law is important primarily as it describes a situation of genetic equilibrium

6.Give the significance of Hardy-Weinberg Law.

Any three -1 mark each

1)when the population is in equilibrium, there is no evolution 2) Evolution occurs only when the equilibrium is altered 3) equilibrium conserves recessive characters 4) it provides a theoretical baseline for measuring evolutionary change 5) the equilibrium tends to conserve gains which has been made in the past and avoids rapid changes 6) Equilibrium maintains heterozygosity in the population

7. Write a note on allopatric speciation.

Allopatric or geographical speciation, is a mode of speciation that occurs when biological populations of the same species get isolated from each other to an extent which prevents gene flow between them, ultimately resulting in the separation of a species into isolated subpopulations subsequently into different species.ex. Darwin's finches, marsupials of Australia etc.

In this type of speciation geographical barrier such as ocean, mountain, glacier, bridge etc. play animportant role. The allopatric speciation is the exclusive mode of speciation in animals and the prevailing mode even in plants.

PART-B

II.ANSWER ANY FIVE 5X5=25

1.Draw a neat labelled diagram of hen's egg.

Diagram with labelling (any 10) - 5 marks

2. Give a brief a/c ofestrous cycle.

Definition-1, cycle with 4 phases- 4 (1 each)

estrus cycle is a series of coordinated changes noticed during reproduction in most female mammals except primates or A regularly recurring period during which most female mammals are ready to mate and are most receptive to male (estrus or heat period).

One or moreperiods of estrusmay occur during the breeding season of a female. Based on the number of times a female is in heat orestrus, the animals are classified into**1.Monestrus**-the female show only one cycle per breeding season ex. dog, fox etc. **2. Polyestrus** –more than one cycle ex. mice

The estrus cycle in case of dog lasts for 18-21 days and includes – 1) Proestrus phase 2.estrus phase 3.Metestrus or postestrous phase 4) Diestrus phase

1. **Proestrus phase**- the period of active preparation for estrus. The female is not yet receptive. The female begins to show certain changes, a swollen vulva and a discharge of blood. This phase lasts for 9 to 11 days. The females attract males because of the smell of the discharge and pheromones. But the female resists the advances of the males, as she is not yet ready to mate. The ovarian follicles are in the process of maturation.
2. **estrus phase**- The female is in receptive state and is ready to mate. The vaginal discharge becomes reduced and there is less blood. The vulva becomes enlarged and

very soft. This phase lasts for 2 to 3 days or even for week and mating occurs during this period.

3. **Metestrus phase**- The uterus prepares itself for pregnancy and anticipates implantation. The uterine lining or endometrium is thick, soft and glandular. If fertilization occurs followed by implantation the female becomespregnant. If there is not fertilization, the uterus will show a regression.
4. **Diestrus phase** – estrus cycle ends and the female is no longer receptive to males. The vulva is no longer swollen and soft, there is no discharge and the female is back to its normal non-reproductive state. The diestrus phase lasts for as long as there months if the female is not pregnant. If she is pregnant, it lasts till she gives birth. After giving birth, the female enters, into resting phase called anestrous phase.

3. Mention the functions of a) Allantois b) Amnion.

a) Allantois and Amnion-any 5points - 5 marks (3/2 function each)

Allantois-1)It helps as a urinary bladder and stores nitrogenous wastesin the form of uric acid 2) It absorbs calcium from the shell and provides it to the development of embryonic skeleton 3) it aids in respiration

b) Amnion –1)it provide aquatic environment for the developing embryo 2) protects against desiccation 3) acts as fluid cushion,protects against external shock 4) isolates the embryo from the egg shell and protects from adhesion to the shell.

4. Explain blastulation in frog.

explanation- 3; diagram -2

Frog egg is mesolecithal and moderately telolecithal. The process of formation of blastula is blastulation.cleavage is holoblastic and unequal. First two cleavages aremeridional,second cleavage is at right angles to the first dividing the zygote into four equal blastomeres. The third is latitudinal slightly above the equator,producing 8 blasomeres in two tiers of four each. The upper cells at animal hemisphere are small called micromeres,lower four cells at vegetal pole are larger with yolk called mega or macromeres. Fourth is two simulataneousmeridional cleavage resulting in 16 cells in two tiers of 8 macromeres below and 8 micromeres above.Blastocoele, a small space appears between the blastomeresat this stage. Fifth cleavage is two latitudinal one near AP and one near VP producing 32 cells, arranged in four tires. Further cleavage is irregular,micromeres divide more rapidly than macromeres resulting in a ball of blastomeres which develops into blastula called coelobastula.Blastula has a cavity which iseccentric in location, called blastocoeleand is filled with fluid. Pigmented micromeres are in animal hemisphere,whereas yolk rich macromeres are near VP.

5. What is placenta? Distinguish between deciduate and non-deciduate placenta.

Definition -1 mark; distinguish between two types -4 marks

Placenta is the organic connection between developing foetus and uterus of mother for physiological exchange.

Two major types of placenta are recognized based on the degree of association between foetal and maternal tissue. **Non- deciduate placenta:** Implantation of embryo is superficial.The foetal chorionic epithelium lies in contact with the uterine epithelium. At the time of birth, the foetal villi are drawn out completely without causing any injury to the uterine wall and bleeding is not observed at parturition ex. pig,cattle,horse and other ruminants.**Deciduate placenta:** contact between foetal chorionic epithelium and uterine epithelium is intimate. The wall of the uterus becomes eroded to various degrees that permit intimate contact with chorionic villi. At the time of birth,the uterine part of placenta is broken causing haemorrhage. Noticed in humans, rabbit,dog,cat etc.

6. Explain lead method of dating of fossils.

It is the method of dating of fossils devised by Boltwood in 1907.Radioactive element Uranium ^{238}disintegrates into lead^{206} and Helium.One half of the total number of uranium atoms will breakdown forming lead in a period of 4.51 billion years. So the half life of Uranium ^{238}is 4.51 billion years. The age of the rock or fossil can be calculated by estimating the ratio of Uranium and lead present in the rock.

Uranium $^{238}\rightarrow$ lead^{206} + Helium

This method has certain limitations- Uranium ^{238}is not a common element, rocks may not contain Uranium ^{238}then this method cannot be used. Lead method cannot be used for more recent rocks.Only approximate date of rock and fossil can be estimated.

7. Enumerate the salient features of Cromagnon man.

Salient features- any 10 -0.5 marks each

Cro-magnon-is the early Modern man, fossils discovered in a cave at cro- Magnon, France in 1868.They succeeded Neanderthals and became extinct about 20,000 years ago.

erect posture, bipedal gait, plantigrade type of locomotion,160-180 cm tall.

vertebral column with sigmoid curve, broad sacrum and pelvis, expanded ilium.

hands became free to manipulate,opposable thumb.

facial skeleton doesnot protrude, flat forehead, chin prominent,had eyebrow ridges.

largeskull, intelligent brain with cranial capacity 1600cc

cave dwellers,good hunters, omnivorous, made tools, used fire

made ornaments from ivory and decorated their body.cave paintings noticed.

communication skills developed including verbal communication .

PART-C

III.ANSWER ANY THREE 3X10=30

1) What is polyspermy? Explainthe mechanisms to block polyspermy.

Definition-1, listing the 2 mechanisms to block polyspermy - 1 ;2 mechanisms-4 marks each

Polyspermy is a condition in which an egg is fertilized by many sperms. There are two types; Physiological polyspermy and Pathological polyspermy. The mechnisms involved in checking of polyspermy is best studied in some sea urchins.

There are two main mechanisms to blockpolyspermy in monospermic forms, **Fast block and slow block to polyspermy.**

Fast block to polyspermy: The eggs of certain sexually reproducing organisms havedeveloped this fast mechanism to blockpolyspermy. This mechanism is developed within 1-3 seconds after the binding of the first sperm and losts for a minute hence the name fast block to polyspermy.

The fast block to polyspermy is achieved by changing the electrical potential of the plasma membrane of egg.Unfertilized sea urchin eggs have a negative charge(-70mV) inside.The ionic concentration of eggs differs from that of surroundings. The egg has more K^+ and less Na^+ inside, more Na^+ and lessK^+ outside. Soon after fertilization, the membrane potential of eggs shifts to a positive level ie +20mV.This change is caused by influx of Na^+ into the egg.The sperms cannot fuse with the egg membrane having a positive resting potential.

Slow block topolyspermy: The eggs of certain sexually reproducing organisms (sea urchin) have also developed a second mechanism to prevent polyspermy. Since the mechanism is developed 20second after the fertilization and is active for long time, it is called as slow block to polyspermy.In this method, cortical granules of the egg play an important role.After the entry of sperm into the egg, the cortical granules of the egg are pumped out, they release certain substance into the egg membrane, which contains the following 4 proteins that help in the formation of fertilization membrane [a)Proteases – separates vitelline membrane from plasma membraneb) Muccopolysaccharides – cause osmatic gradient that makes water to rush into perivitelline space. c) Peroxidase- hardens the fertilization membraned) Hyaline – forms a coating on the fertilization membrane]. The fertilization membrane prevents entry of sperms into the egg.

2.Give an a/c of

a) Fate map of blastula of chick

explanation-3; diagram-2

Fate map is the topographical chart of the blastula with respect to the ultimate fate of presumptive ecto,endo and mesoderm.

In chick before gastrulation, the multi- layered blatoderm of area pellucidaget rearranged to form a single layer of cubical epithelial cells called epiblast. Prospective presumptive areas in epiblast are; In the center lies a small area, destined to produce the notochord; posterior to it, is an elongated oval area of presumptive endoderm which will form gut. To the right and left of these regions lies presumptive mesoderm. Anterior to presumptive notochord is the crescentric area of neural ectoderm.Anterior to it is large area of presumptive embryonic or epidermal ectoderm. All these presumptive areas lie within area pellucida. Area opeca do not form any part of embryo proper,they form extra-embryonic membranes and it is located as outer ring, next to embryonic ectoderm.

b) Regeneration in amphibia.

Regeneration definition-1; listing 3 phases-1;brief explanation of each–3 (1 each)

Regeneration is the ability of an organism to regrow the lost or cut part. Interstitial cells represent the reserve of embryonic, totipotent cells that take part in regeneration. Regeneration involves cells proliferation and migration, blastema formation and differentiation of blastema into last or cut part.

