CHAPTER 5

Morphology of Flowering Plants

5.1 The Root

1. The roots that originate from the base of the stem are
(a) fibrous roots (b) primary roots
(c) prop roots (d) lateral roots.
(NEET 2020)

2. Sweet potato is a modified
(a) stem (b) adventitious root
(c) tap root (d) rhizome. *(NEET 2018)*

3. Roots play insignificant role in absorption of water in
(a) pea (b) wheat
(c) sunflower (d) *Pistia*. *(2015)*

4. Pneumatophores are found in
(a) the vegetation which is found in marshy and saline lake
(b) the vegetation which found in acidic soil
(c) xerophytes
(d) epiphytes. *(2000)*

5. The plant, which bears clinging roots, is
(a) screw pine (b) *Podostemon*
(c) *Trapa* (d) orchid. *(1999)*

6. Velamen is found in
(a) roots of screwpine
(b) aerial and terrestrial roots of orchids
(c) leaves of *Ficus elastica*
(d) aerial roots of orchids. *(1991)*

5.2 The Stem

7. In *Bougainvillea*, thorns are the modifications of
(a) adventitious root (b) stem
(c) leaf (d) stipules. *(NEET 2017)*

8. Which of the following is not a stem modification?
(a) Tendrils of cucumber
(b) Flattened structures of *Opuntia*
(c) Pitcher of *Nepenthes*
(d) Thorns of citrus *(NEET-I 2016)*

9. Stems modified into flat green organs performing the functions of leaves are known as
(a) phylloclades (b) scales
(c) cladodes (d) phyllodes.
(NEET-I 2016)

10. An example of edible underground stem is
(a) carrot (b) groundnut
(c) sweet potato (d) potato. *(2014)*

11. Sweet potato is homologous to
(a) potato (b) *Colocasia*
(c) ginger (d) turnip. *(Mains 2011)*

12. Which one of the following is a xerophytic plant in which the stem is modified into the flat green and succulent structure?
(a) *Opuntia* (b) *Casuarina*
(c) *Hydrilla* (d) *Acacia* *(Mains 2010)*

13. What is the eye of potato?
(a) Axillary bud (b) Accessory bud
(c) Adventitious bud (d) Apical bud *(2001)*

14. New banana plants develop from
(a) rhizome (b) sucker
(c) stolon (d) seed. *(1990)*

5.3 The Leaf

15. Leaves become modified into spines in
(a) onion (b) silk cotton
(c) *Opuntia* (d) pea.
(2015 Cancelled)

16. How many plants among China rose, *Ocimum*, sunflower, mustard, *Alstonia*, guava, *Calotropis* and *Nerium* (oleander) have opposite phyllotaxy?
(a) Three (b) Four
(c) Five (d) Two
(Karnataka NEET 2013)

17. Phyllode is present in
(a) *Asparagus* (b) *Euphorbia*
(c) Australian *Acacia* (d) *Opuntia*. *(2012)*

18. Whorled, simple leaves with reticulate venation are present in
(a) *Calotropis* (b) neem
(c) China rose (d) *Alstonia.* *(Mains 2011)*

5.4 The Inflorescence

19. Inflorescence is racemose in
(a) brinjal (b) tulip
(c) *Aloe* (d) soybean.
(Karnataka NEET 2013)

20. In a cymose inflorescence the main axis
(a) has unlimited growth
(b) bears a solitary flower
(c) has unlimited growth but lateral branches end in flowers
(d) terminates in a flower. *(Karnataka NEET 2013)*

21. Cymose inflorescence is present in
(a) *Solanum* (b) *Sesbania*
(c) *Trifolium* (d) *Brassica.* *(2012)*

22. Long filamentous threads protruding at the end of a young cob of maize are
(a) hairs (b) anthers
(c) styles (d) ovaries. *(2006)*

23. Hair found in the inflorescence of *Zea mays* are the modification of
(a) style (b) stigma
(c) spathe (d) filaments. *(2000)*

24. Hypanthodium is a specialised type of
(a) fruit (b) inflorescence
(c) thalamus (d) ovary. *(1994)*

5.5 The Flower

25. Ray florets have
(a) inferior ovary (b) superior ovary
(c) hypogynous ovary (d) half inferior ovary.
(NEET 2020)

26. The ovary is half inferior in
(a) brinjal (b) mustard
(c) sunflower (d) plum. *(NEET 2020)*

27. Placentation in which ovules develop on the inner wall of the ovary or in peripheral part, is
(a) free central (b) basal
(c) axile (d) parietal. *(NEET 2019)*

28. Match the placental types (column-I) with their examples (column-II).

Column-I	Column-II
(A) Basal	(i) Mustard
(B) Axile	(ii) China rose
(C) Parietal	(iii) *Dianthus*
(D) Free central	(iv) Sunflower

Choose the correct answer from the following options.
(a) (A)-(ii), (B)-(iii), (C)-(iv), (D)-(i)
(b) (A)-(i), (B)-(ii), (C)-(iii), (D)-(iv)
(c) (A)-(iv), (B)-(ii), (C)-(i), (D)-(iii)
(d) (A)-(iii), (B)-(iv), (C)-(i), (D)-(ii)
(Odisha NEET 2019)

29. The term 'polyadelphous' is related to
(a) gynoecium (b) androecium
(c) corolla (d) calyx.
(NEET-II 2016)

30. How many plants among *Indigofera, Sesbania, Salvia, Allium, Aloe*, mustard, groundnut, radish, gram and turnip have stamens with different lengths in their flowers?
(a) Three (b) Four
(c) Five (d) Six *(NEET-II 2016)*

31. Radial symmetry is found in the flowers of
(a) *Brassica* (b) *Trifolium*
(c) *Pisum* (d) *Cassia.*
(NEET-II 2016)

32. Free central placentation is found in
(a) *Dianthus* (b) *Argemone*
(c) *Brassica* (d) *Citrus.*
(NEET-II 2016)

33. The standard petal of a papilionaceous corolla is also called
(a) vexillum (b) corona
(c) carina (d) pappus. *(NEET-I 2016)*

