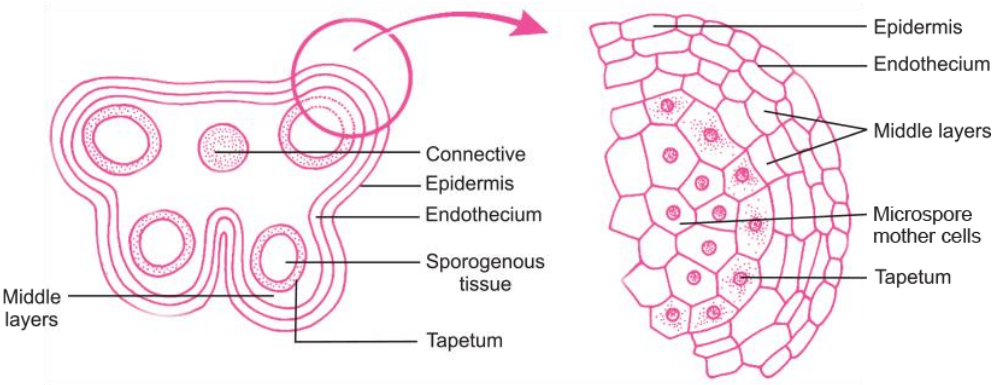
Long Answer Questions (PYQ)

[5 Marks]

Q.1. Draw a labelled diagram of an anther lobe at microspore mother cell stage. Mention the role of different wall layers of anther.

Ans.



(a) Transverse section of a young anther;

(b) Enlarged view of one microsporangium showing wall layers

Roles of different wall layers of anther:

(i) Epidermis, endothecium and middle layers perform the function of protection and help in dehiscence of anther to release the pollen.

(ii) Tapetum is the innermost wall layer and it provides nourishment to the developing pollen grains.

Q.2. Describe in sequence the events that lead to the development of a 3-celled pollen grain from microspore mother cell in angiosperms.

Ans.

● Each cell of the sporogenous tissue in a microsporangium acts as a potential pollen mother cell (PMC) or microspore mother cell.

● PMC undergoes meiotic divisions to form cluster of four cells called microspore tetrad.

● On maturity, the anther dehydrates and the microspores separate from each other to form pollen grains.

● The newly differentiated pollen grain has a central nucleus and dense cytoplasm.

● The protoplast mitotically divides into two unequal cells—bigger vegetative cell which is rich in food reserve and smaller spindle-shaped generative cell with dense cytoplasm and a nucleus. This is called 2-celled stage.

● In majority angiosperms, pollens are released in this 2-celled stage, whereas in other species, the generative cell divides into 2 male gametes and thus pollen is said to be in 3-celled stage.

Q.3. Explain the events upto fertilisation that occur in a flower after the pollen grain has landed on its compatible stigma.

Ans. Pollen−Pistil Interaction

● All the events from pollen deposition on the stigma until the entry of the pollen tubes into the ovule are together called pollen–pistil interactions.

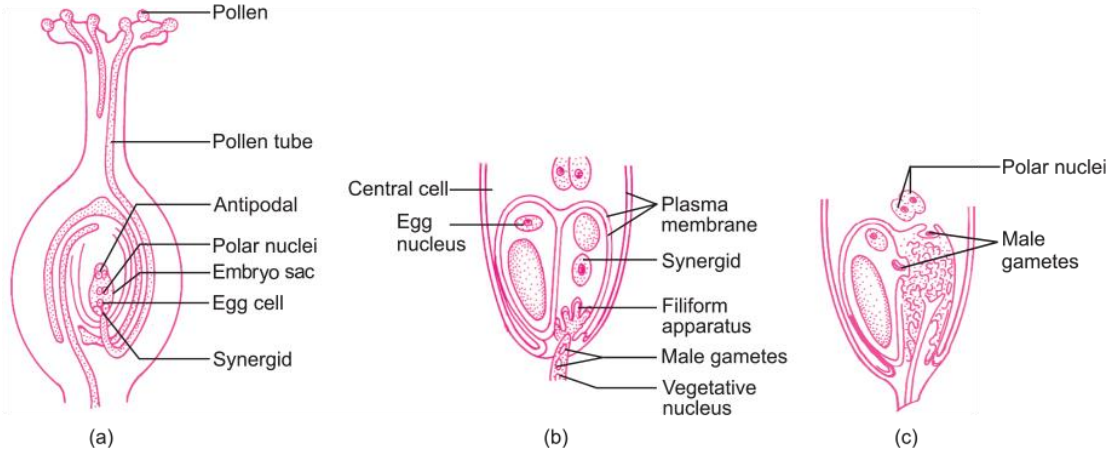
● It is a dynamic process involving pollen recognition by stigma/pistil for compatible pollen.