Among amphibans, urodeles (salamanders and newts) possess the very high capacity of regeneration of limbs, tail etc. Limb regeneration in newt and axolotl are extensively studied. Whenever a limb or tail is amputed, process of regeneration begins immediately which include the following phases **1)phase of wound healing or preblastema stage**- clotting of blood and migration of epidermal cells from the basal layer of the adjacent epidermis towards the centre of the wound;within 24hours of the cut, wound is covered with thick epithelium **2) phase of blastema formation**- cells accumulate beneath the newly formed epithelial covering and the combined cap of epithelial and adjacent cell mask is known as blastema.**3)phase of differentiation and morphogenesis**- when the blastema reaches acertain size de-differentiation ceases and the established blastema enters into a growth phase.

3) Describe the process of gastrulation in Amphioxus.

explanation- 5; diagrams - 5

Gastrulation is a process in the embryonic development involving cell movements (morphogenetic movements) during which the single layered blastula is reorganized into diploblastic or triploblastic gastrula withtwo or three germ layers.

Gastrulation in Amphioxus occurs by invagination (emboly), involution and epiboly. It starts with the rapid proliferation of smaller ventral micromeres or ectodermal cells. As a result,the larger dorsal yolky megameres(endodermal cells) first become flattened then concave and gradually pushed into the blastocoel. This process is invagination or emboly. It continues till the blastocoel is completely obliterated and a new cavity, called archenteron

forms which opens to the exterior through a wide opening, the blastopore. Its edges are the lips of blastopore.The embryo now becomes cup shaped, double layered gastrula.
The anterior dorsal lip of blastopore contains the chorda cells, while the lateral and ventral lip has mesodermal cells. Then involution of notochordal& mesodermal cells takes place. Gastrula elongates along the antero-posterior axis and dorsal surface becomes flat. Dorsal lip grows fast shifting the blastopore to posterior end which will be reduced to a small opening. Outer ectodermal cells develop cilia. Gastrulation is completed by the formation of gastrula with germ layers; outer ciliated ectoderm with neural plate; the inner cells of gastrula have a middorsal strip of notochord cells, on the two sides of which are mesodermal cells. The lateral and ventral cells are endoderm cells.

4. Explain the morphological and physiological changes during metamorphosis of frog.
morphological changes-6physiological-4

Metamorphosis is the post embryonic activation of morphogenetic processes associated with a change in habitat, structure, function and way of life. In frog, metamorphosis is associated with a transition from an aquatic herbivorous, tailed tadpole larva to a terrestrial carnivorous, tail less frog.

Morphological changes: It includes

- **Regressive changes:** The organs or structure necessary during larval life, but no longer needed in the adults are either altered or disappear completely. The long tail with dorsal and ventral fin folds are reabsorbed, the internal gills are reabsorbed, gill clefts are closed, the horny rasping teeth and ventral sucker disappear and is replaced by the jaws. Lateral line system disappear and cloacal tube is reduced.
- **Progressive changes:** Where organs develop and become functional during and after metamorphosis- differentiation of limbs, hind limbs increases in size, the eyes protrude and develops eyelids and nictitating membranes.
  The middle ear and tympanic membrane develops to receive sound vibrations, gill arches become modified into the hyoid apparatus and the tongue develops from the floor of mouth. With development of lungs, corresponding changes takes place in the vascular system, the afferent and efferent vessels develops heart becomes 3 chambered. Aortic arches take on the pattern of adult. Intestine which is very long and coiled as in herbivores become short and straight, the larval pronephric kidney is transformed into the mesonephric, the brain become highly differentiated.

Physiological changes occur with the morphological changes. 1) change in mode of excretion from ammonotelism to ureotelism2)herbivorous to carnivorous mode of digestion 3) change in respiration pigment 4) vascular system changes 5) change in physiology of hearing 6)endocrine function of pancreas starts 7) modification in visual pigments.

5.What is isolation? Explain post-zygotic isolating mechanisms.

Isolation definition -1, post-zygotic isolating mechanisms definition &listing four types-1,explanation of 4 types – 8 ;2 marks for each type

Separation of a single population into several subunits by some barriers that prevent interbreeding is called isolation. Isolation is essential for speciation.

post-zygotic isolating mechanisms are those which prevent the development of hybrid individuals after fertilization or which reduce the fertility of F1 hybrids or the viability of their descendants. There are 4 types of post-zygotic isolating mechanisms-1) cytological isolation 2) zygotic mortality 3} hybridinviability 4) hybrid sterility

1) cytological isolation –fusion of cytoplasm of egg and sperm (amphimixis) after penetration of spermthrough the egg membrane is noticed generally. In cytological isolation, fusion of cytoplasm of eggand sperm fails to complete(absence of amphimixis). **2) zygotic mortality**– the gametes from two closely related species may fuse but the zygote fails to survive or the hybrid zygote development is inhibitedex. interspecific hybrid between two species of Jimson weed(Datura) result in the death of embryo at 8- cell stage 3} **hybrid inviability** – In some interspecific interbreeding, the zygote develops normally but the hybrid does not survive or F1 hybrid produced has reduced viability ex. Warwick and Berry (1949) showed that the cross between goat and sheep produce normal embryos but they die during development 4) **hybrid sterility-** breeding is effective,hybrids are produced successfully. But hybrid produced is sterile and fails to reproduce. it may be due to abnormal development of gonads or abnormal meiosis ex.mule is produced when male horse and female donkey are interbred. it fails to reproduce due to hybrid sterility.

6. Write notes on a) Analogous structures b) Adaptive radiation.

a) Analogous structures

Definition -1, description with examples-4

Organs similar in appearance and perform the same function but differ in their origin and basic structure ex. wings of birds and insects; eye of vertebrates and cephalopods.

b) Adaptive radiation.

Definition -1, description with an example -4

It is the evolution of a group of animals along a number of different lines involving adaptations to a variety of ecological niches (Dowdeswell).or

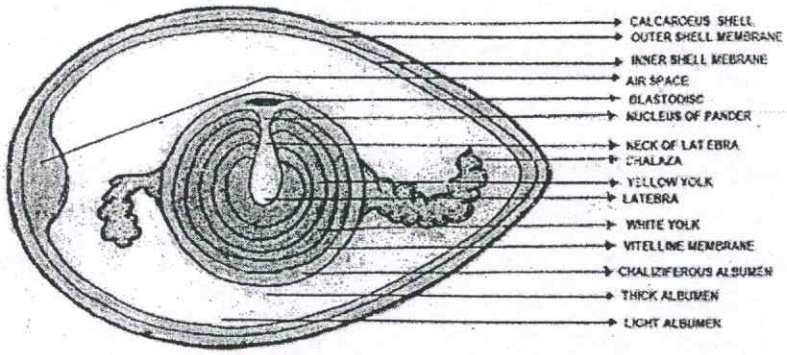
Is a process in which organisms diversify from an ancestral form into a multitude of new species due to diversification in the environment.It is divergence or divergent evolution. It serves as an evidence for evolution.

ex. adaptive radiation in reptiles or mammals or Darwin's finches.

II 1.

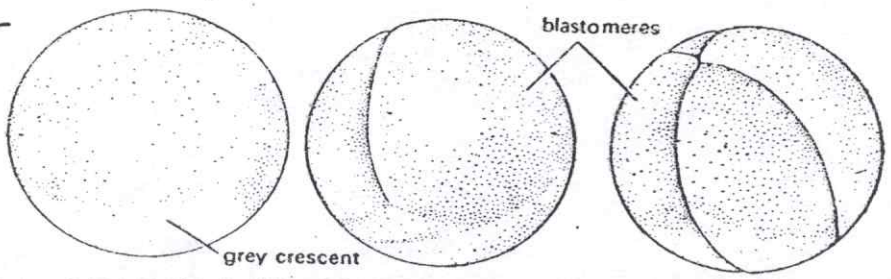
1) Sketch and label the Hen's egg.

Diagram with labellings (any 10) = ½ M each



HEN'S EGG

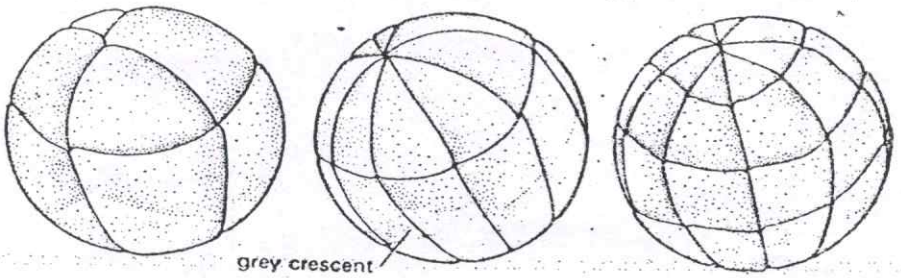
II. 4



FERTILIZED EGG OR ZYGOTE

FIRST CLEAVAGE 2 CELLS

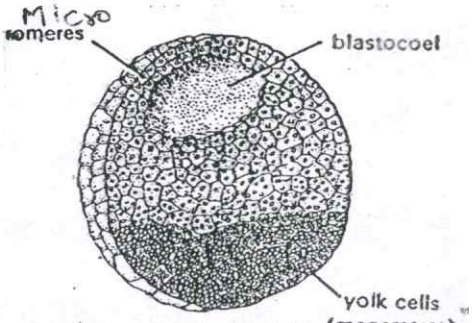
SECOND CLEAVAGE 4 CELLS



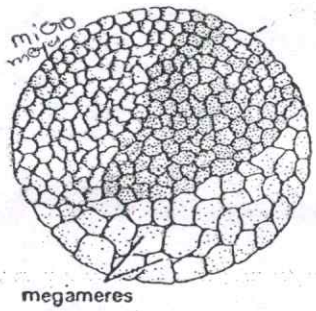
THIRD CLEAVAGE 8 CELLS

CLEAVAGE 16 CELLS

CLEAVAGE 32 CELLS



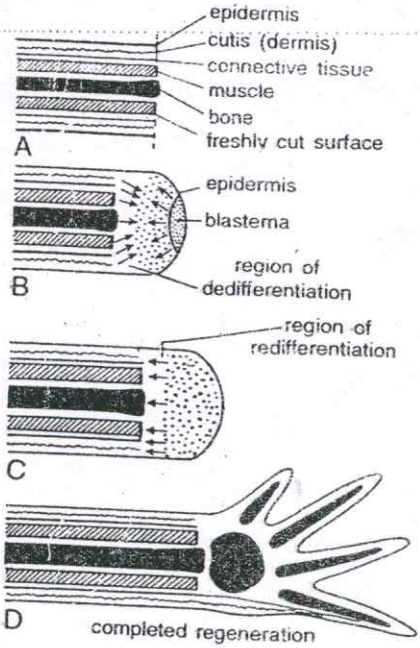
V.S. OF LATE BLASTULA



LATE BLASTULA

Fig. 31·4. Frog. Cleavage in fertilized egg or zygote.

