

ENTRANCE EXAMINATION – 2019
Ph.D. Plant Sciences

Time: 2 hours

Maximum Marks: 70

HALL TICKET NO.

INSTRUCTIONS

Please read carefully before answering the questions:

1. Enter your Hall Ticket number both on the top of this page and on the OMR answer sheet.
2. Answers are to be marked only on the **OMR answer sheet** following the instructions provided there upon.
3. Hand over the OMR answer sheet to the Invigilator before leaving the examination hall.
4. The question paper contains **70** questions. **Part-A:** Question Nos. **1-35** and **Part-B:** Questions Nos. **36-70** of multiple-choice printed in **14** pages, including this page. **One OMR answer sheet** is provided separately. **Please check.**
5. The marks obtained in **Part-A** will be used for resolving the tie cases.
6. Each question carries one mark.
7. Calculators and mobile phones are NOT allowed.

PART-A

1. What is the approximate size of model crop Rice?

A) 400Mb	B) 2400Mb
C) 700Mb	D) 17000Mb

2. Which of the following term define best for the comparative gene or genome analysis between chromosomes or species or even different organisms?

A) Gene duplication	B) Genome annotation
C) Synteny	D) Cryptogene

3. Which of the following term is synonymous to "Phylogenetic Tree"?

A) Whippetree	B) Paedogenetic
C) Phlebogram	D) Dendrogram

4. Which of the following computer based online program is used for comparing DNA sequence of our interest with rest of the sequence available in database?

A) ClustalW	B) FGENESH
C) SWISSPROT	D) BLAST

5. Amino acid sequencing of a purified protein can be obtained using -----

A) Mass spectrometry	B) Tandem mass spectrometry
C) 2D-SDS-PAGE	D) MALDI

6. A genetic analysis based on the progenies derived by crossing a sample of randomly selected F₂ plants with the parental F₁ and two homozygous parents is known as:

A) Biparental mating	B) Triple test cross analysis
C) Three-way cross	D) Triallel analysis

7. Appearance of individuals in the progenies from a hybrid which exceeds either of the two parents involved in hybridization, to produce that hybrid with respect to one or more traits is known as:

A) Translocation selection	B) Trivalent selection
C) Transgression selection	D) Recurrent selection

8. Deviation in the performance of a cross combination from that predicted on the basis of general combining abilities of the parents used in the cross is known as:
- A) Standard deviation B) Standard error
C) Stability error D) Specific combining ability
9. A map of genetic markers obtained based on the relative position of genes of a haploid set of chromosomes of an organism is called as:
- A) Cytological map B) Physical map
C) Linkage map D) Quantitative trait locus
10. Cell is generally used in TILLING process of a crop functional genomics. What is Cell?
- A) It is type of Single Cell Protein
B) It is type of Restriction endonuclease
C) It is a type of pure microbial culture where only one type of cell grows
D) It is the name of instrument used during TILLING process to detect mutation
11. An individual with one pair of chromosomes from a related wild species in addition to the normal somatic chromosome complement ($2n$) of the species is referred as:
- A) Allopolyploid line B) Amphidiploid line
C) Alien-addition line D) Alien-substitution line
12. The adverse effect of feeding of a resistant host plant on the development and reproduction of insect pest is known as:
- A) Antibiosis B) Hyper parasitism
C) Biotype D) Convulsion
13. The restoring of a mutant phenotype to wild-type can be made possible by genetic manipulation and is often termed as:
- A) Gene synthesis B) Gene complementation
C) Gene recombination D) Gene silencing

14. With the discovery of one of the following molecular processes, the events leading to the formation and existence of eukaryotic mRNAs- long nuclear RNA and short mRNA, both of which have 5' caps and 3' poly A was elucidated:

- A) RNA interference
- B) RNA splicing
- C) DNA replication
- D) DNA amplification

15. Which one of the following enzymes has the capacity to completely remove negative supercoils without leaving nicks in DNA molecule?

- A) Topoisomerase
- B) Polymerase
- C) Ligase
- D) Reverse transcriptase

16. The mapping population which can be used for tagging homozygous recessive alleles during early generations of a crop breeding program is:

- A) F₂ population
- B) Near-Isogenic line
- C) Doubled Haploid
- D) Recombinant Inbred line

17. Which of the following organelles contain large amounts of acid phosphatases?

- A) Golgi bodies
- B) Lysosomes
- C) Endoplasmic reticulum
- D) Mitochondria

18. Which technique will be suitable for conservation of a plant species of which few individuals are remaining in nature?