34. Among China rose, mustard, brinjal, potato, guava, cucumber, onion and tulip, how many plants have superior ovary?
(a) Three (b) Four
(c) Five (d) Six *(2015)*

35. Axile placentation is present in
(a) pea (b) *Argemone*
(c) *Dianthus* (d) lemon. *(2015)*

36. Keel is the characteristic feature of flower of
(a) *Aloe* (b) tomato
(c) tulip (d) *Indigofera.*
(2015 Cancelled)

37. When the margins of sepals or petals overlap one another without any particular direction, the condition is termed as
(a) vexillary (b) imbricate
(c) twisted (d) valvate. *(2014)*

38. Among bitter gourd, mustard, brinjal, pumpkin, china rose, lupin, cucumber, sunhemp, gram, guava, bean, chilli, plum, *Petunia*, tomato, rose, *Withania*, potato, onion, *Aloe* and tulip how many plants have hypogynous flower?
(a) Fifteen (b) Eighteen
(c) Six (d) Ten *(NEET 2013)*

39. In China rose, the flowers are
(a) zygomorphic, hypogynous with imbricate aestivation
(b) zygomorphic, epigynous with twisted aestivation
(c) actinomorphic, hypogynous with twisted aestivation
(d) actinomorphic, epigynous with valvate aestivation. *(NEET 2013)*

40. Among flowers of *Calotropis*, tulip, *Sesbania*, *Asparagus*, *Colchicum*, sweet pea, *Petunia*, *Indigofera*, mustard, soybean, tobacco and groundnut, how many plants have corolla with valvate aestivation?
(a) Six (b) Seven
(c) Eight (d) Five
(Karnataka NEET 2013)

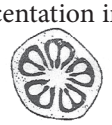
41. Placentation in tomato and lemon is
(a) parietal (b) free central
(c) marginal (d) axile. *(2012)*

42. The gynoecium consists of many free pistils in flowers of
(a) *Aloe* (b) tomato
(c) *Papaver* (d) *Michelia.* *(2012)*

43. How many plants in the list given below have marginal placentation?
Mustard, Gram, Tulip, *Asparagus*, Arhar, Sun- hemp, Chilli, *Colchicum*, Onion, Moong, Pea, Tobacco, Lupin
(a) Four (b) Five
(c) Six (d) Three *(Mains 2012)*

44. Flowers are zygomorphic in
(a) mustard (b) gulmohor
(c) tomato (d) *Datura.* *(2011)*

45. The ovary is half inferior in flowers of
(a) peach (b) cucumber
(c) cotton (d) guava. *(2011)*

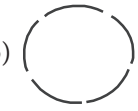
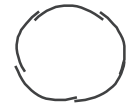
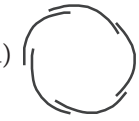
46. Which one of the following figures represents the placentation in *Dianthus*?
(a)  (b) 
(c)  (d) 
(Mains 2011)

47. In unilocular ovary with a single ovule, the placentation is
(a) marginal (b) basal
(c) free central (d) axile. *(2010)*

48. Keel is characteristic of the flowers of
(a) gulmohur (b) *Cassia*
(c) *Calotropis* (d) bean. *(2010)*

49. Ovary is half inferior in the flowers of
(a) guava (b) plum
(c) brinjal (d) cucumber. *(2010)*

50. The technical term used for the androecium in a flower of China rose (*Hibiscus rosa sinensis*) is
(a) monadelphous (b) diadelphous
(c) polyandrous (d) polyadelphous.
(2010)

51. Aestivation of petals in the flower of cotton is correctly shown in
(a)  (b) 
(c)  (d) 
(Mains 2010)

52. An example of axile placentation is
(a) *Dianthus* (b) lemon
(c) marigold (d) *Argemone.* *(2009)*

53. Replum is present in the ovary of flower of
(a) sunflower (b) pea
(c) lemon (d) mustard. *(2008)*

54. Angiosperm, to which the largest flowers belong, is
(a) total root parasite (b) partial root parasite
(c) total stem parasite (d) partial stem parasite.
(1999)

5.6 The Fruit

55. Coconut fruit is a
(a) berry (b) nut
(c) capsule (d) drupe. *(NEET 2017)*

56. The morphological nature of the edible part of coconut is
(a) cotyledon (b) endosperm
(c) pericarp (d) perisperm.
(NEET 2017)

57. Placenta and pericarp are both edible portions in
(a) apple (b) banana
(c) tomato (d) potato. *(2014)*

58. An aggregate fruit is one which develops from
(a) multicarpellary syncarpous gynoecium
(b) multicarpellary apocarpus gynoecium
(c) complete inflorescence
(d) multicarpellary superior ovary. *(2014)*

59. How many plants in the list given below have composite fruits that develop from an inflorescence?
Walnut, poppy, radish, fig, pineapple, apple, tomato, mulberry.
(a) Four (b) Five
(c) Two (d) Three *(2012)*

60. The coconut water and the edible part of coconut are equivalent to
(a) endosperm (b) endocarp
(c) mesocarp (d) embryo. *(2012)*

61. A drupe develops in
(a) mango (b) wheat
(c) pea (d) tomato. *(2011)*

62. A fruit developed from hypanthodium inflorescence is called
(a) sorosis (b) syconus
(c) caryopsis (d) hesperidium. *(2009)*

63. Cotyledons and testa respectively are edible parts in
(a) walnut and tamarind
(b) french bean and coconut
(c) cashew nut and litchi
(d) groundnut and pomegranate. *(2009)*

64. The fleshy receptacle of syconus of fig encloses a number of
(a) berries (b) mericarps
(c) achenes (d) samaras. *(2008)*

65. Dry indehiscent single-seeded fruit formed from bicarpellary syncarpous inferior ovary is
(a) berry (b) cremocarp
(c) caryopsis (d) cypsela. *(2008)*

66. The fruit is chambered, developed from inferior ovary and has seeds with succulent testa in
(a) guava (b) cucumber
(c) pomegranate (d) orange. *(2008)*