III 2 (b)



Regeneration in Amphibia (Diagramatic repretn

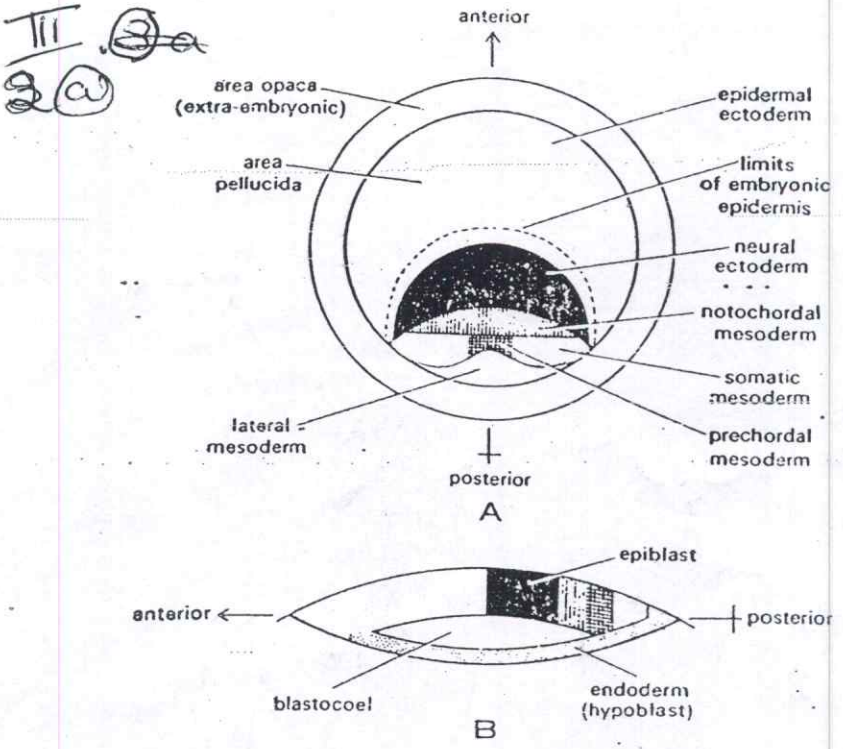


Fig. 31·18. Fate maps of chick blastoderm. A—Surface view of epiblast ; B—Diagrammatic section of discoblastula showing the fate map of epiblast and hypoblast at a glance.

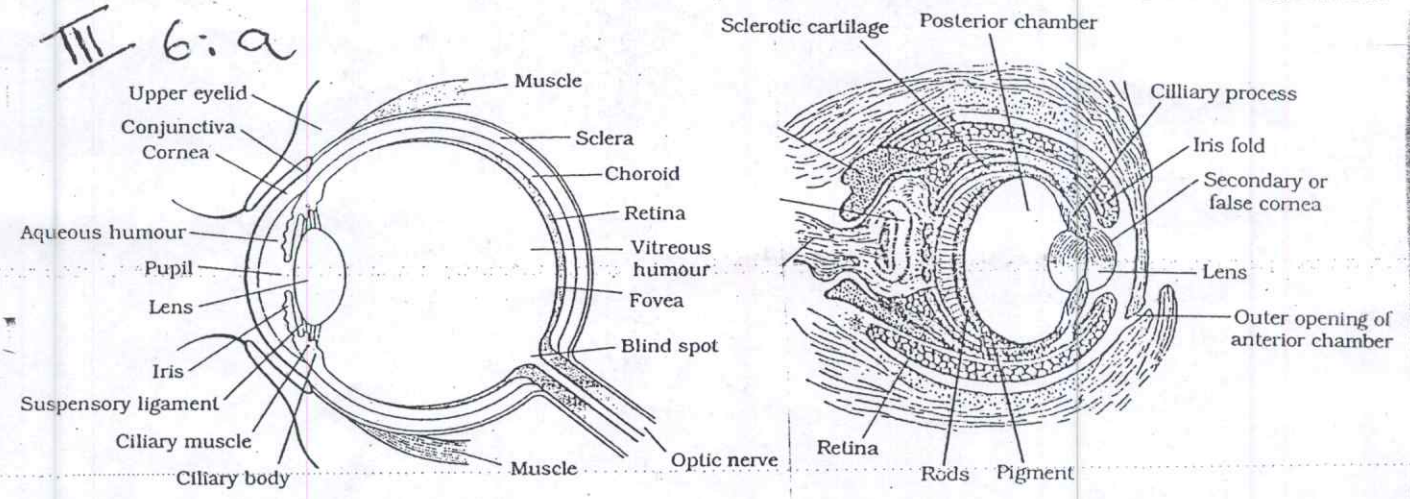
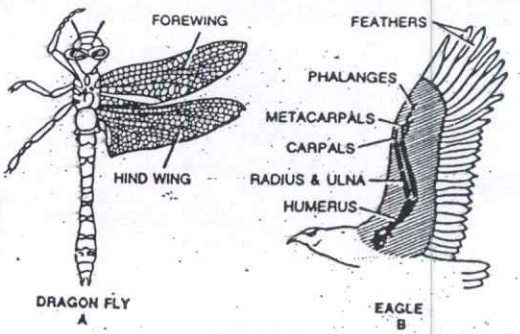
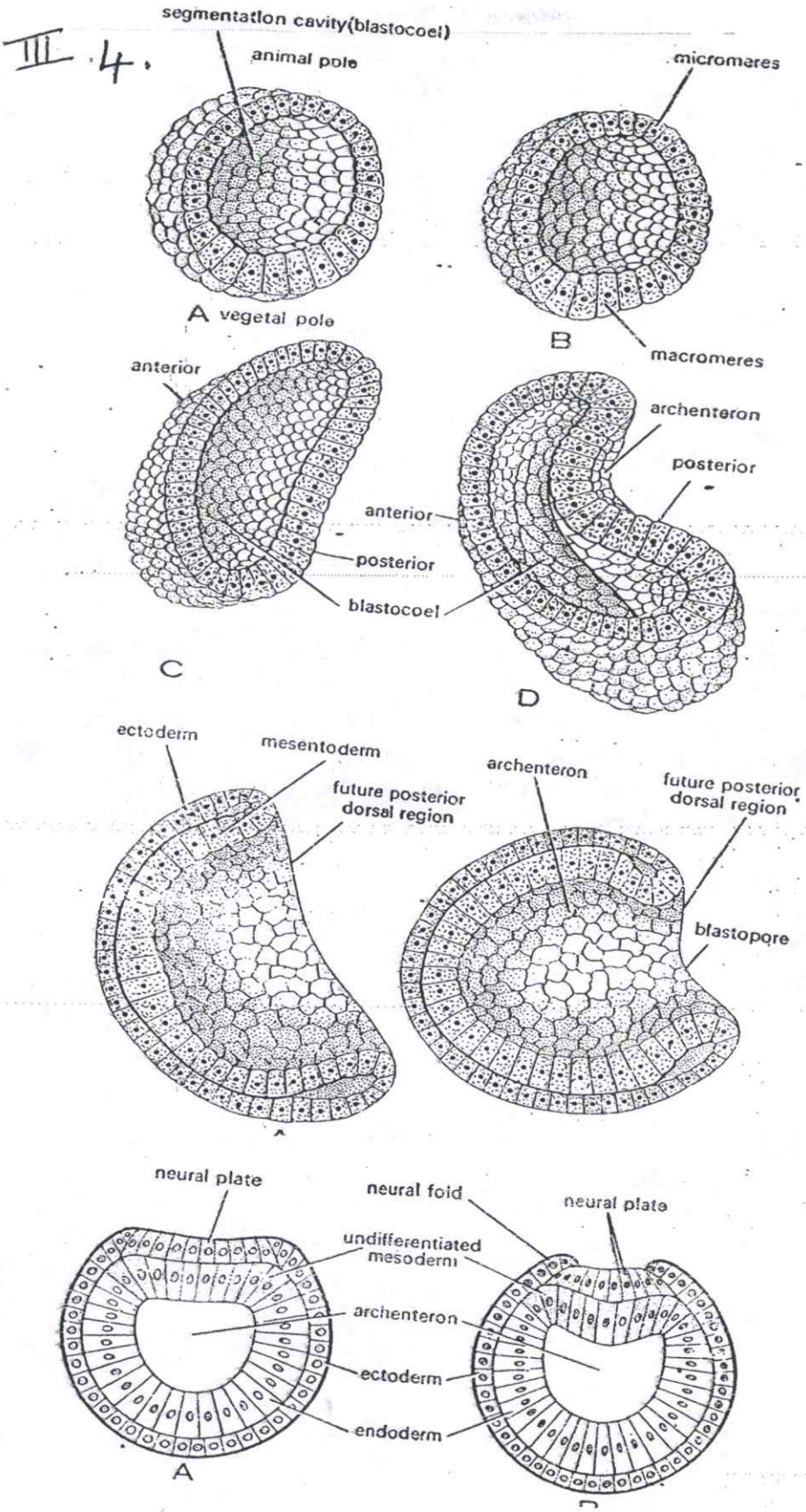


Figure 25 Section of a cephalopod eye

Study of analogous structures illustrates the occurrence of convergent evolution.



III. 4.



Bangalore City university C

Sub : zoology paper v

Max Time:3hrs sub division of the subject: Ecology and Ethology. Marks:70

I Answer the following questions in one word or in a sentence- 10×1=10

1. Earnst- Heckel

2.Small place where the animal lives and perform its life activities.

3 .measurement y population per unit area

4 .It is the bio-chemical modification of one chemical compound or a mixture of chemical compounds.

5. It is generic term given to compounds containing chlorine, carbon and hydrogen.

6 IPM- Integrated pest management

7. It is used to aquiring information, detecting, analysing montoring the characteristics of an area.

8.Response to stimulus.

9.convey the information through signals.

10. It is the principle and moral practice of concern for welfare and happiness other beings or animals.

II Answer any five of the following -5x3=15

11 .Stalt the I law of thermodynamics with an example-1/2+1/2=

12. Explain hydrosphere in brief. meaning -1 stages -1

39 1/2

33 1/2 22 1/2

An area of open Freshwater will naturally dry out, ultimately becoming woodland.

