Roll No. .....

Question Booklet Number

O. M. R. Serial No.

M. Sc. (Biochemistry) (Fourth Semester) EXAMINATION, 2025-26

(Old Syllabus Effective from 2022)

(Only Back Paper Students)

CELL AND TISSUE CULTURE

Paper Code							
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Questions Booklet Series
C

Time : 1:30 Hours] [*Maximum Marks : 75*

Instructions to the Examinee :

1. Do not open the booklet unless you are asked to do so.
2. The booklet contains 100 questions. Examinee is required to answer 75 questions in the OMR Answer-Sheet provided and not in the question booklet. All questions carry equal marks.
3. Examine the Booklet and the OMR Answer-Sheet very carefully before you proceed. Faulty question booklet due to missing or duplicate pages/questions or having any other discrepancy should be got immediately replaced.

परीक्षार्थियों के लिए निर्देश :

1. प्रश्न-पुस्तिका को तब तक न खोलें जब तक आपसे कहा न जाए।
2. प्रश्न-पुस्तिका में 100 प्रश्न हैं। परीक्षार्थी को 75 प्रश्नों को केवल दी गई OMR आन्सर-शीट पर ही हल करना है, प्रश्न-पुस्तिका पर नहीं। सभी प्रश्नों के अंक समान हैं।
3. प्रश्नों के उत्तर अंकित करने से पूर्व प्रश्न-पुस्तिका तथा OMR आन्सर-शीट को सावधानीपूर्वक देख लें। दोषपूर्ण प्रश्न-पुस्तिका जिसमें कुछ भाग छपने से छूट गए हों या प्रश्न एक से अधिक बार छप गए हों या उसमें किसी अन्य प्रकार की कमी हो, तो उसे तुरन्त बदल लें।

(Remaining instructions on the last page) **(शेष निर्देश अन्तिम पृष्ठ पर)**

(Only for Rough Work)

1. The gene which was used to produce insect resistant transgenic cotton plant was taken from :
   (A) Bacillus clausii
   (B) Agrobacterium tumefaciens
   (C) Bacillus subtilis
   (D) Bacillus thuringiensis

2. A transgenic plant "Golden Rice" contains foreign genes that produce :
   (A) Niacin
   (B) Biotin
   (C) Beta-carotene (β-carotene)
   (D) Yellow fluorescent protein

3. Which of the following is an alternative term used to denote flowering plants ?
   (A) Angiosperm
   (B) Gymnosperms
   (C) Ferns
   (D) Mosses

4. What role do phytohormones play in plant biotechnology ?
   (A) Improving plant taste
   (B) Controlling plant color
   (C) Regulating plant growth and development
   (D) Enhancing plant fragrance

5. Which of the following induces polyploidy in plants ?
   (A) Formamide
   (B) 5-Bromouracil
   (C) Colchicine
   (D) PEG

6. Which one of the following is correct with respect to the plant growth promoting bacteria ?
   (A) They provide protection against plant pathogens
   (B) They can cause disease
   (C) They limit the nutrient availability
   (D) They can reduce the water availability

7. Plant growth promoting bacteria promotes plant growth by :
   (A) Increasing nutrient availability
   (B) Phytohormone production
   (C) Enhancing shoots and root development
   (D) All of the above

8. Plant metabolomics is primarily concerned with the study of :
   (A) Plant DNA sequences
   (B) Plant cell division
   (C) Plant protein structure
   (D) Complete set of metabolites present in a plant

9. Haploid plants are produced in large numbers by :
   (A) Anther culture
   (B) Ovary culture
   (C) Both (A) and (B)
   (D) Embryo culture

10. Androgenesis is just the reverse of :

(A) Gynogenesis

(B) Rhizogenesis

(C) Caulogenesis

(D) None of the above

11. Which of the following process that leads to plants that exclusively originates from the female genetic background ?

(A) Gynogenesis

(B) Rhizogenesis

(C) Caulogenesis

(D) Androgenesis

12. Which of the following methods is used to introduce foreign DNA into plant cells ?

(A) Microinjection

(B) Electroporation

(C) Particle bombardment

(D) All of the above

13. The Ti plasmid used in plant genetic engineering is derived from :

(A) *Agrobacterium rhizogenes*

(B) *Escherichia coli*

(C) *Agrobacterium tumefaciens*

(D) *Bacillus thuringiensis*

14. The protoplasts are generally isolated from :

(A) Shoot

(B) Root

(C) Leaf

(D) Bark

15. *In vitro* fusion of plant protoplasts derived either from a somatic cell of the same plant or from two genetically different plants is called :