67. Pineapple (*Ananas*) fruit develops from
(a) a multilocular monocarpellary flower
(b) a unilocular polycarpellary flower
(c) a multipistillate syncarpous flower
(d) a cluster of compactly borne flowers on a common axis. *(2006)*

68. In which of the following fruits, the edible part is the aril ?
(a) Litchi (b) Custard apple
(c) Pomegranate (d) Orange *(2006)*

69. Which of the following represents the edible part of the fruit of litchi?
(a) Mesocarp (b) Endocarp
(c) Pericarp (d) Juicy aril *(2005)*

70. Edible part of mango is
(a) endocarp (b) receptacle
(c) epicarp (d) mesocarp. *(2004)*

71. Juicy hair-like structures observed in the lemon fruit develop from
(a) exocarp
(b) mesocarp
(c) endocarp
(d) mesocarp and endocarp. *(2003)*

72. Geocarpic fruit is
(a) potato (b) peanut
(c) onion (d) garlic. *(2002)*

73. Edible part in mango is
(a) mesocarp (b) epicarp
(c) endocarp (d) epidermis. *(2002)*

74. Edible part of banana is
(a) epicarp
(b) mesocarp and less developed endocarp
(c) endocarp and less developed mesocarp
(d) epicarp and mesocarp. *(2001)*

75. Geocarpic fruit is
(a) carrot (b) radish
(c) groundnut (d) turnip. *(2000)*

76. Which plant will lose its economic value, if its fruits are produced by induced parthenocarpy?
(a) Orange (b) Banana
(c) Grape (d) Pomegranate *(1997)*

77. Which of the following is a 'true fruit'?
(a) Banana (b) Fig
(c) Apple (d) Pear *(1996)*

78. Fruit of *Mangifera indica* is
(a) berry (b) drupe
(c) capsule (d) siliqua. *(1991)*

79. Mango juice is obtained from
(a) epicarp (b) mesocarp
(c) endocarp
(d) pericarp and thalamus. *(1989)*

80. Fruit of groundnut is
(a) legume (b) caryopsis
(c) berry (d) nut. *(1988)*

5.7 The Seed

81. The body of the ovule is fused within the funicle at
(a) hilum (b) micropyle
(c) nucellus (d) chalaza. *(NEET 2020)*

82. Cotyledon of maize grain is called
(a) coleoptile (b) scutellum
(c) plumule (d) coleorhiza.
(NEET-I 2016)

83. The wheat grain has an embryo with one large, shield shaped cotyledon known as
(a) scutellum (b) coleoptile
(c) epiblast (d) coleorhiza. *(2015)*

84. Which one of the following statements is correct?
(a) The seed in grasses is not endospermic.
(b) Mango is a parthenocarpic fruit.
(c) A proteinaceous aleurone layer is present in maize grain.
(d) A sterile pistil is called a staminode. *(2014)*

85. Which one of the following statements is correct?
(a) In tomato, fruit is a capsule.
(b) Seeds of orchids have oil-rich endosperm.
(c) Placentation in primose is basal.
(d) Flower of tulip is a modified shoot. *(2011)*

86. The scutellum observed in a grain of wheat or maize is comparable to which part of the seed in other monocotyledons?
(a) Cotyledon (b) Endosperm
(c) Aleurone layer (d) Plumule *(2010)*

87. An example of a seed with endosperm, perisperm, and caruncle is
(a) coffee (b) lily
(c) castor (d) cotton. *(2009)*

88. Endosperm is consumed by developing embryo in the seed of
(a) pea (b) maize
(c) coconut (d) castor. *(2008)*

89. The aleurone layer in maize grain is specially rich in
(a) proteins (b) starch
(c) lipids (d) auxins. *(2003)*

90. Which is correct pair for edible part?
(a) Tomato-thalamus (b) Maize-cotyledons
(c) Guava-mesocarp (d) Date palm-mesocarp *(2001)*

91. In groundnut the food/oil reserve is present in
(a) epicarp (b) mesocarp
(c) endosperm (d) cotyledons. *(1990)*

92. Oil reserve of groundnut is present in
(a) embryo (b) cotyledons
(c) endosperm (d) underground tubers. *(1990)*

5.8 Semi-Technical Description of a Typical Flowering Plant

93. Floral features are chiefly used in angiosperm identification because
(a) flowers can be safely pressed
(b) reproductive parts are more stable and conservative than vegetative parts
(c) flowers are nice to work with
(d) flowers are of various colours. *(1998)*

5.9 Description of Some Important Families

94. Tricarpellary, syncarpous gynoecium is found in flowers of
(a) Fabaceae (b) Poaceae
(c) Liliaceae (d) Solanaceae *(NEET-I 2016)*

95. $\oplus\ \female\ K_{(5)}\ \overset{\frown}{C_{(5)}\ A_5}\ \underline{G}_{(2)}$ is the floral formula of
(a) *Petunia* (b) *Brassica*
(c) *Allium* (d) *Sesbania*. *(2015 Cancelled)*

96. Vexillary aestivation is characteristic of the Family
(a) Fabaceae (b) Asteraceae
(c) Solanaceae (d) Brassicaceae. *(2012)*

97. The correct floral formula of chilli is
(a) $\oplus\ \female\ K_{(5)}\ C_5\ A_5\ \underline{G}_{(2)}$ (b) $\oplus\ \female\ K_{(5)}\ \overset{\frown}{C_{(5)}\ A_5}\ \underline{G}_{(2)}$
(c) $\oplus\ \female\ K_{(5)}\ C_{(5)}\ A_{(5)}\ \underline{G}_2$ (d) $\oplus\ \female\ K_5\ \overset{\frown}{C_5\ A_{(5)}}\ \underline{G}_2$. *(2011)*

98. The correct floral formula of soybean is
(a) $\%\ \male\ K_{(5)}\ C_{1+(2)\ +\ 2}\ A_{(9)+1}\ \underline{G}_1$
(b) $\%\ \male\ K_5\ C_{1+(2)\ +\ 2}\ A_{(9)+1}\ \underline{G}_1$
(c) $\%\ \male\ K_{(5)}\ C_{1+2\ +\ (2)}\ A_{(9)+1}\ \underline{G}_1$
(d) $\%\ \male\ K_{(5)}\ C_{1+2\ +\ (2)}\ A_{1+(9)}\ \underline{G}_1$ *(Mains 2010)*