Stages:

phytoplankton.

Submerged

Floating

Reed Swamp

Sedge-meadow

wood land.

13 Given any three causes for acid rain -3

1.use of CFC

2Burn of fossil fuel

3.coal burning power plant

4.Auto mobiles

14) Write a note on Biomagnification 1+2

* It is a short document established for documenting rare and endangered species

*It phrase an important rule in the protecting of the endangered species of a state or country

*it provide relevant information about rare species of plants and animals to facilitate research and studies.

Red data book.

* It is the easier way to keep track of the programme that are conducted to prevent these species from becoming extinct.

16) Explain motivation with an example 1+2

Definition: it is the process of motivating individual to take action in order to achieve a goal.

Types:

1.incentive motivation

2.fear motivation

3.power motivation

4.social motivation

Importance: it helps in achieving tasks used to reach the goal

17) Write a note on parental care in fishes 3marks

Defnition : Caring of young ones by its own parent

Ex: Hippocampus,Arias jella

Part C

III Answer the following 5 x5=25

18) Explain the primary productivity in an ecosystem(1+2+2)

Def: It is the role at which energy converted to organic susbstances by photosynthetic producers which obtain energy and nutrients by harnessing sunlight and chemosynthetic producers which obtain chemical energy through oxidation.

*Types of primary producers

Aquatic : plankton and Algae

Terrestrial –Green plants

- Collecting primary productivity
  Total amount of biological productivity in a region is called primary productivity.
  PP= Uptake of CO2/ out put of o2
  PP= Amount of O2 consumed / volume of H2O in a fixed period
  Importance : Photosynthesis important in food chain.

19) Write a note on monoclimax and polyclimax theory (2 ½ +2 ½)

Monoclimax : every region has only one climax plant community towards which all are it is developed by elements (1916,1936)

Major concepts are

1.All successions of a region lead through time to the some adult organism regardless of earlier site differences.

Monoclimax theory allows for only the climate climax is a region and the polyclimax theory allows several climaxes.

*Monoclimax vegetation it is now more commonly known as the monoclimax

*This occurs when the vegetation is in hormony with the local environment ,as several stages develop the number of species and weight of the plant increases.

* Each named after the dominant species.

Pioneer community

⇩

_____ several stages temporarily condition which develop over time

⇩

_____climax

Polyclimax : Number of different climax communities are present in climate geographical region

- Thus preclimax ,postclimax communities are all climax communities .They are all self reproducing communities ,they can maintain themselves or an indefinite period of time .
- This thory does not rule out climax communities but it gives other stages of communities as all stages.

2) Climate factors determine the dominant species that can be present in a region.

3) Although climax is permanent because of the harmony with a stable habitat the equilibrium is dynamic and static.

Polylimax: Tausley (1939) explain polyclimax theory there may be a number of different climax communities within a climatic region.

20) Explain the consequences of ozone layer depletion.

1. Warming of the troposphere and cooling of stratosphere.

2. Lighter risk of skin center.

3. Weakens immune power.

4. Mutation.

5. Quick Aging

21) What are non-conventional energy resources and mention the types and uses.

Renewable or available in abundance on earth

Ex: Wind/Solar/Hydro/Geothermal/Tidal

22) Discuss imprinting with an example.

It is a form of learning in which a young animal fixes its attention on the first object with which it has visual, auditory or tactile experience and there after follows the moving object.

Ex: Ducklings, Chicklings

23) Give the toxic effects of fungicides and herbicides

Fungicides: Headache, salivation, nausea, vomiting, abdominal pain, diarrhea, blurred vision, unclear speech, central nervous system depression, hypertension, cardio respiratory depression

Form the base of the soil

Climate: The rate of weather and organic decomposition is influenced by temperature.

Organisms: Micro-organisms such as bacteria and fungi.

Edophile factors: Soil profile, Structure, Porosity, Soil Moisture, Soil air.

Herbicides : Acetomide aliphatic acids ,gastrointestinal ,respiratory ,nerves chlorophenoxy anilides

Benzoritrites Benzothorad: respiratory tract ,skin

24) Echolocation in Bats :

Bats produces echolocation by emiting high level frequency sound pulses through their mouth or nose by listening to the echo with their echo the bat can determine the size shape and texture of objects in its environment.

Echolocation occurs beyond the range of human hearing ,human hearing from 20hz to 15.20 khz bat use range from 9khz to 20khz

Uses of echolocation

Identification of bird object feeding site swelling site

Part –D

III Answer any two of the following

25)write a note on spatial Niche b) soil as abiotic factor

Spatial Niche : physical area within the habitat that the species occupied in an ecosystem in an ecosystem

Eg: species of millipedes.

Soil as abiotic factor: parent material

Minerals from the soil

26) Solid Waste Management

The collecting, treating and disposing of solid material that is discarded.

Types of Waste: Industrial waste, radio active waste, clinical waste, garbage, household, school, office, restaurant.

Methods: Recycling and reusing.

Importance: For the protection of public, health, safety and environmental quality.

27) What is conservation and explain its types?

Definition: Conservation of ecosystem and natural habitats and the maintenance and recovery of viable population of species in the natural surroundings.

Types: 1) Bio-sphere reserve: large area- 5000km2

2) National parks: area reserved for conversation

3) Wild life sanctuaries: animals only 551 wildlife sanctuaries

28) Social Organization in Termites

1) Construction of termite mounds

2) Caste System

3) Function of individuals

PART A

I **Answer any five of the following.** 5 X 3 = 15

1. Define spatial niche. Give an example.

Definition – 02 marks, Ex – 01 mark

Physical space occupied by the organism. The organisms which belong to the same genera live together in the same habitat but occupy specific spaces / microhabitats. Occupy the same trophic level and exhibit the same interactions with other biotic and abiotic factors.

Ex; O.Neil described the spatial niche of seven different species of millipedes, which are scavengers are found around a log but the microhabitat / the specific spaces they occupy are different.

2. Briefly explain the concept of net primary productivity.

It is the rate of storage of organic matter in plant tissues in excess of the respiratory utilization by plants during the measurement period. The rate of biomass increases. It refers to balance between gross photosynthesis and respiration and other plant losses as growth and reproduction. NPP = GPP – R, where R is energy used in respiration.

Measures of net primary production include: Change in dry biomass per unit time, Calorimetry, Carbon dioxide uptake over time, Oxygen uptake over time, Change in chlorophyll-a concentration.

It is measured by harvest method, oxygen measurement method, oxygen diurnal curve method, carbon dioxide measurement method, aerodynamic method, pH method, radioisotope method and chlorophyll estimation method.

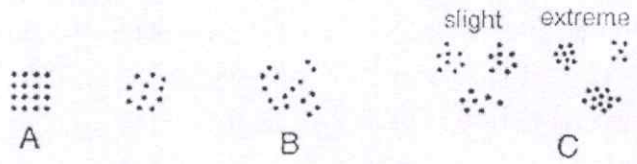
3. Comment on dispersion as a population attributes.

The spatial pattern of individuals in a population relative to one another is called dispersion.

REGULAR DISPERSION - The individuals of a population are regularly arranged and more or less spaced equal distance from one another. This is rare in nature but is common in managed systems (cropland), in fields or orchards. Animals with territorial behavior tend toward this dispersion.

RANDOM DISPERSION - The position of one individual is unrelated to the positions of its neighbors. This is also rare in nature.

CLUMPED DISPERSION - Individuals are grouped together in one part of the area and there is a lot of space between the groups. Such an aggregations may result from social aggregations such as family groups or may be due to certain patches of the environment being more favourable for the population concerned.



A. Regular dispersion. B. random dispersion. C. Clumped dispersion.

4. **Explain parasitism with a suitable example.**

Definition -01 mark and types -02 marks and ex – 01 mark,

It is an inter-specific interaction in which the organism living on or in the body of another organism and derives its food more or less permanently from its tissues. So parasites are categorized into two types namely Ectoparasites and Endoparasites.

Ectoparasites live on the outer surface of the organism or associated with body cavities like mouth, gill chambers, cloaca etc. ex: Fleas' and ticks, mosquitoes etc.

Endoparasites reside deep within the body of the host and are more specialized than ectoparasites, both in their life cycle and in their structures.

Partial parasitism- Blood sucking bugs, flies, leeches and vampire bats may be in contact with their hosts for only short period. Glochidium larva.

Obligatory parasitism. The parasites cannot live without the host, they even exhibit host specificity. Ex - Plasmodium, Trypanosome and Entamoeba, flatworms, sacculina etc

Facultative parasitism - The parasites have continuously a parasitic mode of life. The larvae of mosquito are herbivorous and adults are parasites.

Hyperparasitism - A host harbors a parasite, which has small parasites and these in turn are hosts to even smaller parasites.

Ex: a bird like a parrot harbours ticks and mites. The ticks and mites may have parasites like lice, which have parasites like bacteria and virus in them.

5. **What are fungicides? Give two examples.**

Fungicides definition – 02 marks and any two examples – ½ mark each.

Chemicals which control fungal infection in agriculture or forestry. All fungicides have low toxicity to plants, birds and mammals so these are not potentially hazardous in the short term. However some products contain metals which accumulate in food chains and humans in the long term.

Ex - surface fungicides - phenylmercury, alkylmercury, organicthiocarbamates are used to the foliage as sprays or dusts, these does not penetrate the plant surface, but kills the fungus and surface spores. Benomyl, Thiophantemethyl, Carboxin, and Triarimol are more effective. Benomyl and Thiophanates.

6. **Write a note on alarm calls.**

Many primates and birds have elaborate **alarm calls** for warning conspecifics of approaching predators. Ex-The characteristic alarm call of the blackbird is a familiar sound in many gardens.

Different calls may be used for predators on the ground or from the air. Often, the animals can tell which member of the group is making the call, so that they can disregard those of little reliability.

Some birds have more than one alarm calls; each used response to different kind of predator. Ex: Many birds used alarm call in some contexts but others use and easily located **Mobbing call** that attracts other birds that together attack the predator.

Vervet **monkey** has several distinct alarm calls, each signaling the presence of different predator. Animal hearing these calls make appropriate responses. EX: Rush in up to trees in response to a **Leopard call**, looking up in response to an **eagle call** and looking down in response to **snake call**.