● Incompatible pollens or sterile pollens are rejected by the pistil and do not allow growth of pollen tube.

● Compatible pollens are encouraged by pistil for growth and development of pollen tubes.

● The pollen tube grows through stigma and style to reach the ovary.

● It then enters the ovule through micropyle and reaches the synergids, guided by filiform apparatus.



(a) L.S. of pistil showing path of pollen tube growth;

(b) Enlarged view of an egg apparatus showing entry of pollen tube into a synergid;

(c) Discharge of male gametes into a synergid and the movements of the sperms, one into the egg and the other into the central cell.

Double Fertilisation/Triple Fusion

● On reaching synergid, pollen tube releases the two male gametes into cytoplasm of synergid.

● One of the male gamete fuses with egg nucleus to form a diploid cell called zygote. This event is called **syngamy**.

● Other male gamete fuses with polar nuclei at the centre to produce a triploid primary endosperm nucleus **(PEN).** This is termed as **triple fusion**.

● As syngamy and triple fusion take place simultaneously in the embryo sac, it is termed as double fertilisation.

Q.4. Make a list of any three outbreeding devices that flowering plants have developed and explain how they help to encourage cross-pollination.

Ans.

(i) Production of unisexual flowers/dioecious plants, cross pollination ensured.

(ii) Self incompatibility, genetic mechanism prevent the pollen germination on the stigma of the same flower.

(iii) Anther and stigma are placed at different positions, so the pollen can not come in contact with the stigma of the same flower.

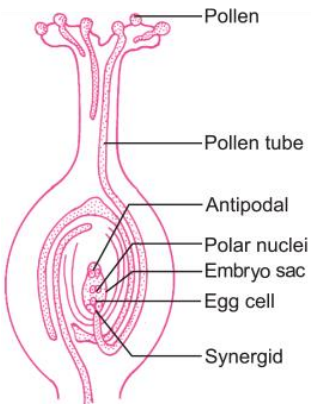
Q.5.

(a) Draw a labelled diagram of L.S. of a flower to show the growth of pollen tube reaching egg apparatus.

(b) Pistil of a flower does not accept pollen from any plant other than from its own kind. How does it happen? Explain.

Ans.

a.



b. The pistil has the ability to recognise pollen, whether it is of right type (compatible) or of the wrong type (incompatible). It is mediated by chemical components of the pollen interacting with those of the pistil.

Q.6. Explain double fertilisation and trace the post-fertilisation events in sequential order leading to seed formation in a typical dicotyledonous plant.

Ans. Double fertilisation:

- On reaching synergid, pollen tube releases the two male gametes into cytoplasm of synergid.
- One of the male gamete fuses with egg nucleus to form a diploid cell called zygote. This event is called **syngamy**.
- Other male gamete fuses with polar nuclei at the centre to produce a triploid **primary endosperm nucleus (PEN)**. This is termed as **triple fusion**.
- As syngamy and triple fusion take place simultaneously in the embryo sac, it is termed as double fertilisation.
- The central cell after triple fusion forms **primary endosperm cell (PEC)** which later develops into endosperm.
- The zygote later develops into an embryo.