99. Consider the following four statements (i), (ii), (iii) and (iv) and select the right option for two correct statements.
Statements :
(i) In vexillary aestivation, the large posterior petal is called-standard, two lateral ones are wings and two small anterior petals are termed keel.
(ii) The floral formula for Liliaceae is $\oplus\ \male\ P_{3+3}\ A_{3+3}\ +\ \underline{G}_{(3)}$.
(iii) In pea flower the stamens are monodelphous.
(iv) The floral formula for Solanaceae is $\oplus\ \male\ K_{(3)}\ C_{(3)}\ A_{(4)}\ +\ \underline{G}_{(2)}$.
The correct statements are
(a) (i) and (iii) (b) (i) and (ii)
(c) (ii) and (iii) (d) (iii) and (iv). *(Mains 2010)*

100. The floral formula $\oplus\ \female\ K_{(5)}\ \overset{\frown}{C_{(5)}\ A_5}\ \underline{G}_{(2)}$ is that of
(a) soybean (b) sunhemp
(c) tobacco (d) tulip. *(2009)*

101. Pentamerous actinomorphic flowers, bicarpellary ovary with oblique septa, and fruit capsule or berry, are characteristic features of
(a) Liliaceae (b) Asteraceae
(c) Brassicaceae (d) Solanaceae. *(2006)*

102. Bicarpellary gynoecium and oblique ovary occurs in
(a) mustard (b) banana
(c) *Pisum* (d) brinjal. *(2001)*

103. Tetradynamous conditions occur in
(a) Cruciferae (b) Malvaceae
(c) Solanaceae (d) Liliaceae. *(2001)*

104. Which is expressing right appropriate pairing?
(a) Brassicaceae - sunflower
(b) Malvaceae - cotton
(c) Papilionaceae - *Catechu*
(d) Liliaceae - wheat *(2000)*

105. Pulses are obtained from
(a) Fabaceae (b) Asteraceae
(c) Poaceae (d) Solanaceae. *(1993)*

106. Epipetalous stamens with free filaments and fused anthers occur in
(a) Asteraceae (b) Solanaceae
(c) Liliaceae (d) Poaceae. *(1992)*

107. Floral formula of tomato/tobacco is
(a) $\oplus ♂♀ K_{4-5}A_{10}G_{(2)}$ (b) $\oplus ♂♀ K_{2+2}C_4A_{2+4}G_1$
(c) $\oplus ♂♀ P_2A_3G_1$ (d) $\oplus ♂♀ K_{(5)}\overset{\frown}{C_{(5)}}A_5\underline{G}_{(2)}$.
(1992, 1989)

108. $\oplus ♂♀ K_{(5)}\overset{\frown}{C_{(5)}}A_5\,\underline{G}_{(2)}$ is floral formula of
(a) Liliaccae (b) Solanaceae
(c) Asteraceae (d) Fabaceae. *(1991)*

109. Epipetalous and syngenesious stamens occur in
(a) Solanaceae (b) Brassicaceae
(c) Fabaceae (d) Asteraceae. *(1991)*

110. A family delimited by type of inflorescence is
(a) Fabaceae (b) Asteraceae
(c) Solanaceae (d) Liliaceae. *(1991)*

111. Syngenesious condition is found in
(a) Asteraceae (b) Labiatae
(c) Solanaceae (d) Fabaceae. *(1991)*

ANSWER KEY

1.	(a)	**2.**	(b)	**3.**	(d)	**4.**	(a)	**5.**	(d)	**6.**	(d)	**7.**	(b)	**8.**	(c)	**9.**	(a)	**10.**	(d)
11.	(d)	**12.**	(a)	**13.**	(a)	**14.**	(b)	**15.**	(c)	**16.**	(a)	**17.**	(c)	**18.**	(d)	**19.**	(d)	**20.**	(d)
21.	(a)	**22.**	(c)	**23.**	(a)	**24.**	(b)	**25.**	(a)	**26.**	(d)	**27.**	(d)	**28.**	(c)	**29.**	(b)	**30.**	(b)
31.	(a)	**32.**	(a)	**33.**	(a)	**34.**	(d)	**35.**	(d)	**36.**	(d)	**37.**	(b)	**38.**	(a)	**39.**	(c)	**40.**	(b)
41.	(d)	**42.**	(d)	**43.**	(c)	**44.**	(b)	**45.**	(a)	**46.**	(b)	**47.**	(b)	**48.**	(d)	**49.**	(b)	**50.**	(a)
51.	(d)	**52.**	(b)	**53.**	(d)	**54.**	(a)	**55.**	(d)	**56.**	(b)	**57.**	(c)	**58.**	(b)	**59.**	(d)	**60.**	(a)
61.	(a)	**62.**	(b)	**63.**	(d)	**64.**	(c)	**65.**	(d)	**66.**	(c)	**67.**	(d)	**68.**	(a)	**69.**	(d)	**70.**	(d)
71.	(c)	**72.**	(b)	**73.**	(a)	**74.**	(c)	**75.**	(c)	**76.**	(d)	**77.**	(a)	**78.**	(b)	**79.**	(b)	**80.**	(a)
81.	(a)	**82.**	(b)	**83.**	(a)	**84.**	(c)	**85.**	(d)	**86.**	(a)	**87.**	(c)	**88.**	(a)	**89.**	(a)	**90.**	(d)
91.	(d)	**92.**	(b)	**93.**	(b)	**94.**	(c)	**95.**	(a)	**96.**	(a)	**97.**	(b)	**98.**	(c)	**99.**	(b)	**100.**	(c)
101.	(d)	**102.**	(d)	**103.**	(a)	**104.**	(b)	**105.**	(a)	**106.**	(a)	**107.**	(d)	**108.**	(b)	**109.**	(d)	**110.**	(b)
111.	(a)																		

Hints & Explanations

1. (a) : In monocotyledonous plants, the primary root is short lived and is replaced by a large number of roots. These roots originate from the base of the stem and constitute the fibrous root system, *e.g.*, wheat plant.