7. Enumerate any three diagnostic features of biological clock.
Any three features – 01 mark each

- Biological clocks are not dependent on temperature.
- It is unaffected by **metabolic inhibitors** which are known to block biochemical reactions.
- The biological clocks are controlled by the **physiological processes** of the body. Ex: **Birds** use their internal time keeping processes in **sun compass** orientation.
- **Light** is an important factor in resetting biological clocks.
- Bird migration depends on **season** and **internal physiological** and **endocrine balance** and on its **genetic makeup** by which bird selects a particular angle of **star pattern**.
- In **directional orientation**, bird has ability to select a particular compass direction and **flies** in that direction.
- In **goal directed orientation**, birds flew to some goal area as in the orientation of **pigeons**.
- In **non sense orientation** animal moves without any aim in different directions at a time and no biological purpose is served.

4. Biological clocks keep **normal cycle** even in the absence of **environmental cues** and are **self sustained** in nature.

- In biological rhythms animals show **differential activity** or **inactivity** in more or less regular patterns. These rhythms are categorized into five namely epicycles, tidal rhythms, lunar rhythms, circadian rhythms, circannual rhythms.

PART B

II Answer any five of the following. 5 X 5 = 25

1. Justify soil as an abiotic factor.

It is weathered layer of the earth's crust with living organisms and their products and best medium for plants, minerals and water. It is formed by the disintegration and decomposition of rocks due to weathering and action of many bacteria, fungi, protozoa and earthworms and various chemical substances.

It is composed of distinct layers called soil horizons. **Top soil (A horizon)** is composed of roots of some plants and animals. **B horizon** is made of mineral soil in which the organic compounds have been converted into inorganic compounds by mineralization by decomposers. **C horizon** composed of unconsolidated parent material. **D horizon** represents the rock or unmodified parent material. Thickness of the horizons varies from soil to soil depends on interaction of climatic and biological factors.

Physical soil is classified into **i) Clay** soil - 30% of clay. **ii) Sandy** - 10% clay and silt. **iii) Loam** - 30% clay and silt, rest is sand; it is best soil for vigorous agricultural crops growth. **Humus** - surface layer of soil, consists of organic matter, best for both plants and animals.

Chemically soil contains chlorides, nitrates, sulphates, phosphates and carbonates of sodium, calcium, magnesium, potassium and iron, trace elements like boron, manganese, copper, zinc, aluminium and molybdenum. These trace elements are involved in plant growth. Acidity or alkalinity of the soil is an important limiting

factor. **Soil air** in the interspaces of soil particles helps in normal respiration of soil organisms like aerobic bacteria, fungi, protozoans and earthworms. Land snails are found in soil rich in calcium, which is required for shell formation. Thus chemical nature of the soil influences the distribution of animals.

Distribution of animals depends on specific food in particular soils. Burrowing animals make the soil loose for better aeration and percolation of water. Fertility of soil is increased by microorganisms and earthworms.

Many plants depend on supply of water. Soil is the most important substratum for animals in land environment, helps in special adaptations. Ex: Animals living in soft soil are characterized by spread out feet like **Camel**. Sand lizards and insects have wide toes or legs by lateral scales or hair.

2. **Give an account of mutualism.**

Mutually beneficial inter-specific interactions which are obligatory associations, both the species derive benefits. Often permanent contact more or less essential for survival of each and are unable to survive separately.

Contact of **lichens** is close, permanent and obligatory. Their body is made up of a matrix formed by a **fungus**, within the cells of which an alga is embedded. The bacterium **Rhizobium** forms nodules in the roots of leguminous plants and live symbiotically with the host.

Some unicellular algae like **Zoochlorellae** live symbiotically in the outer tissues of certain sponges, Coelenterates, mollusks and worms. Algae are photosynthetic and produce nitrogen compounds beneficial to hosts and in exchange, they obtain materials released by metabolism of hosts' animals. The green alga, **Chlorella vulgaris** lives within the gastrodermal cells of **Hydra**. Alga through photosynthesis provides food and water to Hydra which in turn provides shelter, nitrogenous wastes and carbon dioxide to Chlorella. **Bees, moths, butterflies** etc derive food from the nectar or other plant product and bring about **pollination**.

Termites feed on wood. Termites cannot digest cellulose of wood. The **protozoans (Trichonympha)** which are present in their guts digest cellulose for termites and in return obtain food and shelter from the termites.

3. **Enumerate the important causes and effects of acid rain.**
Causes – 02 marks, effects – 03 marks.

- The oxides of sulphur and nitrogen are pollutants produced mainly by combustion of fossil fuels, smelters, power plants, automobile exhausts, domestic fires like coal, fuel wood or petroleum products has sulphur and nitrogen.
- Sulphur and nitrogen when burnt in the presence of atmosphere are converted into sulphur dioxide and nitrogen oxide which are highly soluble in water and react with the water molecules in the atmosphere to produce acids. These oxides are swept up into the atmosphere and can travel thousands of kilometers, then stay there and then oxidized into acids like sulphuric acid, sulphurous acid, nitric acid and nitrous acid which dissolve in the water in the atmosphere and fall to the ground as acid rain or may remain in atmosphere in clouds and fogs.

Effects.

- Does not directly affect human health. Increased amounts of fine particulate matter in the air causes heart and lung problems including asthma and bronchitis.

- Acidity kills fish, many bacteria and blue-green algae thus aquatic ecosystem is destroyed.
- Coral's limestone skeletal is sensitive to pH drop, because the calcium carbonate, core component of the limestone dissolves in acidic (low pH) solutions.
- Acidification of soil changes its biology and chemistry. When the soil get acidified, plants can absorb high levels of cadmium more easily which is dangerous for animals and human beings. Nutrients as calcium, magnesium, potassium have been leached away from soil by acids.
- Acid rain also damages **building, monuments, statues, bridges, fences, railings etc.**

4. List the harmful effects of a) Lead. b) Mercury. 2.5 marks each

LEAD

- Primary sources are industrial dusts and fumes, polluted food. Target organs are nervous system and kidney. It causes abdominal pain, vomiting, diarrhea, oliguria, collapse and coma. There is inflammation of gastro-intestinal tract mucosa and degeneration.
- Chronic inorganic lead poisoning occurs in three states; **i) Early stage** characterized by loss of appetite, weight loss, constipation, irritability, occasional vomiting, fatigue, weakness and anaemia. **ii) Advanced stage** marked by intermittent, vomiting, irritability, nervousness. **iii) Final Severe stage** involving persistent vomiting, encephalopathy, lethargy, delirium, convulsion and coma.

MERCURY.

- Primary sources are industrial fumes, vapours, polluted food and water. Target organs are kidney and nervous system. Mercury salts are associated with acute exposure arising from attempted suicide or accidental ingestion.
- Target organs are kidneys. Chronic toxicity in man varies based on chemical form of mercurial and the duration of exposure. Metallic mercury poisoning following exposure to mercury vapour results syndrome called **mercurialism**. Main symptoms of this syndrome are stomatis, parasthesia, erethism and tremor.
- Organic mercury poisoning due to methyl mercury is well defined syndrome. Hunter-Russell syndrome or new more common **Minamata disease**. The main symptoms of this are parasthesia, ataxia, dysarthria, tremor and constriction of the visual field.

5. With respect to solid waste management explain land filling and incineration.

Land filling – 03 marks, incineration – 02 marks.

Land filing - These are sites where waste is isolated from the environment until it is safe. These are different from the open dumps (simple dumping places) which are engineered operations, designed and operated according to acceptable standards. The basic principle of this operation is to deposit the refuse, compact it with bulldozers and cover the material with at least 6 inches of dirt at the conclusion of each days operation and a final cover of 2 feet when that is full the engineering aspect include i. Drainage – rapid run off to prevent mosquito problems, ii. Wind – down wind from the community. Iii. Distance from collection. iv size- a small site with limited capacity is not desirable of ultimate use. When all the trucks arrive to the landfills, they first get separated into their proper place; disposing of waste in a landfill involves burying the waste, and this remains a common practice in most countries. Sanitary landfills

asides where waste is isolated from the environment until it is safe. It is considered when it has completely degraded biologically, chemically and physically. Older, poorly designed or poorly managed landfills can create a number of adverse environmental impacts such as wind-blown litter, attraction of vermin, and generation of liquid leachate. Another common byproduct of landfills is gas (methane and CO_2), which is produced as organic waste breaks down anaerobically. This gas can create odor problems, kill surface vegetation, and is a greenhouse gas. Modern landfill Designs include methods to contain leachate such as clay or plastic lining material. Deposited waste is normally compacted to increase its density and stability, and covered to prevent attracting vermin (mice or rats). Many landfills also have landfill gas extraction systems installed to extract the landfill gas. Gas is pumped out of the landfill using perforated pipes and flared off or burnt in a gas engine to generate electricity.

INCINERATION - It is a disposal method in which solid organic waste (medical waste) is subjected to combustion so as to convert them into residue and gaseous products. This method is useful for disposal of residue of both solid waste management and solid residue from waste water management. It reduces the volumes of solid waste to 20-30% of the original volume. It is also called thermal treatment, because incinerators convert waste materials into heat, gas, steam and ash. It is carried out both on a small scale by individuals and on a large scale by industry. Combustion in this is not always perfect hence is controversial method of waste disposal due to issues such as emission of gaseous pollutants.

6. **Write a note on taxes.**
   Definition – 01 mark, any four types – 01 mark each.

ε It refers to the orienting behaviour of an entire mobile animal that moves directly towards or away from a stimulus. If the movement is towards the stimulus the reaction is called **positive taxis**, if movement is away from the stimulus the reaction is called **negative taxis**.

ε Taxes are most prominent behavioural patterns in lower invertebrates. There are many types of taxes depending on the kind of stimulus.

a) **Phototaxis:** Light is the stimulus. Paramecium shows positive phototaxis for moderate light and negative phototaxis for total darkness or bright light.

b) **Thermotaxes:** Response to temperature. Paramecium prefers the temperature between 24-28°C, so for this range it shows positive taxis. Below 24°C or above 28°C it shows negative taxis. Amoeba prefers the temperature between 20-25°C.

c) **Chemotaxes:** The response of animals to the chemical substances is referred as chemotaxis. Paramecium is negatively chemotactic for most chemicals but positively chemotactic for mildly acidic environment.

d) **Geotaxes:** The response of the animals to the gravity. Paramecium is negatively geotactic. It tends to collect at the surface with the anterior end uppermost.

e) **Rheotaxes:** Response to water or air currents. Paramecium swims downstream in slow current of water and upstream in fast current.

f) **Thigmotaxes:** Response to contact. Paramecium reverses its movement if its anterior end is touched.

g) **Galvanotaxes:** Response to constant electric current. Paramecium moves towards the negative pole (cathode) if the current is weak and towards the positive (anode) pole if the current is strong.