Following are the post-fertilisation events:

i. **Development of embryo:** Embryo develops in fertilised ovule, from the zygote. The early stages of embryo development from a zygote is known as embryogeny. The formation of embryo starts only after certain amount of endosperm formation to assure the nutrition supply, for development and growth of embryo.
ii. **Development of seeds:** Refer to Basic Concepts Point 10 (Embryogeny in Dicots).
As a result of double fertilisation number of changes takes place in an ovule due to which ovule is converted into seeds.

Q.7. Give reasons why:

Q. most zygotes in angiosperms divide only after certain amount of endosperm is formed.

Ans. To obtain nutrition from the endosperm for the developing embryo, zygotes, divide after itsformation.

Q. groundnut seeds are exalbuminous and castor seeds are albuminous.

Ans. The groundnut seeds are exalbuminous because the endosperm is completely consumed during embryo den. Whereas, castor seeds are albuminous because the endosperm persists and is used up during seed germination.

Q.8. A flower of tomato plant following the process of sexual reproduction produce 240 viable seeds.

Answer the following questions giving reasons:

Q. What is the minimum number of pollen grains that must have been involved in the pollination of its pistil?

Ans. 240 pollen grains. One pollen grain participates in fertilisation of one ovule.

Q. What would have been the minimum number of ovules present in the ovary?

Ans. 240 ovules. One ovule after fertilisation forms one seed

Q. How many megaspore mother cells were involved?

Ans. 240 MMC were involved. Each MMC forms four megaspores out of which only one remains functional.

Q. What is the minimum number of microspore mother cells involved in the above case?

Ans. 60 MMCs (240/4 = 60). Each microspore mother cell meiotically divides to form four pollen grains.

Q. How many male gametes were involved in this case?

Ans. 480 male gametes (240 × 2 = 480). Each pollen grain carries two male gametes (which participate in double fertilisation)

Q.9. A flower of brinjal plant following the process of sexual reproduction produces 360 viable seeds.

Answer the following questions giving reasons:

Q. How many ovules are minimally involved?

Ans. 360 ovules are involved. One ovule after fertilisation forms one seed.

Q. How many megaspore mother cells are involved?

Ans. 360 MMC are involved. Each MMC forms four megaspores out of which only one remains functional.

Q. What is the minimum number of pollen grains that must land on stigma for pollination?

Ans. 360 pollen grains. One pollen grains participates in fertilisation of one ovule.

Q. How many male gametes are involved in the above case?

Ans. 720 male gametes are involved. Each pollen grain carries two male gametes (which participate in double fertilisation) (360 × 2 = 720).

Q. How many microspore mother cells must have undergone reduction division prior to dehiscence of another in the above case?

Ans. 90 MMC undergo reduction division. Each microspore mother cell meiotically divides to form four pollen grains. (360/4 = 90).

Long Answer Questions (OIQ)

[5 Marks]

Q.1.

a. Draw a diagrammatic sketch of the sectional view of a typical anatropous ovule.

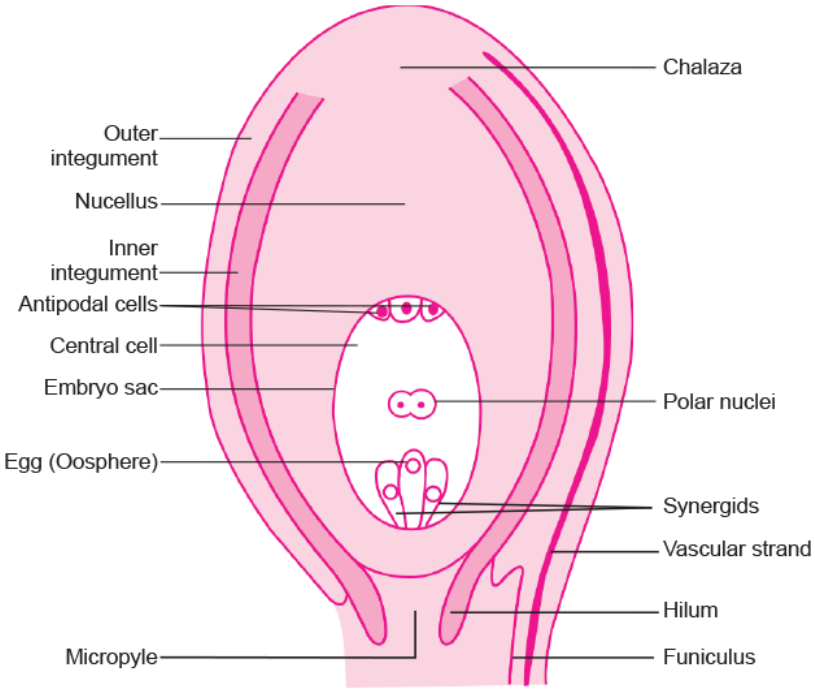
b. List the components of the embryo sac and mention their fate on fertilisation.