- A) Gene editing
- B) Gene cloning
- C) Micropropagation
- D) Mutation

19. The isoelectric point (pI) of a protein is 8.8. At pH 7, the protein will be

- A) Negatively charged
- B) Positively charged
- C) Neutral
- D) Denatured

20. Which of the following essential elements is required for the synthesis of auxin?

- A) Sulphur
- B) Zinc
- C) Potassium
- D) Phosphorous

21. Which of the hormones plays a crucial role during flooding responses of plants?

- A) Ethylene
- B) Brassinosteroid
- C) Cytokinin
- D) Strigolactone

22. Which of the following is an example of a zwitterionic detergent?

- A) CHAPS
- B) SDS
- C) Triton X-100
- D) Nonidet P-40

23. Pea seeds require gas for their germination and that gas is

- A) Nitrogen
- B) Oxygen
- C) Hydrogen
- D) Water vapour

24. Which one of the following is an example of free-nuclear endosperm?

- A) Coconut water
- B) Sugarcane juice
- C) Castor
- D) Groundnut

25. The minimum population size required to allow random mating of all kind of gametes from $AaBbCc$ parents is

- A) 9
- B) 27
- C) 64
- D) 128

26. Calvin Bridges established the chromosomal location of genes based on crosses made between white-eyed females and red-eyed males in *Drosophila melanogaster*. The primary exceptional progeny that were recovered from him due to chromosome non-disjunction from the cross of $X^w X^w \times X^{w+} Y$ were found to be:

- A) Red-eyed fertile females
- B) White-eyed fertile males
- C) Red-eyed sterile males and white-eyed fertile females
- D) White-eyed fertile males and white-eyed sterile females

27. The electrophoretic mobility shift assay (EMSA) is a technique that is used to detect
- A) Protein-nucleic acid interactions
 - B) RNA-DNA interactions
 - C) Detect the artificial heteroduplexes
 - D) To separate small DNA fragments according to size using polyacrylamide gels
28. All of the following statements are true with respect to genome imprinting **except**
- A) Resulting in the differential expression of a gene depending on its parent of origin
 - B) Imprinted genes and imprint control regions are often species and locus-specific
 - C) Genome imprinting alterations in gene expression are not maintained after fertilization
 - D) It is a reversible form of gene inactivation and is not considered a mutation
29. Which of the following statements is **incorrect** with respect to use of bulbosum technique in barley?
- A) Interspecific crosses were made between *Hordeum vulgare* and *Hordeum bulbosum*
 - B) Embryos were rescued by *in vitro* culture following interspecific hybridization
 - C) Chromosomes of *Hordeum bulbosum* were eliminated following interspecific hybridization resulting in monoloids of *Hordeum vulgare*
 - D) The anthers of bulbous wild barley were used in this method for haploid production
30. Thaumatin, a natural plant product is of industrial importance because of its used as
- A) Coloring pigment
 - B) Sweetener
 - C) Antioxidant
 - D) Steroid

31. Which of the following statements is **incorrect** about somatic hybridization in plants?

- A) Protoplast population after induced fusion consists of a heterogenous mixture of homokaryons and heterokaryons
- B) Cybrids were produced due to elimination of chromosomes of one parental species
- C) Asymmetric hybrids with wide variation in chromosome number were recovered after protoplast fusion
- D) There are no experimental evidences of structural and developmental abnormalities following somatic hybridization

32. Which of the following statements is **incorrect** about organogenesis?

- A) It is a process where unipolar structures *viz.*, shoot or roots are formed from the cultured cells/tissues
- B) It is a process where shoot or root initiation is mediated by hormonal signals *i.e.* auxins and/or cytokinins
- C) It is a process which leads to the developments of shoots or roots with closed vascular system
- D) It is a process where the shoots or roots have vascular connection with the maternal tissues

33. Carl Correns provided the first convincing examples of extranuclear inheritance in higher plants. In the experiments with variegated phenotype in *Mirabilis jalapa*, the following observations were made by Carl Correns **except**

- A) Paternal parent is solely responsible for determining the phenotype of all progeny
- B) Maternal parent is solely responsible for determining the phenotype of all progeny
- C) Differences in reciprocal crosses
- D) The variegated maternal branch produced three types of egg cells, with only white chloroplasts, only green chloroplasts or both green and white chloroplasts

34. Which of the following receptor has been found to participate in temperature perception in plants

- A) Cryptochromes
- B) Phytochrome B
- C) PYR/PYL/RCARs
- D) Heat shock factors

35. Let's assume that a hypothetical protein called '**RIP**' acts as a repressor of pigment accumulation in climacteric fruits. Let's also assume that **RIP** represses pigment accumulation by inhibiting the activity of a positive master regulator transcription factor, called '**COL**' by physically interacting with it and not allowing **COL** to bind to the promoters of its target genes. Given that **COL** and **RIP** are ubiquitously expressed and that the turnover of **RIP** protein is tightly controlled by ubiquitin-mediated 26S-proteasomal degradation pathway in an ethylene-dependent manner in fruits, which of the following statements will be true in climacteric wild type fruits, if both genes are functional
- A) Pigment accumulation will not occur as **RIP-COL complex** will not allow **COL** to act.
 - B) Pigment accumulation will occur as **RIP** will be degraded after ripening-initiation, leaving **COL** free to act.
 - C) Pigment accumulation will not occur as **COL** will be degraded after ripening initiation.
 - D) Pigment accumulation will occur as activity of **RIP-COL complex** will remain independent of fruit ripening initiation.