2. (b) : Sweet potato (*Ipomoea batatas*) is swollen single root tuber that does not assume a definite shape. It is a modified adventitious root for storage of food.

3. (d) : *Pistia* (water lettuce) is a floating aquatic plant. In aquatic plants, roots are generally poorly developed and do not take part in absorption of water. Water is absorbed by the general body surface in these plants.

4. (a) : These special roots, called pneumatophores or knees, develop in mangrove plants, *i.e.*, plants growing in saline marshes. These roots grow vertically upward and are negatively geotropic. Air enters these roots through minute breathing pores called pneumathodes, present on the tips of vertical roots. These plants include *Rhizophora*, *Heritiera*, *Avicennia*, etc.

5. (d) : Clinging roots arise from the nodes of stem and penetrate the stem of the host plant. It helps in fixing the plant to the host. It is found in orchids. Orchids bear three types of roots - clinging roots for fixation, absorbing roots for absorbing mineral salts and water and epiphytic roots for absorbing moisture from air.

6. (d) : Velamen is found in aerial roots of orchids. In many epiphytic orchids, the aerial roots are covered by a hygroscopic velamen tissue. They absorb water from the atmosphere.

7. (b)

8. (c) : Pitcher of *Nepenthes* is a modification of leaf. In *Nepenthes*, the pitchers are meant for catching and digesting insects. The lamina is modified into pitcher. The leaf apex gives rise to a coloured lid for attracting the insects.

9. (a) : Phylloclades are flattened green stems which have taken over the function of photosynthesis while cladodes are only the branches of stem that are modified to take over the function of leaves.

10. (d) : Carrot and sweet potato are root modifications while edible part of groundnut is seed. Potato is an edible underground stem.

11. (d) : Sweet potato is homologous to turnip as both are having same origin, *i.e.,* both are root but modified for different functions. Sweet potato is a modified root for storage and vegetative propagation while turnip is modified for storage only.

12. (a) : *Opuntia* is a xerophytic plant which lives in dry habitat. The plant has fleshy organs where water and mucilage are stored. The stem is modified into flat green structure, called as phylloclade.

13. (a) : A tuber is the swollen tip of the underground branch. Tubers are round or oval in shape. Each tuber has many notches on the surface called 'eyes'. These are in fact axillary buds which grow into new plants during favourable conditions.

14. (b) : Suckers are the sub-aerial modification of stem. They grow obliquely upward from the main stem producing roots from the underground nodes. The sucker like structures in banana are also called sword suckers, which give rise to new leafy trunk.

15. (c) : In xerophytic plants, the leaves modify into sharp, pointed spines, *e.g.*, *Solanum surattense, Opuntia, Asparagus,* etc. This modification is either for protection of plant or to lessen transpiration, or for both.

16. (a) : In opposite phyllotaxy, two leaves are borne on the opposite sides of a single node. It is of two types; (i) opposite and superposed, (ii) opposite and decussate. *Ocimum*, guava and *Calotropis* have opposite decussate phyllotaxy.

17. (c) : In several species of *Acacia* found in the deserts of Australia the bipinnate lamina is absent. Instead petiole and part of the rachis become flattened into sickle-shaped structure for performing the function of food synthesis. Such a flattened petiole which carries out the functions of the lamina is called phyllode. Formation of phyllode is a mechanism to reduce transpiration because (i) it is vertically placed and (ii) has fewer stomata.

18. (d) : In *Alstonia*, five or more leaves arises from each node, so it shows whorled phyllotaxy. The leaves are leathery, sessile, simple which are elliptical or ovate or wedge shaped at the base. It is used in traditional medicines.

19. (d) : Racemose inflorescence is also called indefinite and indeterminate type. Growth of the peduncle is indefinite. Here the terminal bud will not modify into a flower. Flowers develop in acropetal succession, *i.e.*, mature flowers are towards the base and the younger ones towards the tip of the peduncle. Flowers open in centripetal succession, *i.e.*, opening of flowers proceeds from the periphery to the centre of the inflorescence. Peduncle may be unbranched or branched. Soybean belongs to Family Fabaceae which has racemose inflorescence.

20. (d) : Cymose inflorescence is also called definite or determinate inflorescence. Growth of the peduncle is definite. Here, the terminal bud is modified into a flower. Flowers develop in basipetal succession, *i.e.*, mature flowers are towards the apex and young flower buds are towards the base. Flowers open in centrifugal sequence, *i.e.*, flowers open from centre to the periphery of the inflorescence, *e.g.*, *Solanum*, *Ranunculus, Datura*, *Gossypium*, etc.

21. (a) : *Refer to answer 20.*

22. (c) : In maize the male inflorescence occupies the terminal position on the main axis, whereas the female inflorescence (ear or cob) is borne on modified lateral branches in the axils of leaves. The ear producing branch has short internodes and bears a female spike at its apex. Each spikelet has a pair of small membranous glumes and two florets. The feathery styles of the female florets are long and emerge out of the cobs to expose stigma for wind pollination.

23. (a) : *Refer to answer 22.*

24. (b) : Inflorescence is the cluster of flowers or arrangement of flowers on the floral axis. Hypanthodium is the characterstic inflorescence of *Ficus* (Family Moraceae). Here a cup-shaped cavity with an apical opening or ostiole is formed by a fleshy receptacle, which is guarded by inwardly projecting hairs and bear flowers on the inner wall of the cavity, *i.e.*, female (♀) flowers at the base and male (♂) flowers above.

25. (a) : The ovary is inferior in ray florets of sunflower. It possess epigynous flower *i.e.,* the margin of thalamus grows upward enclosing the ovary completely and getting fused with it, the other parts of flower arise above the ovary.

26. (d) : The ovary is superior in brinjal and mustard while it is inferior in sunflower.