OR

a. Draw a labelled diagram of the sectional view of a typical anatropous ovule.

b. Mention the fate of all the components of the embryo sac after fertilisation.

Ans. (a)



(b) Components of embryo sac: 2 polar nuclei, 1 egg cell, 2 synergids and 3 antipodal cells.

— After positive pollen−pistil interaction, the pollen tube develops and enters the ovule through synergids guided by filiform apparatus.

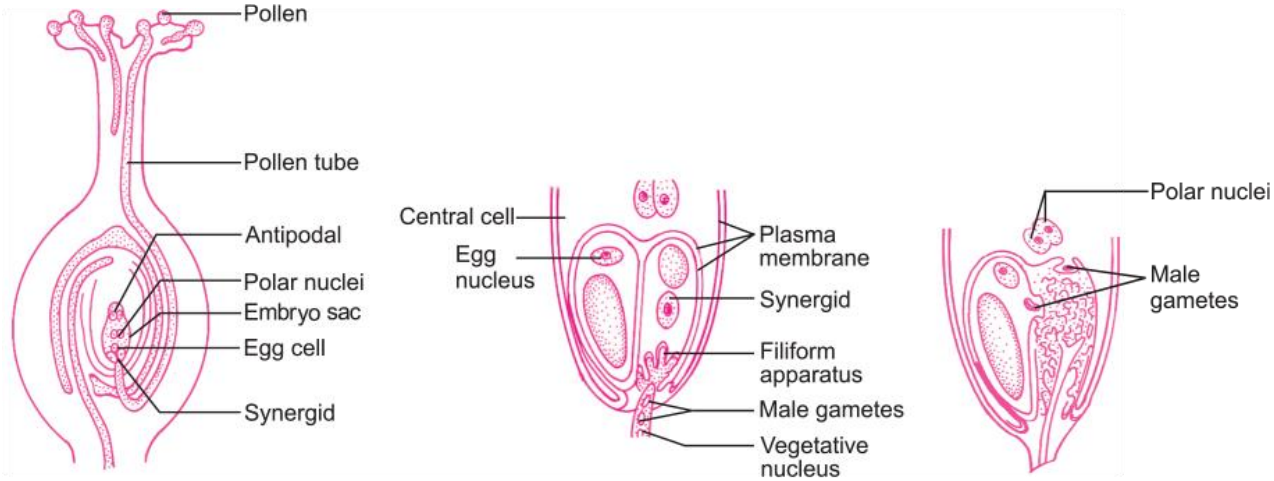
— One of the male gamete fertilises the female gamete to form diploid zygote.

— The other male gamete fuses with the secondary nucleus (polar nuclei if they are already fused) to form a triploid primary endosperm nucleus (PEN) that develops into endosperm.

— The three antipodals at chalazal end and synergids at micropylar end start degenerating.