- **Effect on protoplasm** - In unicellular organisms there is a direct effect of light so UV ray can cause mutations in the protoplasmic DNA, in various organisms including higher forms also.
- **Effect on metabolism** – Effect is indirect cause's ionization of the protoplasm. Increases the enzymatic activities and solubility of salts and minerals. Solubility of gases decreases at high light intensity. Animals living in caves receive poor light that is why shows slow rate of metabolism.
- **Effect on pigmentation**- Cave animals lack skin pigments. The role of pigmentation and protective colouration in terrestrial animals is influenced by light.
- **Effect on locomotion and orientation.**

  Phototaxis – Animals move towards / away from a source of light.

  Photokinesis – Light affects the speed of locomotion. Ex; Larvae of Mussel crab move fast if exposed to increased light intensities.

  Photoklinokinesis – only a part of the animal body deviates from the source of light. Ex; Larvae of Musca domestica.

  Phototropism – It occurs in sessile organisms and involves light directed growth mechanisms. Tubiculous worms, Coelenterates (polyps) and flagellum of Euglena only a part of their body shows movement in response to light is called phototropism.

  +vely Phototactic – Organisms like Euglena, Volvox, Ranatra etc move towards the source of light called positively phototactic.

  -vely Phototactic – organisms like Planarians, Earthworms, Cockroaches, Slugs and Copepods etc avoid light called –vely phototactic.

  Phototropotaxis – when animals are confronted with two lights of equal brightness they move towards / away to a position that is mid distant between the two lights.

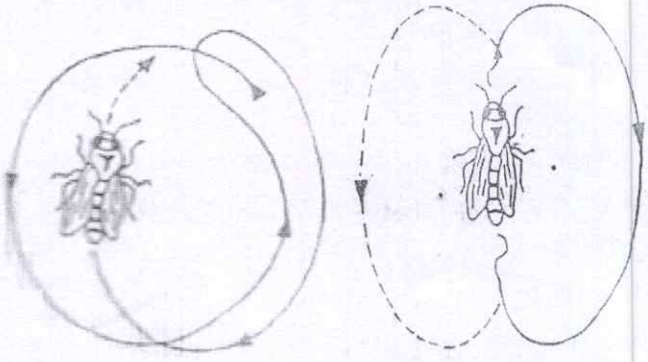
  Light compass reaction- some animals move at a constant angle towards the source of light. Ex: Ants and Bees.

  Telotaxis – attraction of males towards the flash of the females.
- **Photoperiodic effect** - The response of organisms to day length is called photoperiodism. Most of the animals reproduce during spring period due to greater length of the day.
- **Effect on terrestrial animals** - In vertebrates keratin reduce the penetration of light of all wavelengths. In birds the light affects reproductive activities though colouration, protective resemblance and migration. In insects the attraction of light is very strong; they fly into the source of light that may prove fatal to them.
- **Effect on aquatic organisms** - Primary production of food is restricted to surface layers of the sea where there is sufficient light to support plant life and animal life directly / indirectly is also affected. Even moon light is also sufficient in controlling many animal activities. Ex: Neries spawn at a particular period of a moon.
- **Effect on eyes** - The degree of development of the eye depends upon the intensity of light available in the environment. Animals living in total darkness (cave dwelling), like **Proteus, Necturus** and deep sea fishes etc lack eyes / have non- functional eyes / sedimentary eyes.
- **Effect on vision** - In dim light, a dull and overlapped superposition image is formed in insects. In strong light an apposition image is formed. Many fishes locate their food with the help of their vision that depends upon the intensity of light. Man is able to see various objects only in the presence of one / other form of light.

ε Lack of nervous system in Protozoa indicates that their responses are due to the innate irritability of protoplasm. The complex responses of higher forms are thought to have developed from these simple mechanical responses.

7. Give an account of dances in honey bees.

ROUND DANCE - This dance is performed if the food source is within about 85 metres from the hive. On return to the hive, the scout worker bee runs on the comb, where she is immediately surrounded by other bees. She disgorges a drop of nectar from her honey sac and starts dancing. She runs in a circle on the comb, once in one direction and then once in the opposite direction. She repeats this dance at one place for about half a minute. Then she stops, moves to another part of the hive, disgorges another drop of nectar and begins to dance. When she has disgorged the entire nectar in her honey sac, she flies out to gather more. This dance gives no information about the direction of the food source, but the bees know that they have to search for it near the hive. They get a definite clue from the dancing bee about the food source. In a round dance the forager or scout bee turn in circle first to the right and then to the left. It facilitates workers to search the correct food source by comparing the two smells like smell provided by the forager bees and the smell of target flower.



WAG-TAIL DANCE - If the source of food is more than 100 mts away, the informant bee performs a wag-tail dance on the vertical comb. It runs for a short distance in a straight line swiftly wagging / vibrating its tail and then moves in two semicircles one on either side of the straight line. Direction of the food is indicated by the direction of the tail wagging. If the honey bee runs vertically up the comb means the food is in the direction of sun. If the honey bee runs down the comb means the food is present opposite the sun. If the straight line is oblique, then source of food is at the corresponding angle. If it is dark, the worker bees touch the runner with their antennae to determine the direction of its run.

PART C

III Answer any two of the following. **2 X 10 = 20**

1. Discuss light as an abiotic factor.

Explanation of any ten points – 01 mark each.

Light has a stimulating effect. Intensity spectral quality of light, duration of illumination is very important to animals. The growth, pigmentation, migration and reproduction are affected by light in various animals like insects, birds, fishes, reptiles and mammals. In some animals excessive light may have an inhibitory action.

- **Effect on reproduction** - In terrestrial and aerial and some aquatic vertebrates the gonadal activities are under the influence of light, breed in summer. In winter there is a regression in gonadal activity of birds and other vertebrates like Farner, Lofts, Philips, Thapliyal and others, are known as long day animals.
- **Effect on development** - May / may not influence development directly. In reptiles, birds and egg laying mammals, light does not influence development. Salmon larvae undergo normal development only when sufficient light is available, in absence of light there is heavy mortality. The **larvae of Mytilus** grow larger in darkness than in light. In some insects the development is arrested when illumination decrease below a definite value.
- **Effect on photosynthesis** - Visible light is indispensable for photosynthesis, which is efficient means by which energy from abiotic world is trapped for utilization by the biotic world. The chlorophyll of the green plants trap the solar energy, CO_2 is combined with water to form carbohydrates.

2. **Explain chemical and biological control as approaches to pest management.**

   Chemical control – 05 marks, biological control – 05 marks.

CHEMICAL CONTROL - Killing insects by using **insecticides** is called chemical control, extensively used at present. The **toxicants** which kill insects are known as **insecticides / pesticides,** which are used in the form of **powder**, **solutes**, **sprays**, **emulsions / fumes.** They are divided into 4 major groups namely **Stomach poisons, Contact poisons, Fumigants and Repellents.**

- **STOMACH POISONS- Toxicants** are ingested by many insects along with **food**. Insects with **chewing**, **sponging**, **lapping / Siphoning** mouth parts are killed by poisons. Common stomach poisons are,
- **CONTACT POISONS** - Toxicants which kill the insects on coming **indirect contact** with them. These are employed to insects with **piercing and sucking** mouth parts.
  - **DDT** – It is employed in the farms of spray for killing the insect pests of man and crops. It is **relatively safe** but certain **mosquitoes** and other arthropods have become **immune** to it.
  - **BHC** – used as spray for killing **Aphids on fruit and nut crops**.
  - **Malathion** –It is less **toxic for man** hence used widely, alternate to DDT.
  - **Pyrethrum** –used as a spray to kill **house hold** and **live stock pests** and certain **vegetable pests**.
  - **Aldrin** –It is widely used for the control of **grass hoppers**, **cotton pests** and **soil insects**.
  - **Taxophene** –Used to kill pests affecting crops, **vegetable** and **live stock**.
  - **Mineral oils – Kerosene, Crude oils, Mobile oils** etc are used to kill **mosquito larvae and pupae, scale insects, meals, bugs and mites etc.**
- **FUMIGANTS** - These are **toxicants** which are used as **gases** to kill insects such as **ware houses, ships, mills, shops** etc. common **fumigants** are **HCN, CS_2, Ethylene dichloride, Methyl bromide, SO_2 etc.**
- **REPELLENTS** - Substances used to repel the insects rather than kill them. Mild poisons, **Trichlorobenzene** are used to protect buildings from **termites**. **Bordeux** mixture and **lime** ward off **leaf hoppers** and some **chewing insects**. **Oil of Cidar** protects materials from attacks of **carpet beetles** and **clothes moth. Pinctar oil**

diphenylamine prevents **saw flies** from laying eggs in the wounds of animals. **Mosquito repellents** and fly spray lessen the attacks of blood **sucking flies** and mosquitoes.

HAZARDS OF INSECTICIDES.

- **DDT** was discovered in the tissues of fish, wild animals and humans but it could cause **blood cancer (leukemia)** in lab animals. **BHC** was found to cause **nervous disorders** and **fumigants cell mutations**, **cirrhosis, carcinoma, high BP, tumour** formation and **sterility** and also **insecticides, polluting human food**.
- **Over exposure** to chemical pesticides insects becoming **immune** to that.
- 156 out of the **1000** species of **crop pests** have built up **resistance**.
- **Pesticides** frequently kill the **beneficial insects** also that help to keep pests under control.
- To meet the hazards of insecticides the Entomologists advocate a different approach called integrated pest control.

