**Q1/ Define the following:**

Indeterminate growth, determinate growth, hapaxanthic shoot, pleonanthic shoot, monopodial stem, sympodial stem, Twigs, collateral buds, superposed buds, pseudoterminal bud, colleters, hastula, ligule, pulvinus, bractlet, chaff, glumes, phyllary, spathe, Phyllodes, tendril, glochidium, Decompound leaf, geminate-pinnate leaf, heteroblastic leaf, decurrent leaf, amplexicaul, flower, receptacle, tepals, hypanthium, stamen, carpel, perfect flower imperfect flower, hermaphroditic flower, monoecious plant dioecious plant, andromonoecious plant, gynomonoecious plant, trimonoecious plant, androdioecious plant, gynodioecious plant, trioecious plant, complete flower, incomplete flower

------------------------------------------------------------------------------------------------------**Q2/ Mention the differences between each of the followings:**

Indeterminate and determinate growth, lycophylls, euphylls, hapaxanthic and pleonanthic shoot, monopodial and sympodial stem, collateral and superposed buds, vegetative and floral buds, lemma and palea, simple and compound leaf, pinnately and palmately leaf, geminate and bigeminate leaf, perfoliolate and connate-perfoliate, androecium and gynoecium, stamen and carpel, perfect and imperfect flower, monoecious and dioecious plant, monoecious and andromonoecious plant, monoecious and gynomonoecious, monoecious and trimonoecious plant, monoecious and trioecious plant, dioecious and androdioecious plant, dioecious and gynodioecious, dioecious and trioecious plant, complete and incomplete flower, radial and biradial symmetry, Actinomorphic and Zygomorphic symmetry.

-------------------------------------------------------------------------------------------------------**Q3/ Give an example (scientific name) for the following terms:**

Dichotomous stem, monopodial stem, sympodial stem, collateral buds, ocrea, lycophylls, euphylls, epicalyx, chaff, glumes, lemma, palea, phyllary, spathe, Phyllodes, tendril, glochidium, unifacial leaf, sheathing leaf, androgynophore, complete flower, incomplete flower, perfect flower, pistillate flower, staminate flower

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**Q4/ Draw the following:**

Twig parts, stem branching patterns, imparipinnate compound leaf, biternately compound leaf, leaf shape (five), leaf apex (five), leaf base (five), leaf margin (five), leaf attachment types

------------------------------------------------------------------------------------------------------ **Q5/ Write about the following:**

models of stem branching pattern, lycophylls and euphylls, leaf attachment, polygamous plants, flower symmetry,

-------------------------------------------------------------------------------------------------------**Q6/ Fill the following blanks:**

1- Branching pattern is determined by the **relative activity** of **apical meristems**.

2- both the original shoot apical meristem derived from the **seedling epicotyl** and the apical meristems subsequently derived from **lateral buds**.

3- One major feature of branching pattern has to do with the **duration** of **apical meristematic** growth of a shoot.

4- If a given shoot has the potential for **unlimited** **growth**, such that the apical meristem is **continuously active**, the growth is termed **indeterminate**.

5- If instead a shoot terminates growth after a period of time, with either the abortion of the **apical meristem** or its conversion into a **flower, inflorescence** or specialized structure (such as a **thorn or tendril**), the growth is termed **determinate**.

6- A determinate shoot that completely transforms into a **flower** or **inflorescence** is called **hapaxanthic**.

7- An indeterminate shoot that bears lateral **flowers** but that continues **vegetative** growth is termed **pleonanthic**.

8- If a given stem axis is derived from growth of a **singleapical meristem**, the pattern is termed **monopodial**. The monopodial axis may grow **indefinitely** and thus be **indeterminate**.

9- if a given axis (which may appear to be a single, continuous structure) is made up of **numerous** units that are derived from **separateapical meristems**, the branching pattern is **sympodial.**

10- sympodial units arise from **lateral buds** that are proximal to the **apical meristem** of the **original shoot**.

11- a rare type of branching is **dichotomous,** in which a **single apical meristem** divides equally into **branches**, e.g., ***Psilotum***

12-**Twigs** are the **woody**, recent-growth branches of **trees** or **shrubs**.

11- **Buds** are **immature shoot systems** that develop from **meristematic regions**.