PART-B

36. Which of the following statement is **TRUE** for CRISPR/Cas9 and RNA-interference (RNAi) gene manipulation approaches
- A) While CRISPR/Cas9 can be used in both gene knock-down and knock-out approaches, RNAi is the best fit for gene knock-out
 - B) While RNAi can be used in both gene knock-down and knock-out approaches, CRISPR/Cas9 is the best fit for gene knock-down
 - C) While CRISPR/Cas9 can be used in both gene knock-down and knock-out approaches, RNAi is the best fit for gene knock-down
 - D) While RNAi can be used in both gene knock-down and knock-out approaches, CRISPR/Cas9 is the best fit for gene knock-out

37. Match the characters given in the list A with the plant families presented in the list B

A	B
a. Papilionaceous petals	i. Solanaceae
b. Pappus calyx	ii. Brassicaceae
c. Epipetalous stamens	iii. Asteraceae
d. Tetradynamous stamens	iv. Fabaceae

- A) a(i), b(ii), c(iii), d(iv)
 B) a(iv), b(iii), c(i), d(ii)
 C) a(iv), b(ii), c(iii), d(i)
 D) a(iii), b(iv), (ii), d(i)

38. Which of the following molecular cloning approach is best suitable for ordered assembly of multiple DNA fragments in a single reaction

- A) Gateway
 B) Sticky-end cloning
 C) GoldenBraid
 D) TA-cloning

39. Given the scenario of their indigenous reserves status in India, interrupted supply of which of the following mineral nutrient can pose the greatest threat to the Indian agriculture in 2030

- A) Nitrogen
 B) Phosphorus
 C) Zinc
 D) Potassium

40. Which of the following is **NOT** true for mitochondrial electron transport chain in plants

- A) Of the four mitochondrial complexes, Complex II participate in translocation of protons from matrix to intermembrane space
 B) Rotenone-insensitive dehydrogenase is located, only on the inner side of membrane, facing the matrix
 C) Alternative oxidase complex activity is cyanide resistant but is inhibited by salicylhydroxamic acid
 D) Plant mitochondrial 'external' dehydrogenases are capable of oxidising cytosolic NADH and NADPH

41. In the photorespiratory glycolate pathway, which of the following is the immediate source of photorespired CO₂

- A) Serine
- B) Glycine
- C) Glycolate
- D) Glyoxylate

42. Which of following remains the most widespread commercial GM traits

- A) Herbicide tolerance
- B) Bt-mediated insect resistance
- C) Flavr Savr delayed fruit ripening
- D) Papaya Ringspot Virus resistant

43. Which is the prosthetic group involved in aminotransferases reaction of catabolism of most amino acids

- A) Vitamin B₁₂
- B) Vitamin B₆
- C) NAD⁺
- D) FAD

44. Which is the precursor for the synthesis of Glycine and Cysteine

- A) α-Ketoglutarate
- B) Pyruvate
- C) 3-Phosphoglycerate
- D) Ribose 5-phosphate

45. How is respiration related to the carbon cycle?

- A) Removes carbon by making sugar
- B) Removes carbon by breaking down sugar
- C) Releases carbon by breaking down sugar
- D) Releases carbon by making sugar

46. Inulin is a

- A) Protein
- B) Lipid
- C) Glycoprotein
- D) Carbohydrate

47. In general the colour of flower is due to the presence of

- A) Xanthophylls
- B) Chlorophyll
- C) Florigen
- D) Chromoplast or Anthocyanin

48. The reaction-center chlorophyll of photosystem I is known as P700 because

- A) 700 chlorophyll molecules in the center
- B) It absorbing light with a wavelength of 700 nm
- C) It contains 700 photosystem I
- D) It absorbs 700 photons per microsecond

49. In mitochondria, chemiosmosis translocates protons from the matrix into the intermembrane space, whereas in chloroplasts, chemiosmosis translocates protons from---

- A) The stroma to the photosystem I
- B) The grana to the stroma
- C) The stroma to the thylakoid space
- D) Through electron transport chain within PSII

50. The variation in *in vitro* culture called as

- A) *In vitro* variation
- B) Somaclonal variation
- C) Mutation
- D) Ploidy Variation