BIOLOGICAL CONTROL

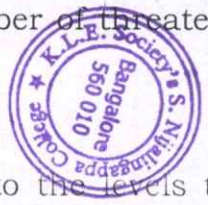
- **HORMONES - Juvenile hormone** is secreted by the **Corpora allata** (paired glands which are associated with brain) during larval stages. It permits moulting of larva to larva but inhibits metamorphosis. Some **trees** secrete substances **with juvenile hormone** like activity, when ingested these **prevent the maturation of larvae** into annoying adults and **reproduction**, thus protect the trees.
- **PHEROMONES** - These are the substances secreted by the **exocrine glands** and released into the **external environment**. These cause specific reactions in other animals of the same species. These include **sex attractants**, secreted by females that can attract males of the same species from a distance **4.5 km**. These **attractants** are used in the **detection and control of insect pests** which are collected by baiting **traps** and killed with **potent insecticides**.
- **PREDATION AND PARASITISM** - Many **harmful** pests **Aphids, Scale insects** which feed and damage **Citrus** and other trees are destroyed and eaten by a host of predaceous insects like **ground beetles, Syrphid flies, Wasps and larvae of Lady bird beetles.** By introducing parasites of various types, over the past 20 years about **42 insect** species have been controlled / their damage is reduced.
- **STERILIZATION** - To control the **birth rate** of insects the **females** into mating with males have been sterilized by **exposure to radiation**.
- **GENETIC CONTROL** - According to the theory of **"incompatibility"**, certain strains of **mosquitoes** when crossed cannot breed. He found in1947 that if a **Paris female (Culex fatigans) was crossed with a Hamburg male, the eggs would never hatch.**

HAZARDS.

- **Biological control** of insects will be **quite expensive**. The cost of production of tiny amount of **pheromones** is **thousands of rupees**.
- The expenses involved in **sterilizing insects** and in identifying and isolating the **hormones, are exorbitant**.
- Laboratory tests show that after **15 generations, houseflies** and **mosquitoes** develop **resistance** to **juvenile hormone insecticides**.
- So the **battle between human beings and insects goes on**, with some hope that man will continue to maintain an insects.

3. **Write notes on: a) Red-data book. 06 marks.**
b) Biodiesel. 04 marks.

RED DATA BOOK - IUCN (International union of Conservation of Nature and Natural Resources) now known as **WCU** (World Conservation Union) maintains a document called Red list or Red data book of taxa that are facing the risk of extinction. It will give a complete list of all endangered animals and plants in the country for the first time. IUCN has recognized eight Red list categories of species namely Extinct, Extinct in the wild, critically endangered, Vulnerable, Lower risk, Data Deficient and not evaluated. Among these vulnerable, endangered and critically endangered categories include those species which are facing extinction. Threatened species belong to critically endangered, Endangered, Vulnerable, Lower risk categories. Such species are liable to become extinct if these are not allowed to realize their full biotic potential by providing protection from human exploitation, habitat deterioration, exotic species, depletion of food etc. Another category is rare species, which includes small populations in the World. These are confined to limited areas or are thinly distributed over a more wide area. These are not endangered or vulnerable at present but have risk of becoming so because of small numbers. It was initiated in 1963. 2000 IUCN Red list covers assessment of more than 18, 000 species of plants and animals of which 11,167 species are threatened species. The number of threatened species has now risen to 15,500 (IUCN 2004).



ENDANGERED SPECIES.

- These populations have decreased or habitats have been reduced to the levels that pose immediate danger of extinction. These are not likely to survive if the factors threatening their extinction continue.
- During the last 2000 years about 106 species of animals and 139 species of birds have become extinct. Now it is estimated that about 600 species are going to become extinct, if proper protective measures are not taken.
- Most of the endangered species are **mammals** which include, Rabbit eared Bandiccot, Maned sloth, Wooly spider Monkey, Mediterranian Monk Seal, Golden ramped Lion Tamarin, Golden Lion Tamarin, Pangolin, Musk deer, Spotted deer, Kashmir sag, Indian Gazella, Javan Rhinoceros, Elephant, Lion, Tiger, Wild buffalo, Pigmy Hog, Indian bison, Lion-tailed monkey, Lion-tailed Macaque, Wroughton's free tailed Bat, Giant squirrel.

BIODIESEL.

- It is vegetable oil or animal fat-based diesel fuel with long-chain alkyl (methyl, ethyl, or propyl) esters. It is made by chemically reacting lipids (e.g., vegetable oil, animal fat (tallow)) with an alcohol producing fatty acid esters. The **National Biodiesel Board (USA)** also has a technical definition of "**biodiesel**" as a **mono-alkyl ester**.
- It can be used alone, or blended with petro diesel. Biodiesel can also be used as a low carbon alternative to heating oil.
- Blends of biodiesel and conventional hydrocarbon-based diesel are products most commonly distributed for use in the retail diesel fuel market place. Much of the world uses a system known as the "B" factor to state the amount of biodiesel in any fuel mix:
- 100% biodiesel is referred to as **B100**

- 20% biodiesel, 80% petro diesel is **B20**
- 5% biodiesel, 95% petro diesel is **B5**
- 2% biodiesel, 98% petro diesel is B2.
- When biodiesel is cooled below a certain point, some of the molecules aggregate and form crystals. The fuel starts to appear cloudy once the crystals become larger than one quarter of the wavelengths of visible light - this is the **cloud point (CP).**
- As the fuel is cooled further these crystals become larger. The lowest temperature at which fuel can pass through a 45 micrometer filter is the **cold filter plugging point (CFPP).** As biodiesel is cooled further it will gel and then solidify.
- The temperature at which pure (B100) biodiesel starts to gel varies significantly and depends upon the mix of esters and therefore the feedstock oil used to produce the biodiesel. For example, biodiesel produced from **low erucic acid** varieties of **canola seed (RME)** starts to gel at approximately −10 °C (14 °F). Biodiesel produced from tallow tends to gel at around +16 °C (61 °F).
- There are a number of commercially available additives that will significantly lower the pour point and cold filter plugging point of pure biodiesel. Winter operation is also possible by blending biodiesel with other fuel oils including #2 low **sulfur** diesel fuel and #1 diesel / **kerosene**.
- Another approach to facilitate the use of biodiesel in cold conditions is by employing a second fuel tank for biodiesel in addition to the standard diesel fuel tank.
- The second fuel tank can be insulated and a heating coil using engine coolant is run through the tank. The fuel tanks can be switched over when the fuel is sufficiently warm. A similar method can be used to operate diesel vehicles using straight vegetable oil.

- Biodiesel is hygroscopic (not miscible with water), it may absorb little water due to presence of mono and diglycerides which are present due to incomplete reaction. These molecules can act as an emulsifier, allowing water to mix with the biodiesel. In addition, there may be water that is residual to processing or resulting from storage tank **condensation**. The presence of water is a problem, because Water reduces the heat of fuel combustion, causing smoke, harder starting, and reduced power, causes corrosion of fuel system components (pumps, fuel lines, etc.), Microbes in water cause the paper-element filters in the system to rot and fail, causing failure of the fuel pump due to ingestion of large particles. Water freezes to form ice crystals that provide sites for **nucleation,** accelerating gelling of the fuel.

1. **Production levels** - Total world production of vegetable oil for all purposes in 2005-06 was about 110 million tonnes, with about 34 million tonnes each of palm oil and soybean oil. According to the year-end data released by the EPA, biodiesel production in 2011 reached more than 1 billion gallons. This production number far exceeded the 800 million gallon target set by the EPA. The projected production for 2020 is nearly 12 billion gallons.

A variety of oils can be used to produce biodiesel.

- Virgin oil feedstock – rapeseed and soyabean oils are most commonly used,
- Animal fats including tallow, lard, yellow grease, chicken fat, and the by-products of the production of Omega-3fatty acids from fish oil.
- The sewage-to-biofuel field is attracting interest from major companies like Waste Management and start ups like Info Spi, which are betting that renewable sewage biodiesel, can become competitive with petroleum diesel.

4. **Discuss social behaviour in ants.**

About 3,500 species of ants are present. These are adopted for social life, live in colonies with one or more caste differentiation. Polymorphism is common in ants and are basically like a family with queen mother and her female dominant descendants. Offsprings are wingless worker females, winged males and winged females which become virgin queens.

New colonies are established by males and young queens after their short mating flights. During mating flight, queen carries about half a dozen workers clinging to her legs.

Workers live for a few years where as males die after their mating flights. A wingless female worker is not fertilized by the male but eggs are laid by them which develop into males which are not of so much importance to the colony. This shows that evolution of ants has been genetically little affected by the worker's presence in the society.

The large workers have large heads with enlarged mandibles which are used in fighting, are known as soldiers which protect the colony from enemies.

Colobopils soldiers block entrance road of the nest by keeping their heads at the entrance functioning like a bottle plug. The worker of the colony takes care of the brood, and maintains proper temperature and humidity in the colony. Communicating system is highly developed, where brood recognition is done by releasing contacting pheromone by the workers. Pheromone helps in identification of broods of different casters and sexes. Ants mark scent trails to locate the food.

The queen ant reproduces quickly and the larvae lice in groups in open chambers and galleries which exhibit **trophallaxis** phenomenon. Exchange of food occurs between different members of the society. The ant's food consists of micro-organisms but in few cases it may be nectar or flowers or honey dew released from **aphids**.

PART D **1 X 10 = 10**

IV **With respect to remote sensing explain:**

Definition 01 mark, Principle - 03 marks, Types – 03 marks, Applications – 03 marks

It is a system for collecting information on earth's biosphere from a distance. Used to obtain data to prepare inventory of complex natural ecosystems and their regular monitoring. It is a non-contact technique to observe the earth surface or the atmosphere from out of space using satellites (space borne) or from the air using aircrafts (airborne), without making physical contact with the object.

PRINCIPLES OF REMOTE SENSING.

- Detection and discrimination of objects or surface features means detecting and recording of radiant energy reflected or emitted by objects or surface.
- Different objects return different amount of energy in different bands of the electromagnetic spectrum, incident upon it. This depends on the property of material (structural, chemical, and physical), surface roughness, angle of incidence, intensity, and wavelength of radiant energy.
- It includes a combination of various disciplines such as optics, spectroscopy, photography, computer, electronics and telecommunication, satellite launching etc.

- All these technologies are integrated to act as one complete system in itself, known as Remote Sensing System.
- Observation of the object / geographical area is made from a distance using sensors mounted on suitable plateforms.
- Reflected radiations from the object are recorded by sensors (camera, scanner / radiometer) mounted on a plateform.
- Electromagnetic radiation (EMR) of the sensor interacts with atmosphere and land and water surfaces.
- The sensor emits radiation which is directed towards the object / geographical area (target) and the radiation reflected from it is directed and measured by the sensor.
- The active sensors are independent of solar and terrestrial radiation. Thus EMR transfers the information from an object to a sensor.
- The spectral data acquired from the remote sensors are processed, enhanced and interpreted for different applications.
- There are a number of stages in a Remote Sensing process, and each of them is important for successful operation.

TYPES OF REMOTE SENSING.