13- The bud of a twig that contains the **original apical meristem** of the shoot (which by later growth may result in further **extension** of the **shoot**) is called the **terminal** or **apical** bud. Buds formed in the **axils** of **leaves** are called **axillary** or **lateral** buds.

14- A given bud may be **vegetative**, if it develops into a **vegetative shoot** bearing **leaves**; **floral** or **inflorescence**, if it develops into a **flower or inflorescence**; or **mixed**, if it develops into both **flower(s) and leaves**.

15- In some species more than **one axillary bud** forms per **node**.

16- **Two or more axillary buds** that are **oriented sideways** are called **collateral buds**; two or more axillary buds **oriented vertically** are called **superposed** **buds**.

17- If the original **terminal apical meristem** of a shoot aborts (e.g., by ceasing growth or maturing into a flower), then an axillary bud near the shoot apex may continue extension growth; because this axillary bud assumes the function of a terminal bud, it is called a **pseudoterminal bud**.

18- Several scars may be identified on a woody, deciduous twig. These include the **leaf scar**, **leaf vascular bundle scars**, **stipule scars** (if present), and **bud scale scars.**

19-Bud scale scars represent the point of **attachment** of the bud **scales** of the **original terminal** bud after resumption of growth during the new season.

20- Leaves are the primary **photosynthetic** organs of plants, functioning also as the main site of **transpiration**. Leaves are derived from leaf primordia of the **shoot apex**, generally **dorsiventrally** flattened.

21- A leaf can be **gametophytic**, in the leafy **liverworts** and **mosses**, or **sporophytic**, in the **vascular** plants.

22- The expanded, flat portion of the leaf, which contains the most of the chloroplasts, is termed the **blade** or **lamina**. Many leaves also have a proximal stalk, the **petiole** or (e.g., in ferns) the **stipe**. A leaf or leaf part (typically at the base) that **partially** or **fully** clasps the stem above the node is a **leaf sheath**, such as in the **Poaceae** (grasses) and many **Apiaceae**.

23- A pseudopetiole is a **petiole**-like structure arising between a leaf sheath and blade, found in several **monocots**, such as **bananas and bamboos**.

24- leaves contain one to many vascular bundles, the **veins**; similar specialized (although not truly **vascular**) conductive tissue is present in **mosses**.

25- Many leaves have stipules, a **pair** of leaf like **appendages**, which may be modified as **spines or glands**, at either side of the base of a leaf. If **stipules** are present, the leaves are **stipulate**; if **absent**, they are **exstipulate**.

26- A specialized, scarious, sheath like structure arising above the node in some members of the family **Polygonaceae**, interpreted as **modified stipules**, is termed an **ocrea**.

27- **Stipels** are **paired** leaf like structures, which may also be modified as **spines** or **glands**, at either side of the **base** of the **leaflet** of a compound leaf, as in some **Fabaceae**.

28- If stipels are present, the leaves are **stipellate**; if absent, they are **exstipellate**.

29- In the Rubiaceae the inner surface of the connate **stipules** (from **opposite leaves**) bear **colleters**, structures that **secrete mucilage** (aiding to protect young, developing shoots). Some leaves are compound, i.e., divided into discrete components called **leaflets**. The stalk of a leaflet is termed the **petiolule**.

30- **Hastula**, an appendage or projection at the junction of **petiole** and **blade**, as in some **palms**.

31- **Ligule**, an outgrowth or projection from the **inner**, **top** of the **sheath**, at its junction with the **blade**, as in the **Poaceae**.

32- **Pulvinus**, the swollen base of a **petiole or petiolule**, as in some **Fabaceae**.

**33-** Leaf structural type deals with specialized **modifications** of **leaves**. One basic leaf structural type in vascular plants is whether the leaves are **lycophyllous** or **euphyllous**. **Lycophylls** are **small, simple** leaves with **intercalary** growth and a **single, central** vein that joins to the stem without a **leaf gap** (below).

34- **Euphylls** are **larger, simple or compound** leaves with **marginal or apical** growth, a **leaf gap**, and generally **multiple** veins. Euphylls are found in **ferns, gymnosperms, and angiosperms.**

35- A leaf that is modified in shape and usually smaller than the major photosynthetic leaves is called a **bract**. In angiosperms bracts are typically associated with **flowers** (**flower bracts**) or the axes of **inflorescences** (**inflorescence bracts**).