51. In angiosperm, the endosperm is

- A) Triploid
- B) Diploid
- C) Haploid
- D) Tetrad

52. Lichen involves two organisms as

- A) Fungi and Mosses
- B) Bacteria and Algae
- C) Fungi and Bacteria
- D) Algae and Mosses

53. Mycorrhizae are symbiotic associations between

- A) Bacteria and Fungi
- B) Root and Fungi
- C) Algae and Fungi
- D) Bacteria and Root

54. What is Stokes Shift?

- A) The difference between positions of the band maxima of the absorption and emission spectra
- B) The difference between positions of the band maxima of two absorption spectra
- C) The difference between positions of the band maxima of two emission spectra
- D) Those with wavelengths shorter than the incident line

55. What is role of SDS in SDS-PAGE?

- A) Protein unfolding
- B) Gives overall negative charge to the protein
- C) Protein denaturing and gives net negative charge to the protein
- D) Gives equal mass to the protein

56. Which of the following is used as a media for density gradient?

- A) Agarose
- B) Ficoll or Sucrose
- C) Glycerol
- D) Propylene glycol

57. Elaioplasts are a type of leucoplast found in higher plants that may synthesize and store--

- A) Starch
- B) Protein
- C) Lipids
- D) Carotenoids

58. The basic difference between the *Tobacco mosaic virus* (TMV) and *Cucumber mosaic virus* (CMV) are

- A) TMV is spherical and CMV is rodshaped viruses
- B) TMV is Rod shaped and CMV is spherical virus
- C) TMV is DNA and CMV is RNA virus
- D) TMV is RNA and CMV is DNA virus

59. Sargassum is a genus of brown macroalga in the order Fucales comes in the class of

- A) Rhodophyceae
- B) Phaeophyceae
- C) Raphidophyceae
- D) Chrysophyceae

60. Below given carnivorous plant uses “fly paper trap” mechanism to capture the preys

- A) *Utricularia vulgaris*
- B) *Darlingtonia californica*
- C) *Drosera capensis*
- D) *Dionaea muscipula*

61. Paclitaxel, the most well-known natural-source cancer drug, is derived from the bark of

- A) *Vinca rosea*
- B) *Gloriosa superba*
- C) Pacific yew tree
- D) *Strychnos nuxvomica*

62. Presence of betalains, a class of red and yellow indole-derived pigments found in plants, is a characteristic feature of family

- A) Chenopodiaceae
- B) Amaranthaceae
- C) Portulacaceae
- D) Caryophyllaceae

63. *Mimosa pudica* leaves fold inward and droop when touched, these type of movements are termed as

- A) Cell to cell and systemic movement
- B) Nyctinastic movement
- C) Seismonastic movements
- D) Vander wall movement

64. A substance that inhibits the development of a fungus on hypersensitive tissue formed when host plant cells come in contact with the parasite

- A) Phytoalexin
- B) Aflatoxin
- C) Vincristine
- D) Nematicide

65. The role of a “Flag leaf” is

- A) Providing nourishment to the growing inflorescence
- B) To enhance nitrogen fixation
- C) Preventing the stomatal opening
- D) Enhancing the nitrogen fixation

66. Photolyase is a

- A) Photorespiratory enzyme
- B) Light activated enzyme in photosynthesis
- C) Light activated peptidase
- D) DNA repair enzyme

67. Nuclease Bal31 is

- A) An endonuclease of single stranded DNA
- B) An exonuclease of double stranded DNA
- C) specific to degradation of DNA component of RNA-DNA hybrid
- D) A single strand specific exonuclease

68. Condensed tannins are formed by condensation of

- A) Flavanols
- B) Terpenes
- C) Peptides
- D) Lipids

69. Steviol glycosides are considered for their property of _____.

- A) Natural colourants
- B) Natural fragrance compounds
- C) On-nutritive sweeteners
- D) Psychoactive compounds

70. Which of the following plant extract taken for execution of the philosopher Socrates

- A) *Conium maculatum*
- B) *Rauwolfia serpentina*
- C) *Erythroxylon coca*
- D) *Camptotheca acuminata*

ENTRANCE EXAMINATION – 2019

Ph.D. Plant Sciences

Key-2019

1. A	25.B	49.C
2. C	26.C	50.B
3. D	27.A	51.A
4. D	28.C	52.C
5. B	29.D	53.B
6. B	30.B	54.A
7. C	31.D	55.C
8. D	32.C	56.B
9. C	33.A	57.C
10.B	34.B	58.B
11.C	35.B	59.B
12.A	36.C	60.C
13.B	37.B	61.C
14.B	38.C	62.D
15.A	39.B	63.C
16.C	40.A	64.A
17.B	41.B	65.A
18.C	42.A	66.D
19.B	43.B	67.B
20.B	44.C	68.A
21.A	45.C	69.C
22.A	46.D	70.A
23.B	47.D	
24.A	48.B	