- **Passive sensors** detect natural radiation that is emitted or reflected by the object or surrounding areas. Reflected sunlight is the most common source of radiation measured by passive sensors.
- A remote-sensing system, such as an aerial photography imaging system, that only detects energy naturally reflected or emitted by an object.
  Ex: **Film photography, infrared, charge-coupled devices and radiometers.**
- Active collection, on the other hand, emits energy in order to scan objects and areas whereupon a sensor then detects and measures the radiation that is reflected or back scattered from the target.
- A remote-sensing system, such as radar, that produces electromagnetic radiation and measures its reflection back from a surface.
  Ex: **RADAR and LiDAR** are examples of active remote sensing where the time delay between emission and return is measured, establishing the location, height, speeds and direction of an object.

ACTIVE REMOTE SENSING.

Remote sensing makes it possible to collect data on dangerous or inaccessible areas. Remote sensing applications include monitoring deforestation.

IRS data applications.

- Pre-harvest crop area and production estimation of major crops.
- Drought monitoring and assessment based on vegetation condition.
- Flood risk zone mapping and flood damage assessment.
- Hydro-geomorphological maps for locating underground water resources for drilling well.
- Irrigation command area status monitoring
- Snow-melt run-off estimates for planning water use in down stream projects
- Land use and land cover mapping
- Urban planning
- Forest survey
- Wetland mapping

- Environmental impact analysis
- Mineral Prospecting
- Coastal studies
- Integrated Mission for Sustainable Development (initiated in 1992) for generating locale-specific prescriptions for integrated land and water resources development in 174 districts.
- Change Detection — Determine the changes from images taken at different times of the same area
- Orthorectification — Warp an image to its location on the earth.
- Spectral Analysis — For example, using non-visible parts of the electromagnetic spectrum to determine if a forest is healthy
- Image Classification — Categorization of pixels based on reflectance into different land cover classes (e.g. supervised classification, unsupervised classification and Object Oriented Classification).

OR

Write an essay on bird migration.

- It is two way journey, means a regular, periodic, to and fro movement of a population of some birds between their summer and winter homes or from a breeding and nesting place to a feeding and resting place.

KINDS OF MIGRATION.

- The birds can fly with a speed of 80-100 km/hr from one place to another, but some aquatic birds like ducks and geese swim very fast in water and they are also active fliers.

1. LATITUDINAL MIGRATION.

- Birds show North to South and South to North migration in search of suitable place for nesting, feeding and reproduction. Every year about 5000-6000 million birds fly 3200 kms. South to the forest, grasslands, lakes, rivers of central and southern Africa. During migration they cover several thousands of miles as in Arctic tern which covers about 17600 kms, greater Shear water, and back pole Warbler etc, between their summer and winter home. The American golden plover migrates about 9 months and 8000 miles during winter to Argentina likewise many birds leave Siberia and go to Himalayas.

2. LONGITUDINAL MIGRATION.

- Some birds migrate from East to West and vice-versa. Ex: Starling move from a breeding area in east Europe or Asia towards the Atlantic coast to avoid the continental winter.
- Evening Gross beaks nesting in Northern Michigan passes its winter in New England. The California Gulls, breed in Utah, migrate to Pacific coast during winter.

3. ALTITUDINAL OR VERTICAL MIGRATION.

- This is found in mountainous birds, when large mountains are found in temperate regions, the birds migrate regularly up and down their slopes, as the weather changes.
- During winter they migrate to warmer, lower altitudes in search of food and shelter. During summer they pass in the mountainous regions.

- It occurs in the Grebes and coots of Andes in Argentina, violet green swallows of Great Britain and Willow Ptamigan of Siberia, Red start of Eastern Himalayas, Rufons turtle doves of China, Nepal and Sikkim, Sterling of Turkey.

2. PARTIAL MIGRATION.

- Many species of temperate regions are partial migrants. Barn owls (Tyto alba), blue birds and many blue jays of Canada and Northern United States travel southwards to mingle with the sedentary populations of the southern states.
- Song thrush, red breast titmouse, finch etc, seen throughout the year, actually represent partial migrants, as the birds seen in winter are not the same as seen in summer.

3. IRREGULAR OR VAGRANT MIGRATION.

- In some birds like herons, after breeding the adults and the young may stray from their home to disperse in all directions over many or a few hundred miles in search of food and protection from enemies.
- Sometimes seabirds are taken by hurricanes to as far as 2,000 miles away from home seas to drop exhausted or to die on unfamiliar shores.

4. SEASONAL MIGRATION.

- Due to change in the season, migration occurs in tropics and subtropics. Ex: in Britain swifts, swallows, nightingales and cuckoos are summer visitors for they arrive in spring from the south, remain to breed and leave from the south in all them.
- Snow bunting and red wing are winter visitors as they in autumn, from the north, stay throughout winter and fly northwards again in spring.
- Snipes and sand pipers, found for s short time twice a year on their way to colder or warmer countries in spring and autumn.
- **CYCLIC MIGRATION** - Some birds like Snowy owl which lives in United States show cyclical migration within 3-5 years of time.

5. DAILY OR LOCAL MIGRATION.

- Many birds migrate from their place of loving to search food, proper light intensities or darkness, temperature, humidity etc.
- House sparrow makes short daily migration in search of food and drinking water.
- Local migration is found in golden Oriole, paradise flies catcher etc at regular intervals of time.

STATUS OF MIGRATORY BIRDS.

a. SUMMER MIGRANTS.

- These birds migrate to their breeding grounds during March and April months where they rear their young ones during summer months and return to their wintering grounds during November and pass winter months from December to February.

b. WINTER MIGRANTS.

- These migrate from their breeding ground to spend their winter in a suitable place where temperature of the environment and availability of food is up to their liking.
- Winter migrants visit Keoladeo National Park at Bharathpur. Ex: Siberian crane, marble Teal, falcated teals, common shell duck, pigeon, red crusted pochard etc.
- The birds like common teal, pintail, shoveller and geese migrate from Palaearctic region or Eurasia region.

c. PASSAGE MIGRANT.

- These are transient visitors which migrate twice during a year. During spring they visit their breeding grounds and then again during winter they visit wintering grounds.
- **PERMANENT RESIDENT** - These are not migratory birds, live in a particular area throughout the year. Ex:, **Spot bill duck, mallards, whistling teals** are the permanent residents of **Keotadeo N.P. Bharthpur.**

CAUSES OF MIGRATION.

- Generally birds migrate from one place to another in search of shelter, nesting, feeding and breeding grounds and also to get optimum temperature for living.
- They avoid too much cold in search of a warmer place to live and return to their original home when the optimum temperature is available in that area.
- Before migration they store a lot of energy in the form of fat, which acts as fuel, is utilized during migratory processes. Ex: **Black pole Warbler** becomes almost double in its weight before it migrates.
- Before migration birds show migratory-restlessness or Zugunruhe. Under these conditions, day length influences pituitary glands which bring about necessary physiological and behavioural changes in the birds triggering migration.
- The change in the environmental conditions like temperature, day length, and wind velocity on set off winter are responsible for their migratory restlessness.

WAY FINDING DURING MIGRATION.

i. VISUAL LANDMARKS.

- Sense of direction has been established that some migratory birds follow obvious landmarks or topographical features like rivers, mountain ranges, chains of oceanic islands, valleys, coastal lines etc, which give long range guidance in day light.
- Landmarks may be learned, ducks and Geese travelling in family groups transmit the information from generation to generation. Most birds migrate during the night so do not make use of landmarks except for the last stage of homing. For birds crossing great stretches of seas, there are no sea marks for them to follow.

ii. CELESTIAL BODIES.

- If landmarks are of little use, in migration and homing depends on flying in a particular compass direction by the sun or stars.
- Mathew showed that the birds are equipped to use a "Biological Clock" which enables them to make necessary adjustments in their course, according to the changes in the position of the sun and stars.
- The German Ornithologist, Gustav Kramer claimed that the birds which travel by day use the sun as a compass for orientation. He proved this by altering the direction of flight in Starling by using mirrors to give a false apparent direction of the sun. He kept caged Starlings in a circular building with the windows through which only the sky could be seen. He noted that the birds always moved round to face the direction they would normally take in migrating flight. He then closed the windows and installed a powerful light to imitate the sun, but made its rising and setting at wrong

times, but bird again oriented itself as it does for migration, according to the position of the electric "Sun".

- **WIND DIRECTION AND EARTH'S MAGNETIC FIELD** - Birds usually avoid flying in clouds, but they have some ability to maintain a course when forced to move under clouded skies or even in fog. Probably they use wind direction and other meteorological information for migration.

FACTORS REGULATING MIGRATION IN BIRDS.

- Some workers have suggested that the migratory behaviour of a bird is under hormonal control from gonads, migrate to north in spring when their gonadial activity increases and southward migration after breeding season is associated with regression in gonadial activity. The thyroid which exhibits cyclical changes.
- Depends on the season and changes in the amount of daylight.
- In India increase in day length (starting from February /March onward) induces the Siberian birds to migrate to their breeding habitat, Siberia. Decrease in photoperiod (starting from September – October onward) induces these Siberian birds to migrate to Indian subcontinent because the days are considerably shorter in Siberia during winter and they find considerable difficulty in obtaining food.
- The substantial subcutaneous and visceral fat deposits play an important role in migration of the species.
- The sexual cycle of seasonal birds is regulated by various external factors that ensure movement to the traditional breeding grounds in time.
- Light is particularly an important post-regenerated accelerator of sexual cycle of temperature, zone birds.
- Others under natural conditions are warmth, territory, adequate food, the nest site, nesting materials and behavioural interactions.
- Inhabitants are cold, inclement weather, hunger, fear and lack of appropriate nesting material and traditional nesting site.

ADVANTAGES OF BIRD MIGRATION.

- Helps securing a better climate for living by avoiding cold, stormy weather and heat.
- Different habitats are available for migratory birds for food, nesting, breeding etc.
- Helps in the geographical dispersal of birds, which isolate population of different species from each other increasing the rate of evolution because genetic variation or mutations occur faster in a small population than the larger one.
- Migratory birds are exposed to greater variety of foods which may be more nourishing and providing chance for adaptive radiation.
- Individual survival value becomes more because the predation pressure is divided in the large number of eggs laid in their breeding grounds because of more arrival of the migratory birds.
- Helps in providing greater ecological diversity and adaptability to the migratory birds than the permanent resident birds, which is of evolutionary significance.
- Parasites and infections of micro-organisms are reduced to minimum in far northern habitats due to long cold winters.
- Provides golden opportunity to human beings for bird watching.