36- A **bractlet** or **bracteole** (also called a **prophyll** or **prophyllum**) is a smaller or **secondary** bract often borne on the side of a **pedicel** in flowering plants. The term bractis also used for the largely non-photosynthetic leaves that subtend the **ovuliferous** scales in conifer cones or that subtend the **fascicles** or **short shoots** of members of the **pine** family (Pinaceae).

37- A group of **bracts** resembling **sepals** immediately below the true **calyx** is termed an **epicalyx**, found, e.g., in many members of the **Malvaceae**. Bracts subtending individual flowers of composites (Asteraceae) are collectively termed **chaff** or **paleae** (singular, **palea**), e.g., as found in the tribe **Heliantheae** of that family.

38- The specialized bracts of the grass (Poaceae) spikelet are given different terms: **glumes**, the **two bracts** occuring at the base of a grass **spikelet**; **lemma**, the **outer** and **lower** bract at the base of the grass **floret**; and **palea**, the **inner** and **upper** bract at the base of the grass **floret**.

39- A **phyllary** is one of the **involucral** bracts subtending a head, as in the **Asteraceae**. A **spathe** is an enlarged, sometimes **colored** bract subtending and usually enclosing an **inflorescence**, e.g., that subtending the **spadix** of the **Araceae**.

40- **Phyllodes** are leaves that consist of a flattened, bladelike **petiole**. Phyllodes are found in a group of mostly Australian ***Acacia***species (the phyllodinous Acacias) and are derived from **ancestrally** **compound** leaves by loss of the **rachis and leaflets**.

41- A **tendril** is a **coiled** and **twining** leaf or leaf part, usually a modified **rachis** or **leaflet**. (Tendrilcan also refer to a **modified, coiling** stem).

42- A **spine** is a sharp-pointed **leaf or leaf part**. The typical spines of cacti (Cactaceae) are **leaf spines**.

43- A very small, **deciduous** leaf spine with numerous, **retrorse barbs** along its length is a **glochidium** (plural, **glochidia** or **glochids**), as found in the **areoles** of opuntioid cacti.

44- Some taxa have spines that develop from a **petiole, midrib, or secondary vein** of a leaf, e.g., the **petiolar spines** of *Foquieria* spp.

45- In some palms, e.g., ***Phoenix***, the leaflets may be modified into sharp-pointed **leaflet spines**. Many plants, such as the stem-succulent *Euphorbias*, have **stipular spines**; these are typically **paired**, at the base of a **leaf**.

46- A **unifacial leaf** is **isobilateral**, i.e., flattened side-to-side and having a left and right side, except at the **base**, where they are often **sheathing**. Some monocots belonging to several different families have unifacial leaves, notably members of the **Iridaceae**, the Iris family. A **centric leaf** is one that is **cylindrical** in shape, e.g., *Fenestraria* of the **Aizoaceae**.

47- The pattern of division of a leaf into **discrete** components or **segments** is termed leaf type. A **simple** leaf is one bearing a **single**, **continuous** blade. A **compound** leaf is one divided in to **two or more, discrete** leaflets.

48- For either compound or divided leaves of ferns, the first (**largest**) division of a leaf is termed a **pinna**; the ultimate divisions are termed **pinnules**.

49- If the leaves are compound or divided into more than two orders, the terms **primary pinna, secondary pinna**, etc. can be used, with the ultimate divisions or leaflets always being pinnules.

50- Simple leaves were the ancestral condition in the vascular plants, as in the **lycophylls** of the lycopods. Simple leaves are also the norm among the **psilophytes**, **equisetophytes, Ginkgo, and conifers** (including the **Gnetales**).

51- Various types of compound leaves have evolved, perhaps as a means of increasing total **blade area** without **sacrificing** structural **integrity**.

52- Compound leaves are defined based on the **number** and **arrangement** of **leaflets**. A pinnately compound or **pinnate** leaf is one with leaflets arranged (either **oppositely** or **alternately**) along a **central axis,** the **rachis**. If a pinnate leaf has a terminal **leaflet** (and typically an odd number of leaflets), it is **imparipinnate**; if it lacks a terminal **leaflet** (and has an even number of leaflets), it is **paripinnate**.

