

**Telangana University**  
**Department of Botany**  
**M. Sc Botany Semester-II**  
**Paper –II GYMNOSPERMS AND EMBRYOLOGY**  
**Internal Assessment – 1 Question Bank**  
**(Unit I and II)**

1. The term gymnosperms was first used by (B)  
a) Aristotle b) Theophrastus c) Tansely d) Charles Darwin e) None of these
2. In which of the following group of plants the adult plant is a sporophyte (D)  
a) Algae b) Fungi c) Bryophyta d) Gymnosperms e) None of these
3. Which of the following does not require external water for fertilization (B)  
a) Mosses b) Cycads c) Ferns d) Liverworts e) None of these
4. Gymnosperms differ from the angiosperms (B)  
a) In showing heterospory b) In having naked ovules c) In having seeds  
d) In being smaller in size e) None of these
5. In Gymnosperms pollination is exclusively by (D)  
a) Water b) Insects c) Animals d) Wind e) None of these
6. The pollen grains in gymnosperms are (A)  
a) Haploid b) Diploid c) Triploid d) Tetraploid e) None of these
7. The phloem in gymnosperms lack (C)  
a) Pollen parenchyma b) Sieve tubes c) Companion cells d) Sclerenchyma  
e) None of these
8. The endosperm in gymnosperm is (A)  
a) Haploid b) Diploid c) Triploid d) Tetraploid e) None of these
9. The number of living genera in Cycadaceae is (A)  
a) 10 b) 5 c) 12 d) 8 e) None of these
10. The gymnosperms are most ancient seed plants that originated during (A)  
a) Late Paleozoic b) Mesozoic c) Cretaceous d) Triassic e) None of these
11. Sago is obtained from (A)  
a) *Cycas circinalis* b) *Zamia* c) *Dioon* d) *Macrozamia* e) None of these
12. The megasporangium is also known as (B)  
a) Ovule b) Nucellus c) Fruit d) Micropyl e) None of these
13. Perisperm is (B)  
a) Outgrowth of the outer integument b) Surviving nucellus in the seed  
c) Outgrowth of funicles d) Inside of funicles e) None of these
14. Mega Sporophylls of *Cycas revoluta* are large ranging from (B)  
a) 4 to 6 inches b) 6 to 8 inches c) 8 to 9 inches d) 10 to 12 inches  
e) None of these
15. Alternation of generation is exhibited by (D)  
a) Bryophytes b) Pteridophytes c) Gymnosperms d) All of these e) None of these
16. In which of the following feature Angiosperm resemble Gymnosperm (B)  
a) Presence of ovules b) Presence of vessel c) Nature of endosperm  
d) Nature of fertilization e) None of these
17. Endosperm in Gymnosperm is formed (B)  
a) All the time of fertilization b) Before fertilization c) After fertilization d) Along with the development of  
embryo e) None of these
18. Largest sperms are found in (C)  
a) *Pinus* b) *Cedrus* c) *Cycas* d) *Gnetum* e) None of these
19. Zooidogamy is seen in (A)  
a) *Cycas* b) *Gnetum* c) *Pinus* d) *Taxus* e) None of these
20. Coralloid roots are found in (A)  
a) *Cycas* b) *Pinus* c) *Dryopteris* d) *Ephedra* e) None of these
21. The most advanced order in Gymnosperm (C)  
a) Cycadales b) Coniferales c) Gnetales d) Taxales e) None of these
22. How many integuments occur in the *Cycas* ovule (A)  
a) One b) Two c) Three d) Four e) None of these
23. The number of ovules in the female cone of *Ephedra* is (B)  
a) One b) Two c) Three d) Four e) None of these
24. In which Gymnosperm plant vessels are observed (A)  
a) *Gnetum* b) *Ephedra* c) *Pinus* d) *Taxus* e) None of these
25. Which Gymnosperm have no archegonia (A)  
a) *Gnetum* b) *Pinus* c) *Taxus* d) *Ephedra* e) None of these
26. Both centripetal and centrifugal xylem are found in (A)  
a) *Cycas* b) *Ephedra* c) *Pinus* d) *Taxus* e) None of these
27. The male gametophyte in *cycas* is (A)  
a) 2 celled b) 4 celled c) 5 celled d) 6 celled e) None of these
28. How many *Cycas* species are found in India (D)  
a) 16 b) 10 c) 8 d) 6 e) None of these
29. Which of the following is called a living fossil (B)  
a) *Gnetum* b) *Ginkgo biloba* c) *Taxus* d) *Pinus* e) None of these
30. The pollination in *Ginkgo* is (C)  
a) Hydrophilous b) Zoophilous c) Anemophilous d) Entomophilous  
e) None of these
31. In *Ephedra* leaves are (A)  
a) Scale like b) Broad shaped c) Oval shaped d) Linear e) None of these
32. Mycorrhizae is characteristic feature of (B)  
a) *Cycas* b) *Pinus* c) *Ficus* d) *Taxus* e) None of these
33. Dimorphic roots occur in (A)  
a) *Cycas* b) *Pinus* c) *Gnetum* d) *Ephedra* e) None of these