(A) Somatic hybridization

(B) Nuclear hybridization

(C) Protoplasmic hybridization

(D) Cellular hybridization

16. A plasma membrane-bound vesicle formed as a result of removal of the cell wall is called :

(A) Tonoplast

(B) Trophoblast

(C) Protoplast

(D) Spheroplast

17. Chloroplast transformation involves the introduction of foreign genes into :

(A) Nuclear genome

(B) Mitochondrial genome

(C) Chloroplast genome

(D) Ribosomal RNA

18. Which of the following is an advantage of plant cell culture for metabolite production ?
(A) Seasonal dependency
(B) High contamination risk
(C) Low yield
(D) Controlled production conditions

19. Somaclonal variation in plant tissue culture refers to :
(A) Genetic variation in cultured cells
(B) Cell death
(C) Lack of growth
(D) Mutation in bacteria

20. Bioreactors in plant cell culture are used for :
(A) DNA sequencing
(B) Large-scale metabolite production
(C) Chromosome counting
(D) Tissue staining

21. Which bacterium is used to induce hairy root cultures ?
(A) *Agrobacterium tumefaciens*
(B) *Agrobacterium rhizogenes*
(C) *E. coli*
(D) *Bacillus subtilis*

22. Hairy root cultures are commonly induced using :
(A) Bacteria
(B) Virus
(C) Fungi
(D) Algae

23. Elicitors are used in plant cell cultures to :
(A) Reduce growth
(B) Kill plant cells
(C) Stop cell division
(D) Enhance secondary metabolite production

24. Suspension cultures are preferred for secondary metabolite production because they :
(A) Grow slowly
(B) Allow large-scale production
(C) Require soil
(D) Cannot be scaled up

25. Secondary metabolites in plants are primarily involved in :
(A) Growth and development
(B) Defense and adaptation
(C) Photosynthesis
(D) Respiration

26. Marker-assisted selection in plant genomics helps in :
(A) Protein purification
(B) Selection of desirable traits
(C) DNA degradation
(D) Mutation induction

27. Comparative genomics is used to :
(A) Compare genomes of different species
(B) Study plant metabolism
(C) Sequence proteins
(D) Clone genes