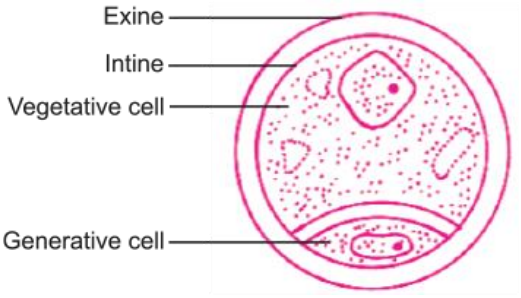
Q.2. Trace the events that would take place in a flower from the time the pollen grain of the same species falls on the stigma up to the completion of fertilisation.

Ans. When pollen grain lands over the stigma, it starts germinating and produces a pollen tube through a germ pore. Pollen tube passes through style and reaches the ovule. The generative cell divides and forms two male gametes. Finally the pollen tube enters the embryo sac through micropyle. Now the pollen tube enters the egg apparatus through one of the synergids with the help of filiform apparatus. The vegetative nucleus degenerates while pollen tube leaves two male gametes in embryo sac. Now one of the male gamete fuses with the egg cell to form diploid zygote known as syngamy. The other male gamete fuses with the two already fused polar nuclei (called secondary nucleus) and forms triploid primary endosperm nucleus (PEN) which later gives rise to endosperm. This is called triple fusion. Hence syngamy and triple fusion together are known as double fertilisation.



Q.3. Draw a labelled diagram of the sectional view of a mature pollen grain in angiosperms. Explain the functions of its different parts.

Ans.

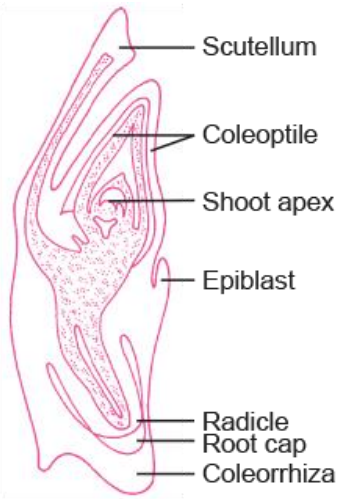


Functions:

i. Pollen grains are generally spherical with a prominent two-layered wall. The hard outer layer is called exine made up of sporopollenin, which is a resistant organic material.
ii. Exine can withstand high temperature, strong acids and alkali, thus provide protection.
iii. It has prominent aperture called germ pore, through which pollen tube comes out.
iv. Vegetative cell has abundant food reserve.
v. Generative cell divides mitotically giving rise to two male gametes, before pollen grains are shed (3-celled stage).

Q.4. Draw a labelled diagram of the L.S. of embryo of grasses. How does it differ from that of bean?

Ans.



L.S. of an embryo of grass (monocot)

Differences:

S. No.	Embryo of grass	Embryo of bean

(*i*)	The seed has a single cotyledon (scutellum), *i.e.*, it is monocotyledonous.	The seed has two cotyledons, *i.e*., it is dicotyledonous.
(*ii*)	The plumule is protected by a foliaceoussheath called coleoptile.	There is no such protection for the plumule in bean
(*iii*)	The radicle is protected by coleorhiza.	There is no such protective covering for theradicle.

Q.5. Rose plants produce large, attractive bisexual flowers but they seldom produce fruit. On the other hand, Lady's finger produces plenty of fruits. Analyse the reasons for failure of fruit formation in rose.

Ans. Failure of fruit formation in rose may be due to several reasons. Some of them are:

(a) Inability to produce viable pollens.

(b) Absence of functional egg.

(c) Presence of abortive ovules.

(d) Being hybrids, the meiotic process may be abnormal resulting in non-viable gametes.

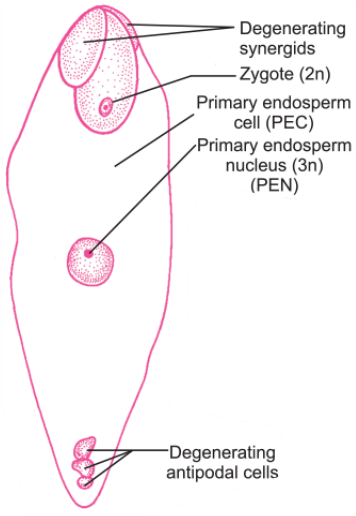
(e) There may be self-incompatibility.