34. Dimorphic leaves occur in (B)  
a) Cycas b) Pinus c) Taxus d) Ephedra e) None of these
35. Cycas is propagated by (D)  
a) Cuttings b) Adventitious buds c) Seeds d) Bulbils e) None of these
36. The age of cycas plant can be determined by it's (D)  
a) Growth rings b) Size of it's crown c) Amount of coralloid roots d) Leaf base system  
e) None of these
37. Mark the Gymnosperms plant having vessels (B)  
a) Ginkgo b) Gnetum c) Both d) Dioon e) None of these
38. The leaf arrangement in Cycas is (A)  
a) Spiral b) Vertical c) Polycyclic d) All of these e) None of these
39. Cedar wood oil used in microscopy is obtained from (D)  
a) Picea smithiana b) Cedrus deodora c) Cissypomesia d) Juipesus Verginina e) None of these
40. A Gymnospermic plant (C)  
a) Bear flower b) Exhibit no vascular tissue c) Produce seeds in cones  
d) Does not produce seeds in cones e) None of these
41. Blue green algae present in coralloid root of cycas are (B)  
a) Nostoc and Oscillatoria b) Anabaena and Nostoc c) Chlorella and spirogyra d) Scytonema and Gloeotrichia  
e) None of these
42. Cycas ovule is (B)  
a) Anatroous b) Othrotropous c) Hemianatroous d) campylotropus e) None of these
43. Maiden hair tree is the name given to (B)  
a) Cycas b) Ginkgo c) Pinus d) Ephedra e) None of these
44. Taxus baccata yields an alkaloid known by the name (B)  
a) Toxol b) Taxin c) Ephidrine d) Toxin e) None of these
45. The ovule in Taxus is (A)  
a) Orthotropus and sessile b) Orthotropus and stalked c) Anatroous and stalked d) Anatroous and sessile  
e) None of these
46. An aril is present in the ovule of (B)  
a) Cycas b) Taxus c) Ephedra d) Selaginella e) None of these
47. Wingless pollen grains are characteristic of (A)  
a) Taxus baccata b) Pinus triphylea c) Pinus wallichiana d) Cycas  
e) None of these
48. The neck of archegonium is longest in the gymnosperms (A)  
a) Ephedra b) Cycas c) Ginkgo d) Welwitschia e) Pinus
49. Ephedra pollen grains are shed at which stage (D)  
a) Binucleate b) Trinucleate c) Tetranucleate d) Penta nucleate e) None of these
50. The largest seeds are found in (B)  
a) Pinus b) Ephedra c) Cycas d) Gnetum e) None of these
51. Which plant has green, branched jointed stem (C)  
a) Cycas b) Pinus c) Ephedra d) Gnetum e) None of these
52. How many female cones develop one each node of Ephedra (A)  
a) 2-4 b) 5-8 c) 10-15 d) 1-Infinite e) None of these
53. Ephedrin is obtained from (B)  
a) Equisetum b) Ephedra c) Ectocarpus d) Isoetes e) None of these
54. Which among the following has medicinal importance (B)  
a) Cycas b) Ephedra c) Cupressus d) Welwitschia e) None of these
55. Vessels are present in (A)  
a) Gnetum b) Ginkgo c) Araucaria d) Zamia e) None of these
56. Reticulate venation is present in (B)  
a) Ginkgo b) Gnetum c) Araucaria d) Cycas e) None of these
57. According to Maheshwari vasil the development of stomata in Gnetum (B)  
a) Syndetocheilic b) Haplocheilic c) Monocheilic d) Maphocheilic e) None of these
58. Gnetum trinerve is a (D)  
a) Tree b) Shrub c) Parasite d) Climber e) None of these
59. The plant is used as fish poison (A)  
a) G. Montanum b) G. Gnemon c) G. Ula d) Lillipfolium e) None of these
60. In Gnetum seed germination is (A)  
a) Epigeal b) Hypogeal c) Perigeal d) Enogeal e) None of these
61. The plants are usually cultivated as ornamentals. (A)  
a) Taxus b) Gnetum c) Pinus d) Ephedra e) None of these
62. The endosperm of the roasted seeds is edible. (B)  
a) Taxus b) Ginkgo c) Ephedra d) Gnetum e) None of these
63. The young leaves and strobili are cooked as vegetable (A)  
a) Gnetum gnemon b) G. ula c) G. Lallipfolium d) G. Montanum e) None of these
64. Which type of the Gnetum yield an oil used for Illumination and also a massage in rheumatism (A)  
a) G. ula b) Gnetum gnemon c) G. Lallipfolium d) G. Montanum e) None of these
65. The only surviving species of Ginkgos (A)  
a) G. biloba b) Gnetum gnemon c) G. Lallipfolium d) G. Montanum e) None of these
66. Bal kunwar is the name given to the genus (A)  
a) Ginkgo b) Gnetum c) Pinus d) Ephedra e) None of these
67. In Cycadophyta the secondary wood is (A)  
a) Monoxyllic b) Pycnoxyllic c) Polyxyllic d) Penta xyllic e) None of these
68. Cycas revoluta is popularly known as (C)  
a) Data palm b) Sea palm c) Sago palm d) Royal palm e) None of these
69. In Cycas (A)  
a) Male and female strobili occur on separate plant b) Male and female strobili occur on same plant  
c) One cone contain both microsporangia and ovules d) The same sporophyll bears both male and female  
reproductive organs. e) None of the above.