28. Functional genomics aims to study :

(A) DNA replication

(B) Gene function and expression

(C) Chromosome number

(D) Protein purification

29. The first plant genome sequenced was :

(A) Wheat

(B) Rice

(C) Arabidopsis

(D) Maize

30. Plant genomics involves the study of :

(A) Plant proteins only

(B) Plant tissues only

(C) Plant hormones only

(D) Entire genetic makeup of plants

31. Find the name of the artificial process in which a plant or embryo is derived from a single somatic cell :

(A) Gynogenesis

(B) Rhizogenesis

(C) Somatic embryogenesis

(D) Androgenesis

32. Which of the following is the plant stress hormone ?

(A) Auxin

(B) Gibberellin

(C) Abscisic acid

(D) Ethylene

33. Relatively high levels of cytokinin promote :

(A) Leaf formation

(B) Root differentiation Root

(C) Shoot bud differentiation

(D) All of the above

34. MS medium was originally formulated by :

(A) Mehta and Sahu

(B) Mark and Spencer

(C) Murashige and Skoog

(D) Martin and Smith

35. Rooting is stimulated by :

(A) Green light

(B) Red light

(C) Blue light

(D) UV rays

36. Shoot Bud Formation is inhibited by :

(A) Low light intensity

(B) High light intensity

(C) Blue light

(D) None of the above

37. The process of organogenesis is regulated by various factors such as :

(A) Physiological state and size of explants

(B) Environmental conditions

(C) Quality and quantity of light

(D) All of the above

38. Plant biotechnology involves :

(A) A production of valuable products in plants

(B) Rapid clonal multiplication of desired genotypes

(C) Production of virus free plants

(D) All of the above

39. A group of genetically similar organisms obtained by asexual reproduction is called :

(A) Population

(B) Clone

(C) Assembly

(D) None of the above

40. Cybrids are :

(A) Nuclear hybrids

(B) Hybrid plants derived from cross pollination

(C) Plants derived from self-pollination

(D) Cytological hybrids

41. Which of the following is cultured to obtain haploid plants ?

(A) Embryo

(B) Nucleus

(C) Apical bud

(D) Entire anther

42. The process of organogenesis involves two steps :

(A) Denaturation and Renaturation

(B) Dedifferentiation and Redifferentiation

(C) Dehydration and Rehydration

(D) Desiccation

43. Organogenesis has been obtained from :

(A) Shoot apex

(B) Root

(C) Flower petals

(D) All of the above

44. Initiation of shoot formation is called :

(A) Gynogenesis

(B) Rhizogenesis

(C) Caulogenesis

(D) None of the above

45. The initiation of root formation (adventitious roots) is termed :

(A) Gynogenesis

(B) Rhizogenesis

(C) Caulogenesis

(D) None of the above

46. The development of organs like roots, shoots, and flowers directly from an explant or from the callus is called :

(A) Embryogenesis

(B) Transgenesis

(C) Organogenesis

(D) Gynogenesis

47. High levels of auxin promotes formation of :

(A) Shoot

(B) Root

(C) Needle like leaves

(D) All of the above

48. Variations observed during tissue culture of some plants are known as :

(A) Clonal variations

(B) Somaclonal variations

(C) Somatic variations

(D) Tissue culture variations

49. Which of the following is not properly matched ?

(A) Explant - excised plant part used for callus formation

(B) Cytokinins - root initiation in callus

(C) Somatic embryo - embryo produced from a vegetative cell

(D) Callus undifferentiated mass of cells

50. Somaclonal variation appears in :

(A) Organisms produced through somatic hybridization

(B) Plants growing in highly polluted conditions

(C) Apomictic plants

(D) Tissue culture raised plants

51. Which one of the following is the most preferred external source of carbon used in the plant tissue culture medium ?

(A) Agarose

(B) Ribose

(C) Fructose

(D) Sucrose

52. Which plant is most commonly used for chloroplast transformation studies ?

(A) Rice

(B) Tobacco

(C) Wheat

(D) Maize

53. Which of the following provides a place free from dust particle/micro contaminants and helps in carrying out cell culture under an aseptic environment ?

(A) BOD Incubator

(B) Laminar airflow cabinet

(C) Microwave oven

(D) Shakers

54. Autoclave machine is used for :

(A) Precipitation

(B) Vaporization

(C) Sterilization

(D) Incineration

55. What is Callus ?

(A) Tissues that grow to form an embryoid

(B) An unorganised actively dividing the mass of cells maintained in a culture

(C) An insoluble carbohydrate

(D) A tissue that grows from an embryo

56. Which of the following chemicals are most widely used for protoplast fusion ?

(A) Mannitol

(B) Polyethylene glycol

(C) Sorbitol

(D) Mannol

57. Which of the following mediums is composed of chemically defined compounds ?

(A) Natural media

(B) Artificial media

(C) Synthetic media

(D) None of the above

58. Cybrids are produced by :

(A) The nucleus of one species but cytoplasm from both the parent species

(B) The fusion of two same nuclei from the same species

(C) The fusion of two different nuclei from different species

(D) None of the above

59. Chloroplast transformation is commonly achieved using :

(A) Electroporation

(B) Particle bombardment

(C) Heat shock

(D) Microinjection

60. In plant tissue culture, the callus tissues are generated into a complete plantlet by altering the concentration :

(A) Sugars

(B) Hormones

(C) Amino Acids

(D) Vitamins and minerals

61. Haploid plants can be obtained from :

(A) Anther culture

(B) Bud culture

(C) Leaf culture

(D) Root culture

62. In which of the following conditions do the somaclonal variations appear ?

(A) Plants raised in tissue culture

(B) Plants exposed to gamma rays

(C) Plants growing in polluted soil or water

(D) Plants transferred by a recombinant DNA technology

63. In tissue culture of parenchyma, mitosis is accelerated in the presence of :

(A) Auxin

(B) Cytokinin

(C) Gibberellin

(D) Both (A) and (B)

64. Which of the following is the main application of embryo culture ?

(A) Clonal propagation

(B) Production of embryoids

(C) Induction of somaclonal variations

(D) Overcoming hybridisation barriers

65. Synthetic seeds are produced by the encapsulation of somatic embryos with :

(A) Sodium acetate

(B) Sodium nitrate

(C) Sodium chloride

(D) Sodium alginate

66. The formation of embryoids from the pollen grains in the tissue culture medium is due to :

(A) Agar medium

(B) Test tube culture

(C) Double fertilization

(D) Cellular totipotency

67. What is Dimethyl sulfoxide used for ?

(A) A gelling agent

(B) Cryoprotectant

(C) Chelating agent

(D) An Alkylating agent

68. The pair of hormones required for a callus to differentiate is :

(A) Ethylene and Auxin

(B) Auxin and Cytokinin

(C) Auxin and Abscisic acid

(D) Cytokinin and Gibberellin

69. Ti plasmid directs the formation of transfer apparatus which allow the transfer of T-DNA into the host plant. The transfer apparatus belong to the class of :