53- A bipinnately compound or bipinnate leaf is with **two orders** of **axes**, each of which is **pinnate**. The central axis of a bipinnate leaf is still termed the **rachis**; the lateral axes that bear leaflets are termed **rachillae** (singular **rachilla**). Similarly, a compound leaf with **three orders of axes**, each pinnate, is termed

tripinnately compound or **tripinnate**; etc.

54- A compound leaf, in which four or **more leaflets** arise from a common point, typically at the end of the **petiole**, is termed palmately compound or **palmate**.

55- A costa-palmate leaf type is one that is essentially palmately compound to divided, but has an elongate, **rachis** like extension of the **petiole** (termed the **costa**), as occurs in some **palms**.

56- A compound leaf with only three leaflets is termed **trifoliolate** or **ternately** compound. (A leaf with two orders of axes, each ternately compound, is termed **biternately compound**.

57- Decompound is a general term for a **leaf** that is more than once **compound**, i.e., with two or more orders, being bi-, tri-, etc. **pinnately, palmately, or ternately, compound**.

58- A compound leaf consisting of only two leaflets is termed **geminate** (Gemini, the twins, in Greek mythology). A compound leaf with **two rachillae**, each bearing **two** **leaflets**, is termed bigeminate.

59- A compound leaf with two **rachillae**, each of these bearing a **pinnate** arrangement of **leaflets**, is termed **geminate-pinnate**.

60- unifoliolate, is interpreted as being derived by reduction of an **ancestrally** **compound** leaf.

In some taxa, e.g., many **Araceae**, the leaves exhibit **heteroblasty** (adjective, heteroblastic), in which the **juvenile** leaves are distinctly different in size or shape from the **adult** leaves.

61**-** The nature of the joining of the leaf to the stem is termed **leaf attachment** (sometimes treated under **Base**). In general, leaves may be **petiolate**, with a **petiole**, or **sessile**, without a **petiole**.

62- Leaflets of a compound leaf are either **petiolulate** or **sessile**. (The term **subsessile** is sometimes used for a leaf/leaflet with a small, **rudimentary petiole/petiolule**).

63- Sessile or petiolate leaves can also have a **sheathing** leaf attachment, in which a **flattened** leaf base (the **sheath**) **partially or wholly** clasps the **stem**, typical of the **Poaceae** (grasses) and many **Apiaceae**.

64- If a leaf appears to extend **down** the stem from the point of **attachment**, as if fused to the stem, the leaf attachment is **decurrent** (e.g., as in many **Cupressaceae**).

65- If a leaf is **sessile** and clasps the **stem** most, but not all, of its **circumference**, the attachment is termed **amplexicaul**.

66- If the leaf is sessile with the base of the blade completely **surrounding** the **stem**, it is termed **perfoliolate**. A special case of the latter (involving fusion of leaves) is **connate-perfoliate**, whereby typically **two opposite** leaves fuse **basally**, such that the blade bases of the fusion product completely surrounds the stem.

67**-** A major diagnostic feature of **angiosperms** is the **flower**. A **flower** is a **modified reproductive shoot,** basically a stem with an **apical meristem** that gives rise to leaf primordia. Unlike a typical vegetative shoot, the flower shoot is **determinate**.

68- At least some of the leaf primordia of a flower are modified as **reproductive sporophylls** (leaves bearing sporangia). Flowers are unique, differing, e.g., from the cones of gymnosperms, in that the **sporophylls** develop either as **stamens** or **carpels**.

69**-** The **pedicel** is the **flower** stalk. (If a pedicel is absent, the **flower** attachment is **sessile**). Bracteoles, where present, are typically **paired**. [In some taxa, a series of bracts, known as the **epicalyx**, immediately subtends the **calyx**, as in ***Hibiscus***and other members of the **Malvaceae**].

70- The **receptacle** is the tissue or region of a **flower** to which the other **floral** parts are attached. The **perianth** (also termed the **perigonium**) is the outermost, **non-reproductive** group of **modified** leaves of a flower.

71- If the **perianth** is relatively **undifferentiated**, or if its components intergrade in form, the individual leaf-like parts are termed **tepals**.

72- In most flowers the perianth is differentiated into two groups. The **calyx** is the outermost series or **whorl** of **modified** leaves. Individual units of the calyx are **sepals**, which are typically **green**, leaf-like, and function to **protect** the **young flower**.

73- The **corolla** is the innermost series or **whorl of modified leaves** in the **perianth**. Individual units of the corolla are **petals**, which are typically **colored** and function as an **attractant** for **pollination**.