70. The *Cycas* ovule is (B)  
a)Anatropus b)Orthotropus c)Hemi anatropus d)Campylotropus e)None of these
71. Which plant is known as living fossil (C)  
a)Cardaites b)Pentoxylis c)Ginkgo d)Gnetum e) None of these
72. Archegonia are absent in (A)  
a)Gnetum b) Ephedra c)Ginkgo d)Cycas e) None of these
73. The female gametophyte in *Gnetum* follows the development pattern of. (D)  
a)Monosporic type b)Bisporic type c)Trisporic type d)Tetrasporic type e)None of the above.
74. The pavement tissue in the ovule of *Gnetum* is developed from (B)  
a)Nucellus b)Female gametophyte c)Integument d)Male gametophyte e)None of these
75. Very large and numerous spirally arranged cilia are present in sperms of (B)  
a) Ginkgo b) Cycas c)Pinus d)Ephedra e)None of these
76. Vivipary has been observed in (C)  
a) Taxus b)Gnetum c)Ephedra d)Ginkgo e) None of these.
77. Bitegmic ovule occur in which Gymnosperm (A)  
a) Gnetum b) Pinus c) Ephedra d)Cycas e) None of these
78. Pencils are prepared from the wood of (B)  
a) Sequoia dendron b) Juniperus virginiana c) Pinus roxburghii  
d) Araucaria e) None of these
79. Canada balsam is obtained from (C)  
a) Juniperus virginiana b) Pinus roxburghii c) Abies balsamea  
d) Sequoia dendron e) None of these
80. The source of Starch (Sago) either from the seed kernel or from stem pith is from. (A)  
a) Cycas b) Gnetum c) Ginkgo d) Zamia e) None of these.