27. (d) : Parietal placentation is found in compound or syncarpous ovary. There are two or more longitudinal placentae or files of ovules attached to the ovary wall. The

ovary is usually unilocular but becomes falsely two or more locular due to ingrowth of placentae or formation of false septa.

28. (c)

29. (b) : Polyadelphous condition represents cohesion of stamens. In this condition stamens of a flower are fused by their filaments only to form many groups, *e.g.*, *Citrus*.

30. (b)

31. (a) : The flowers of *Brassica* are radially symmetrical whereas flowers of *Trifolium*, *Pisum* and *Cassia* are zygomorphic.

32. (a) : Free central placentation is found in *Dianthus*. Parietal placentation is present in *Argemone* and *Brassica* whereas *Citrus* has axile placentation in ovary.

33. (a) : The posterior large bilobed petal of a papilionaceous corolla is called standard or vexillum. It overlaps the two smaller lateral petals known as wings or alae.

34. (d) : China rose, mustard, brinjal, potato, onion and tulip are the plants that have superior ovary whereas in guava and cucumber, ovary is inferior.

35. (d) : Axile placentation occurs in syncarpous pistils. The ovary is partitioned into two or more chambers. Placentae occur in the central region where the septa meet so that, an axile column bearing ovules is formed, *e.g.*, shoe flower (pentalocular), lemon (multilocular), etc.

36. (d) : The flowers of Family Papilionaceae have butterfly shaped corolla (papilionaceous corolla). Posterior or outermost petal is the largest and is called standard or vexillum, two lateral petals are similar and generally clawed, are called wings or alae and the two anterior petals called keel are fused enclosing stamens and carpels. This type of petal arrangement is found in bean, gram, pea, *Indigofera,* etc.

37. (b) : Aestivation is the arrangements of accessory floral organs (sepals or petals) in relation to one another in floral bud. It may be of open, valvate, twisted or imbricate type. In imbricate aestivation there is an irregular overlapping of petals or sepals by one another. *Cassia*, gulmohar, etc., show imbricate aestivation.

38. (a) : In the hypogynous flower the gynoecium occupies the highest position while the other parts are situated below it. The ovary in such flowers is said to be superior, *e.g.*, mustard, China rose and brinjal. All the given plants except bitter gourd, pumpkin, cucumber, guava, plum and rose have hypogynous flower.

39. (c) : In China rose the flowers are actinomorphic, *i.e.*, it can be divided into two equal radial halves in any radial plane passing through the centre; they are hypogynous, *i.e.*, the gynoecium occupies the highest position, while the other parts are situated below it; they have twisted aestivation, *i.e.*, one margin of petal overlaps that of the next one and so on.

40. (b) : The mode of arrangement of the sepals or petals with respect to one another in the floral bud is termed as aestivation. In valvate aestivation, sepals or petals or tepals just touch each other without any overlapping. *Calotropis*, tulip, *Asparagus*, *Colchicum*, *Petunia*, mustard and tobacco have valvate aestivation.

41. (d)

42. (d) : Gynoecium is the female reproductive organ of a flower. It may be apocarpous (pistils separated), *e.g.*, *Michelia* or syncarpous (fused), *e.g.*, tomato.

43. (c) : Gram, arhar, sunhemp, moong, pea and lupin belong to Family Fabaceae which is characterised by marginal placentation.

44. (b) : Flowers of gulmohar have bilateral symmetry. So, they are called zygomorphic. *Datura*, mustard and tomato have actinomorphic flowers.

45. (a) : If gynoecium is situated in the centre and other parts of the flower are located on the rim of the thalamus almost at the same level, it is called perigynous. The ovary here is said to be half inferior, *e.g.*, plum, rose, peach.

46. (b) : The given figure in option (b) represents the free central placentation. In free central placentation, ovary is unilocular and ovules are borne on the axis in the center of the ovary and septa are absent. It is seen in *Dianthus* and *Primrose*.

47. (b) : In basal type of placentation the ovary is unilocular and ovules and generally reduced to one borne at the base of the ovary.

48. (d) : *Refer to answer 36.*

49. (b) : If gynoecium is situated in the centre and other parts of the flower are located on the rim of the thalamus almost at the same level, it is called perigynous. The ovary here is said to be half inferior, *e.g.*, plum, rose, peach.

50. (a) : China rose of Family Malvaceae possess numerous stamens. The filaments of stamens are united in one group thus forming a staminal tube around the style. Such stamens are called monadelphous.

51. (d) : In cotton, China rose and lady's finger margins of sepals or petals overlap that of the next one this mode of arrangement (aestivation) is called twisted.

52. (b)

53. (d) : Replum is a false septum formed due to the ingrowth of parietal placenta. This makes the ovary bilocular. It is mainly seen in the ovary of flowers of Brassicaceae (Cruciferae) Family, *e.g.*, mustard, candytuft, etc.

54. (a) : *Rafflesia* is a specialised total root parasite as the vegetative parts of its body are reduced and the whole body is within the host root and only structure which is visible outside, is the biggest flower. The diameter of the flower is one meter and its weight is about 10 kg. Its pollination is done by elephant. The flowers are fleshy white and they emit smell, which resembles the smell of decaying meat.

55. (d) : Coconut fruit is fibrous drupe with a fibrous mesocarp.

56. (b)

57. (c) : A true fruit consists of a pericarp (fruit wall) formed from ovary wall and seeds formed from ovules. Pericarp is divisible into epicarp, mesocarp and endocarp. Tomato is a berry fruit derived from bicarpellary, syncarpous, bi- to tetralocular ovary with swollen placenta. Berry consists of a membranous skin represented by epicarp. Mesocarp is the middle fleshy part. Endocarp, septa and placenta are pulpy and edible.

58. (b) : An aggregate fruit or etaerio is a group of simple fruitlets that develop from free ovaries (apocarpous condition) of a single flower (single gynoecium).

59. (d) : A composite or multiple fruit is a group of fruitlets which develop from the different flowers of an inflorescence. It is of two main types, sorosis (*e.g.*, mulberry, pineapple, jackfruit) and syconus (*e.g.*, peepal, banyan, fig, etc.)