74- Some flowers have a **hypanthium** (floral tube), a **cuplike** or **tubular** structure, around or atop the ovary, bearing along its margin the **sepals, petals, and stamens**. 75- Many flowers have a **nectary**, a specialized structure that **secretes nectar**. Nectaries may develop on the **perianth** parts, within the **receptacle**, on or within the **androecium or gynoecium** (below), or as a separate structure.

76- The **androecium** refers to all of the **male organs** of a flower, collectively all the **stamens**. A **stamen** is a **microsporophyll**, which characteristically bears two thecae (each theca comprising a **pair** of **microsporangia**. Stamens can be leaf like (laminar), but typically develop as a stalk like **filament**, bearing the pollen-bearing **anther**.

77- The **gynoecium** refers to all of the **female organs** of a flower, collectively all the **carpels**. A **carpel** is the **unit** of the gynoecium, consisting of a modified **megasporophyll** that encloses one or more **ovules**. A **pistil** is that part of the gynoecium composed of an **ovary**, one or more **styles** (which may be absent), and one or more **stigmas**.

78- In some taxa, e.g. Aristolochiaceae and Orchidaceae, the **androecium** and **gynoecium** are fused into a common structure, known variously as a **column**, **gynandrium**, **gynostegium**, or **gynostemium**. A stalk that bears the **androecium** and **gynoecium** is an **androgynophore**, e.g., **Passifloraceae**.

**79-** Flower sex refers to the **presence** or **absence** of **male** and **female** parts within a flower. Most flowers are **perfect** or **bisexual**, having both **stamens** and **carpels**.

80- **Bisexual** flower sex is likely the ancestral condition in **angiosperms**. Many angiosperm taxa have **imperfect** or **unisexual** flower sex. In this case, flowers are either **pistillate**/**female**, in which only **carpels** develop, or **staminate**/**male**, in which only **stamens** develop.

81- Plant sex refers to the **presence** and **distribution** of **perfect** or **imperfect** flowers on individuals of a **species**. A **hermaphroditic** plant is one with only **bisexual** flowers. 82- A **monoecious** plant is one with only **unisexual** flowers, both **staminate** and **pistillate** on the **same** individual plant; e.g., ***Quercus***spp., oaks. A **dioecious** (*di*, two + *oikos*, house) plant is one with **unisexual** flowers, but with **staminate** and **pistillate** on **separate** individual plants (i.e., having separate male and female individuals; e.g., ***Salix*** spp., willows).

83- **Polygamous** is a general term for a plant with both **bisexual** and **unisexual** flowers. **Andromonoecious** refers to a plant with both **staminate** and **perfect** flowers on the **same** individual, and **gynomonoecious** is a plant with both **pistillate** and **perfect** flowers on the **same** individual. **Trimonoecious** refers to a plant with **pistillate**, **staminate**, and **perfect** flowers on the **same** individual. **Androdioecious** refers to a plant with **male** flowers on **some** individuals and **perfect** flowers on **other** individuals. **Gynodioecious** refers to a plant with **female** flowers on **some** individuals and **perfect** flowers on **other** individuals. **Trioecious** refers to a plant with **pistillate, staminate, and perfect** flowers on **different** individuals.

84**-** Flower attachment is **pedicellate**, having a **pedicel**; **sessile**, lacking a **pedicel**; or **subsessile**, having a short, **rudimentary** pedicel.

85- Flower cycly refers to the **number** of **cycles** (series or whorls) or **floral parts**. The two basic terms used are **complete**, for a flower having **all four** major series of parts (**sepals, petals, stamens, and carpels**) and **incomplete**, for a flower lacking one or more of the **four major whorls of parts**.

86- Flower symmetry is an assessment of the **presence** and **number** of mirror-image planes of symmetry. **Actinomorphic** or **radial** symmetry (also called **regular**) is that in which there are **three** or **more** planes of symmetry, such that there is a repeating structural morphology when rotated less than **360°** about an **axis**. **Biradial symmetry** means having **two (and only two)** planes of symmetry. **Zygomorphic** or **bilateral** symmetry (also called **irregular**) is that in which there is **only one** plane of symmetry. An **asymmetric** flower **lacks** any plane of symmetry, usually the result of **twisting** of parts.

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