(f) There may be internal barriers for pollen tube growth and/or fertilisation.

Q.6. Answer the following questions:

Q. Draw a schematic labelled diagram of a fertilised embryo sac of an angiosperm.

Ans.



Fertilised Embryo Sac of an Angiosperm

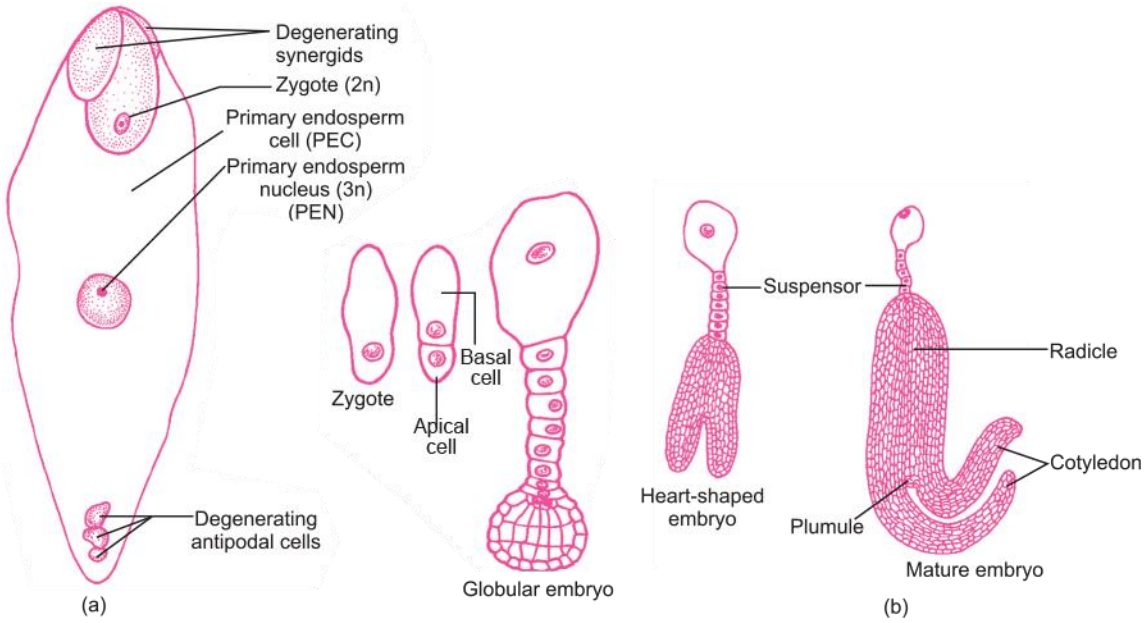
Q. Describe the stages in embryo development in a dicot plant.

Ans. For explanation refer to Basic Concepts Point 10 (Embryogeny in Dicots).

Q.7. Answer the following questions:

Q. With labelled diagrams, depict stages in embryo development in a dicotyledenous plant.

Ans.



Q. Endosperm development precedes embryo development. Why?

Ans. Endosperm is filled with reserve food materials which are used for nutrition of the developing embryo.

Q.8. Answer the following questions:

Q. Seeds offer several advantages to angiosperms. Describe any three such advantages.

Ans. Reproductive processes such as pollination and fertilisation are independent of water.

Following are their advantages:

- **i.** Better adaptive strategies for dispersal to new habitats.
- **ii.** Hard seed coat provides protection to young embryo .
- **iii.** Sexual reproduction—new genetic combinations.
- **iv.** Sufficient food reserves for the seedling.
- **v.** Basis of agriculture–storage of seeds can occur due to seed habit-dehydration and dormancy.

Q. Why is banana called a parthenocarpic fruit? Would you call banana a true fruit? Give reason in support of your answer.

Ans.

Banana fruit develops without fertilisation therefore, it is called parthenocarpic fruit.

Yes, it is a true fruit because it develops from ovary.