60. (a) : Coconut fruit is a drupe. It has a membranous epicarp, fibrous mesocarp and stony endocarp. The endocarp encloses a single seed with brown testa that contains a small embryo and a white oily endosperm (edible part) with watery fluid called coconut water.

61. (a) : Drupe is a fleshy fruit that develops from either one or several fused carpels and contains one or many seeds. The seeds are enclosed by the hard protective endocarp (pericarp) of the fruit, *e.g.*, mango. In mango the pericarp is well differentiated into an outer thin epicarp, a middle fleshy edible mesocarp and an inner stony hard endocarp.

62. (b) : Syconus fruit develops from a hypanthodium inflorescence, *e.g.*, *Ficus.* Hypanthodium is a box like inflorescence where the box is formed by the fleshly receptacle. It opens to exterior by a single pore called ostiole. The hollow pear shaped fleshy receptacle encloses a number of minute male and female flowers, it becomes fleshy and forms the fruit.

63. (d) : Groundnut is dry, one chambered, one seeded fruit developing from a superior bi or poly carpellary ovary. The edible part is cotyledons and embryo lobe. Pomegranate is balausta type of fruit. The fruits develop from multilocular syncarpous inferior ovary. Testa is fleshy and edible.

64. (c) : Syconus develop from hypanthodium type of inflorescence. The flask shaped fleshy receptacle encloses female flower which produces small achene like fruitlets and has a small pore protected by scale leaves, *e.g.*, syconus of fig (*Ficus carica*).

65. (d) : Cypsela is a dry, one chambered, one seeded fruit developing from an inferior, bicarpellary ovary, *e.g.*, sunflower, marigold, cosmos, etc. Caryopsis or grain is a small, dry one seeded fruit developing from superior monocarpellary ovary. Pericarp is fused with the seed coat, *e.g.*, rice, wheat, maize, etc. Cremocarp is a bilocular, two seeded fruit developing from an inferior bicarpellary ovary. It is characteristic fruit of umbelliferae, *e.g.*, coriander, *Cuminum*, etc. Berry or bacca develops from mono or multicarpellary superior or inferior syncarpous ovary with axile or parietal placentation, *e.g.*, tomato, banana, brinjal, guava, grapes, etc.

66. (c) : In pomegranate, the whole fruit is covered by a hard rind made up of exocarp and a part of mesocarp. It develops from multilocular syncarpous inferior ovary. Mesocarp forms plate like infolding (*i.e.*, chambered) and the seeds are covered by endocarp and contain bright red succulent testa.

67. (d) : Pineapple is a sorosis type of fruit that develops from spike or spadix inflorescence. Here the flowers fuse by their succulent tepals and axis bearing the flowers becomes fleshy or woody, thus forming a compact mass. These are composite or multiple fruits. In pineapple fleshy axis, bracts, fused perianth and pericarp are edible.

68. (a) : In litchi, aril forms the edible part in fruit. It is a collar like outgrowth from the base of the ovule forming a kind of third integument. Litchi is a nut. In litchi, the epicarp and mesocarp (layers of pericarp) together become leathery and the endocarp is membranous.

69. (d)

70. (d) : Mango (*Mangifera indica*) of Family Anacardiaceae is a drupe. The edible part in mango is mesocarp.

71. (c) : Lemon is a hesperidium type of fruit. It is many chambered fleshy fruit developing from a multicarpellary, syncarpous, multilocular, superior ovary bearing seeds on axile placentation. The leathery epicarp of hesperidium has many glands of aromatic oil. The mesocarp, represented by white fibres, is fused to the epicarp. The epicarp and mesocarp together form the rind. The endocarp is thin and papery. It projects inwards and forms many compartments. The inner wall of endocarp gives out many juicy succulent hairs which form the edible part of the fruit. Hesperidium is a characteristic fruit of the Rutaceae, *e.g.*, *Citrus aurantifolia* (lemon), *Citrus reticulata* (orange), etc.

72. (b)

73. (a) : Mango (*Mangifera indica*) of Family Anacardiaceae is a drupe. The edible part in mango is mesocarp.

74. (c) : Banana is a berry. It develops from monocarpellary or multicarpellary syncarpous ovary. Epicarp makes the rind of the fruit, mesocarp is fleshy and endocarp is thin and membranous. The edible portion of banana is endocarp and less developed mesocarp.

75. (c)

76. (d) : Development of fruits without fertilisation is called parthenocarpy and such fruits are called parthenocarpic fruits. Since in pomegranate juicy testa is the edible part and parthenocarpy will make the fruit seedless and hence they will be useless.

77. (a) : A fruit is a ripened ovary. On the basis of the formation of fruits, they are classified into two types - true fruits and false fruits. True fruits are developed from the ovary only. Banana is a fleshy fruit - berry. It develops from multicarpellary syncarpous superior or inferior ovary. The pericarp of berries is differentiated into epicarp, mesocarp and endocarp (like drupes) but the endocarp is not stony as in drupes. Apple and pear are pome. Pome is a false fruit in which the edible part is thalamus where the true fruit remains embedded. Fig is a composite fruit. These fruits are the products of the whole inflorescence together with its component parts.

78. (b) **79. (b)**

80. (a) : Fruit of groundnut is legume. It is developed from monocarpellary ovary but dehisces by both sutures from apex downward.

81. (a) : The hilum is a scar on the seed coat where funicle and body of ovule is attached..

82. (b) : The seeds of monocotyledonous plants have only one cotyledon. In Family Poaceae (*e.g.*, wheat, maize, etc.), this cotyledon is called scutellum, situated towards lateral side of embryonal axis. It provides nourishment to the developing embryo.

83. (a)

84. (c) : Grass seeds are endospermic. Mango is a seeded fruit. A sterile pistil is called pistillode and a sterile stamen is called staminode. Maize grains consist of fruit wall, seed coat, endosperm and embryo. The endosperm occupies most of the grains interior and consists of two parts, horny aleurone layer and mainly storage layers. The aleurone layer lies immediately below the grain covering and is 1-3 cell thick. Aleurone cells are thick walled with cytoplasm filled with aleurone grains which produce enzymes during seed germination to mobilise stored nutrients.