1. The cycads were once a large and dominant group with widest distribution in the Mesozoic, which is sometimes referred to as the age of cycads
2. The Coniferales form 75% of the modern gymnosperms
3. The conifers are plants of the more temperate regions of the world
4. The Pinaceae have ten genera, which form prominent coniferous forests of the Northern Hemisphere
5. Cupressaceae is the largest family of the conifers includes ca. 19 genera, 8 monotypic.
6. Podocarpaceae is the most important family of the Southern Hemisphere
7. Araucariaceae is an extremely old family with fossil record extending back to the Triassic of both North and South Hemispheres
8. The Ephedrales comprise a single mono generic family, Ephedraceae.
9. The order Taxales includes a single family, Taxaceae, with five genera.
10. The single family, Gnetaceae, includes only one genus, Gnetum
11. The seed coat may develop mainly from the tissue derived from the chalazal portion of the ovule in cycads, members of Pinaceae, and Cephalotaxus
12. The seed coat may develop mainly from the tissue derived from both from chalazal and integument in Ginkgo; podocarps, taxads and Gnetum
13. Most cycads grow in exposed habitats, and are considered xerophytes
14. The root system of cycads consists of a tuberous, contractile taproot with narrow racemously branched lateral roots, and swollen dichotomously branched coralloid roots
15. Cycads are pachycaulous plants with stems either aerial and columnar (arborescent) or subterranean (geophilous), tuberous, and fleshy.
16. Most cycads appear palm-like due to their columnar trunk and apical clusters of large pinnate leaves
17. The tallest cycad is Macrozamia hopei, which is ca. 20 m high, while the smallest Zamia pygmaea has an underground stem 2 or 3 cm in diameter and is ca. 25 cm high.
18. The leaf length varies from 5 or 6 cm Zamia pygmaea to about 3 m Cycas circinalis
19. The stomata in all the cycads are haplocheilic
20. All cycads have motile ciliated spermatozooids
21. The general structure of the ovule in all cycads is similar. The egg is the largest in the plant kingdom
22. The pollen tube in cycads is not involved in the conduction of sperm to the egg
23. Ginkgo biloba is a tree more than 30 m high and exceeds 1.5 m in diameter.
24. The petiole of Ginkgo biloba shows two endarch vascular bundles.
25. Ginkgo is dioecious. The male cones are pendant and catkin-like, borne on short shoots in the axil of normal leaves or scale leaves

#### Typical features of gymnosperms

There are no herbaceous gymnosperms, and the plants whether trees, shrubs or lianas are woody and evergreen. They have a tap root which usually persists for a long time. The xylem consists of tracheids, parenchyma and rays. Vessels are present in *Ephedra*, *Welwitschia* and *Gnetum*. They have evolved from pitted tracheids, as shown by intermediate stages between pits and perforations. In phloem only sieve cells differentiate; sieve areas commonly occur on the radial walls as well, and are numerous where the end of one sieve element overlaps that of another. The companion cells are absent. Secondary growth takes place in all gymnosperms; mature metaxylem shows bordered pits of various types; *Stangeria* and *Zamia* show scalariform thickenings. The anther has an exothecium. There are numerous light pollen grains which land directly on the surface of the nucellus during pollination. Prothallial cells are formed in the male gametophyte. The ovule is unitegmic and orthotropous. There is a prolonged free-nuclear phase in the development of the female gametophyte, a long interval between pollination and fertilization, a free-nuclear phase in the development of the proembryo, and haploid nutritive and storage tissue (the female gametophyte).

#### Development of the male gametophyte

The development of the male gametophyte mostly follows a uniform pattern, except in *Welwitschia* and *Gnetum*. The initial step in the pollen grain is the formation of one (cycads) or two prothallial cells which are usually inconspicuous and ephemeral. The prothallial cells are absent in Cupressaceae, Taxodiaceae, Cephalotaxaceae and Taxales. The microspore functions directly as the antheridial initial. After the formation of prothallial cells, the antheridial initial divides to form a small antheridial cell and a large tube cell. The latter is usually vacuolate and shows a large nucleus, while the small antheridial cell remains attached to the intine at the site of prothallial cell(s). The antheridial cell generally divides periclinally to form the stalk cell towards the pollen wall, and body cell. Initially, the stalk cell is surrounded by a distinct wall which eventually breaks down, and its cytoplasm merges with

that of the tube cell. In later stages the stalk and tube nuclei are indistinguishable from each other. The body cell enlarges, has dense cytoplasm, and a large nucleus. It divides and gives rise to male gametes.