(A) Type I secretion system

(B) Type II secretion system

(C) Type III secretion system

(D) Type IV secretion system

70. Plant tissue culture is technique of :

(A) *In vivo* growing cells

(B) *In vitro* maintaining and growing cells

(C) Growing plants in a greenhouse

(D) Cutting plants

71. Which of the following is a fusogenic agent used in protoplast culture ?
(A) PEG
(B) PVC
(C) Salicylic acid
(D) Auxin

72. Solidifying agent that is used in plant tissue culture is :
(A) Agar
(B) EDTA
(C) Cobaltous chloride
(D) Nicotinic acid

73. Which of the following is an advantage of enzymatic method of protoplast isolation ?
(A) Mostly used for vacuolated cells
(B) Osmotic shrinkage is maximum
(C) Cells remain intact
(D) Yield and viability are unpredictable

74. In a plant tumor cell :
(A) Complete Ti plasmid is incorporated in plant nuclear DNA
(B) Different parts of the Ti-plasmid are incorporated
(C) Only a small specific segment of the Ti-plasmid (T-DNA) is incorporated
(D) Complete Ti plasmid is incorporated in the plant chloroplast DNA

75. What is Bavistin ?
(A) Chemically synthesized plant growth regulator
(B) Callus growth inhibitor
(C) Fungicide
(D) Bactericide

76. Which of the following induces callus formation ?
(A) Auxin
(B) Gibberellin
(C) Abscisic acid
(D) Ethylene

77. Name the asexual mode of embryo formation ?
(A) Protoplast fusion
(B) Callus culture
(C) Somatic embryogenesis
(D) Protoplast culture

78. Increase amount of auxin in callus culture will promote growth of which part of the plant tissue ?
(A) Multilayer tissues
(B) Meristem
(C) Shoot
(D) Root

79. Gene transfer across the protoplast membrane is promoted by :
(A) Phenol
(B) Benzoic acid
(C) Polyethylene glycol
(D) Naphthalene

80. Which of the following is NOT a plant growth regulator ?

(A) Auxin

(B) Cytokinins

(C) Abscisic acid

(D) Polyphenols

81. Out of the following, which one is NOT the basic component of culture media used for plant cultivation ?

(A) Complex mixture of salts

(B) Amino acids

(C) Serum albumin

(D) Sugar/ sucrose

82. Name the term given to the ability of single cells to divide and produce the entire differentiated cell in the organism ?

(A) Unipotent

(B) Pluripotent

(C) Multipotent

(D) Totipotency

83. Disarmed Ti vectors do not contain :

(A) Oncogenes located in the T-DNA region

(B) Opine catabolic genes

(C) *vir* genes

(D) Left and right border sequences

84. Which of the following is an application of tissue culture ?

(A) Rapid Clonal Propagation

(B) Somaclonal Variations

(C) Transgenic plants

(D) All of the above

85. Which of the following is not related to embryo culture ?

(A) Growth of embryos on culture medium

(B) Developing seedlings

(C) Multiplication of rare plants

(D) Making virus-free plants

86. Which of the following statements is incorrect with respect to T-DNA binary vector system ?

(A) The *vir* genes and the disarmed T-DNA containing the transgene are located on separate plasmids.

(B) The *vir* functions are supplied in trans, causing transfer of the recombinant T-DNA to the plant genome.

(C) Mini-Ti plasmid and helper Ti plasmid forms T-DNA binary vector system.