85. (d)

86. (a) : Scutellum is the tissue in a grass or wheat or maize seed that lies between the embryo and the endosperm. It is the modified cotyledon, being specialised for the digestion and absorption of the endosperm.

87. (c) : In castor seed, testa and tegmen are united together. Seed coat is tough and bright due to scleroprotein. Over narrower end a brownish pad is found which is called caruncle. Caruncle is carbohydrate in nature. This protects micropyle and develops as an integumental outgrowth after fertilisation.Below seed coat a very thin membrane is found over kernel and called perisperm (the persistant nucellus).Below perisperm there is a large, white, swollen and oily mass called endsoperm.

88. (a) : During the process of the development of the embryo, the food stored up in the endosperm is continuously drawn up by the developing embryo and thus completely exhausted. Such seeds are known as exalbuminous or non-endospermic. The common examples of exalbuminous are gram, pea, bean, tamarind, orchid, etc.

89. (a) : In monocotyledons the seeds are generally endospermous. The internal structure of grain can be studied in a longitudinal section. It shows two distinct regions upper large region, the endosperm and lower smaller region, the embryo. The endosperm is surrounded by a special one cell thick layer, called aleurone layer. It is filled with aleurone grains which are proteinaceous in nature.

90. (d)

91. (d) : In groundnut the food/oil reserve is present in cotyledons. It is very important commercial crop of Leguminosae.

92. (b) : *Refer to answer 91.*

93. (b) : Floral features are used to identify angiosperms because reproductive parts are more stable and conservative than vegetative parts.

94. (c) : Members of Liliaceae possess tricarpellary, syncarpous gynoecium with superior ovary. The ovary is trilocular with two to many ovules in each loculus.

95. (a) : The given floral formula is of Family Solanaceae. Among the given options, only *Petunia* belongs to Family Solanaceae. *Allium* is a member of Family Liliaceae, *Sesbania* is of Family Leguminosae and *Brassica* is a member of Family Brassicaceae or Cruciferae.

96. (a) : Vexillary aestivation is a characteristic of Family Fabaceae. In it, the posterior largest petal (standard) overlaps two lateral petals (wings) which in turn overlap two anterior petals (keel). It is also called papilionaceous corolla.

97. (b) : Chilli is the member of Solanaceae, in

which flowers are bisexual (♀), actinomorphic (⊕); calyx – 5 and gamosepalous, corolla – 5 and gamopetalous; androecium – 5, free, epipetalous basifixed, inferior; gynoecium – bicarpellary, syncarpous and ovary superior. So, floral formula of chilli is $\oplus \, ♀ \, K_{(5)} \overset{\frown}{C_{(5)}} \, A_5 \, \underline{G}_{(2)}$.

98. (c) : The plants belonging to the Family Fabaceae such as soybean, pea, *sem*, *moong*, gram, etc. have the floral formula $\% \, ♀ \, K_{(5)} \, C_{1+2+(2)} \, A_{(9)+1} \, \underline{G}_1$.

99. (b) : Flowers in pea have diadelphous stamens. The floral formula for Solanaceae is $\oplus ♀ \, K_{(5)} \, \overset{\frown}{C_{(5)}} \, A_5 \, \underline{G}_{(2)}$.

100. (c) : The floral formula of tobacco is $\oplus ♀ \, K_{(5)} \overset{\frown}{C_{(5)}} \, A_5 \, \underline{G}_{(2)}$. It belongs to the Family Solanaceae. The flower is actinomorphic, bisexual, 5 sepals gamosepalous, 5 gamopetalous corolla, 5 epipetalous stamens and 2 carpels syncarpous having superior ovary.

101. (d) : A pentamerous actinomorphic flower is one where the floral parts are in multiples of five and the flower can be divided into two equal halves in more than one plane. Gynoecium is bicarpellary, syncarpous, forming a superior bilocular ovary. Each locule has many ovule on axile placentation. Members of Solanaceae are characterised by the presence of an obliquely placed septum in the ovary and highly swollen placentae.

102. (d) : Brinjal or *Solanum melongena* belongs to Family Solanaceae. The fruits are rich in iodine. They are used in the form of vegetable. Gynoecium is bicarpellary, syncarpous, forming a superior bilocular ovary. Each locule has many ovules on axile placentation. Members of Solanaceae are characterised by the presence of an obliquely placed septum in the ovary and highly swollen placentae. The oblique septum is probably due to shifting in the position of the ovary.

103. (a) : In tetradynamous condition there are six stamens, 4 are long and 2 are short, *i.e.*, 4 + 2 arrangement of stamens. It is characterstic feature of Cruciferae members. In Liliaceae 6 stamens are arranged in whorls of 3 each (3 + 3). In Solanaceae there are 5 stamens they are epipetalous and polyandrous. In Malvaceae there are numerous stamens that are monadelphous.

104. (b) : Malvaceae is also known as cotton family or mallow family. The plants of this family are cosmopolitan in distribution, although more common in tropical (warm) regions. *Gossypium* (cotton) is an important genera of this family. Sunflower belongs to Family Compositae. Wheat belong to Family Poaceae. *Catechu* belongs to Family Mimosaceae.

105. (a) : Pulses are obtained from Fabaceae.

106. (a) : Epipetalous stamens with free filaments and fused anthers occur in Asteraceae. Asteraceae possess five stamens with free filaments. This family shows syngenesious condition in which anthers are united forming a tube around the style.

107. (d) **108. (b)**

109. (d) : Syngenesious condition is found in Asteraceae. It is the condition when stamens are united by their anthers (filaments free). Epipetalous condition is also seen here.

110. (b) : A family delimited by type of inflorescence is Asteraceae. Asteraceae possess head or capitulum inflorescence, which is racemose and is surrounded by an involucre of bracts.

111. (a) : Syngenesious condition is found in Asteraceae. It is the condition when stamens are united by their anthers (filaments free). Epipetalous condition is also seen here.

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