#### Ovule

The young ovule has a central nucellus covered by a single integument. *Ephedra* has two coverings and *Welwitschia* and *Gnetum* three. All along the central region of integument up to the nucellus is a narrow passage, the micropyle. There is a conspicuous chalaza, the funiculus is not recognizable. The ovule is mostly orthotropous in gymnosperms, both extinct and extant. In the family Podocarpaceae the ovule is anatropous

#### Megasporogenesis

The young nucellus has one to several hypodermal archesporial cells. They divide periclinally to form the primary parietal and primary sporogenous cells. The parietal cell and its derivatives divide periclinally and give rise to a massive parietal tissue capping the primary sporogenous cells. The latter may also divide once or twice, or one or more cells may function directly as megaspore mother cell. The latter are elongated, have prominent nuclei, dense cytoplasm, and a thick wall. They undergo meiosis and produce triads (due to undivided upper dyad cell) or linear tetrads, generally the lowermost megaspore functions. The division takes place in a layer of callose, indicating that meiosis takes place under controlled conditions, comparable to the division of the microspore mother cell giving rise to microspores. One to several layers of densely cytoplasmic cells differentiate around the sporogenous cells, and become progressively conspicuous during subsequent stages. This is designated the spongy tissue or tapetum. Eventually, it degenerates and becomes compressed between the female gametophyte and outer tissues of the ovule.

Name the stages of development ovules receive pollen in different gymnosperms

In different gymnosperms the ovules receive pollen at various stages of development: (a) sporogenous cells or megaspore mother cell in *Ginkgo*, conifers and taxads; (b) free-nuclear gametophyte in many cycads and *Gnetum*; (c) young archegonia in *Macromia*, and (d) mature archegonia in *Ephedra*.

#### Mode of pollination

The pollen is produced in large quantities, is dispersed by wind, and the adjoining areas become covered by yellow dust, the sulphur shower. In *Ephedra aphylla*, *Gnetum* sp. and *Welwitschia* there is effective insect pollination

#### Write about release of male gametes during fertilization

The release of male gametes varies in different taxa of gymnosperms. (a) In cycads and *Ginkgo*, the gametes are released in the archegonial chamber which may contain a fluid. (b) In gymnosperms where the archegonia occur singly (*Pinus*, *Podocarpus*, *Cephalotaxus*, *Taxus*, *Ephedra*), the neck cells degenerate and the pollen tube penetrates the egg cell and releases the male gametes. (c) In taxa where the archegonial complexes are laterally placed as in *Athrotaxis* and *Callitris*, the pollen tubes grow adpressed to the neck of several archegonia

#### Name the phases of embryo development

The development of embryo can be divided into three phases.

- (a) Proembryogeny. Development beginning with the division of zygote up to the stage prior to elongation of the suspensor. There is heterogeneity in the development and four types can be distinguished: (i) Cycad and *Ginkgo* type, (ii) Conifer type, (iii) *Ephedra* and *Sequoia* type, and (iv) *Gnetum* and *Welwitschia* type.
- (b) Early embryogeny. Varies in different taxa; it includes elongation and proliferation of suspensors and formation of young embryonal mass.
- (c) Late embryogeny. Further development of the embryo, and establishment of polar meristems, i.e. root and shoot.

#### Ginkgoaceae

Ginkgoaceae is a monotypic family. The deciduous leaves are fan-shaped with parallel veins. The tree is dioecious; male flowers are catkin-like while the female is long-stalked with (usually) two ovules. The male gametes are motile, and the fruit is drupeous.

#### *Taxus*

*Taxus*, commonly known as yew, the leaves, shoots and seeds have poisonous properties. The active principle is taxine although other alkaloids are also present. Both fresh and partly dried shoots contain alkaloids; the withered/ dried shoots are considered more toxic in action than the fresh foliage. The poison content may vary in male and female trees, or in different trees. The scarlet aril around the seed is, however, harmless. The plants have to be fenced from cattle. From the inner bark (*T. brevifolia*) taxol is obtained which has therapeutic qualities

#### **Ephedrales**

The plants are herbs, woody shrubs or trees, leaves free, scale-like, and the stem jointed and green. Secondary wood has vessels. The plants are dioecious with compound male and female strobili. The ovule is surrounded by two envelopes, the inner projects as a long tube and archegonia are present. The embryo is dicotyledonous.