(D) Gene of interest (transgene) is cloned in the helper Ti plasmid

87. What are the somaclones ?

(A) Plants chemically identical to the original plant

(B) Plants morphologically identical to the original plant

(C) Plants anatomically identical to the original plant

(D) Plants genetically identical to the original plant

88. Essential requirement of an artificial medium in which explant is being regenerated is :

(A) Medium should have a sulphur source

(B) Medium should have phosphorus source

(C) Medium must provide a carbon source

(D) Medium must provide a nitrogen donor

89. What is an explant ?

(A) A part of plant grown under soil

(B) Any part of a plant taken out and grown in a test tube

(C) Fungal species grown in a novel medium

(D) Algae grew in a test tube

90. What is plant tissue culture ?

(A) The technique of *in vitro* maintaining and growing cells

(B) The technique of *in vivo* growing cells

(C) The technique of growing plants in gardens

(D) The technique of cutting plants

91. Which one of the following method is used to develop virus free plants ?

(A) Cell suspension culture

(B) Protoplast culture

(C) Meristem culture

(D) Organ culture

92. Protoplasts are devoid of :

(A) Cell wall

(B) Cell membrane

(C) Both cell membrane and cell wall

(D) None of the above

93. Identify the genes that encode for a two-component signal system that drive the expression of other *vir* genes of Ti plasmid via sensing plant-derived signals such as plant phenolics and monosaccharides :

(A) *vir*D and *vir*E

(B) *vir*C1 and *vir*C2

(C) *vir*A and *vir*G

(D) *vir*B and *vir*D

94. An excised piece of stem tissue or leaf used in micropropagation is :

(A) Scion
(B) Explant
(C) Medium
(D) Microshoot

95. In artificial media, the growth of plant tissues is called :

(A) Gene expression
(B) Transgenesis
(C) Plant tissue culture
(D) Cell hybridization

96. Protoplasts can be synthesized from suspension cultures, intact tissues or callus tissues by the enzymatic treatment with :

(A) Proteolytic enzymes
(B) Pectolytic and cellulolytic enzymes
(C) Restriction enzymes
(D) Galactosidase enzymes

97. Benefit of clonal propagation or micropropagation is :

(A) Multiplication of sexually derived sterile hybrids
(B) Multiplication of disease free plants
(C) Rapid multiplication of superior clones
(D) All of the above

98. The *vir* genes required for the T-DNA transfer are located :

(A) Within the T-DNA region of the Ti plasmid
(B) Outside of the T-DNA region of the Ti plasmid
(C) On the plant genome
(D) On the chloroplast genome

99. Which one of the following is incorrect about Agar as a gelling agent in plant tissue culture medium ?

(A) It is not digested by the enzymes of plants
(B) Agar remains stable at incubation temperature
(C) Does not react with media constituents
(D) None of the above

100. Micropropagation involves :

(A) Microspores used for vegetative multiplication of plants
(B) Microbes used for vegetative multiplication of plants
(C) Small explants used for vegetative multiplication of plants
(D) Megaspores and microspores used for non-vegetative multiplication of plants

(Only for Rough Work)

4. Four alternative answers are mentioned for each question as—A, B, C & D in the booklet. The candidate has to choose the correct answer and mark the same in the OMR Answer-Sheet as per the direction :

Example :

Question :

Q. 1 (A) ● (C) (D)
Q. 2 (A) (B) ● (D)
Q. 3 (A) ● (C) (D)

Illegible answers with cutting and over-writing or half filled circle will be cancelled.

5. Each question carries equal marks. Marks will be awarded according to the number of correct answers you have.
6. All answers are to be given on OMR Answer Sheet only. Answers given anywhere other than the place specified in the answer sheet will not be considered valid.
7. Before writing anything on the OMR Answer Sheet, all the instructions given in it should be read carefully.
8. After the completion of the examination candidates should leave the examination hall only after providing their OMR Answer Sheet to the invigilator. Candidate can carry their Question Booklet.
9. There will be no negative marking.
10. Rough work, if any, should be done on the blank pages provided for the purpose in the booklet.
11. To bring and use of log-book, calculator, pager and cellular phone in examination hall is prohibited.
12. In case of any difference found in English and Hindi version of the question, the English version of the question will be held authentic.

Impt. : On opening the question booklet, first check that all the pages of the question booklet are printed properly. If there is any discrepancy in the question Booklet, then after showing it to the invigilator, get another question Booklet of the same series.

4. प्रश्न-पुस्तिका में प्रत्येक प्रश्न के चार सम्भावित उत्तर—A, B, C एवं D हैं। परीक्षार्थी को उन चारों विकल्पों में से सही उत्तर छाँटना है। उत्तर को OMR आन्सर-शीट में सम्बन्धित प्रश्न संख्या में निम्न प्रकार भरना है :

उदाहरण :

प्रश्न :

प्रश्न 1 (A) ● (C) (D)
प्रश्न 2 (A) (B) ● (D)
प्रश्न 3 (A) ● (C) (D)

अपठनीय उत्तर या ऐसे उत्तर जिन्हें काटा या बदला गया है, या गोले में आधा भरकर दिया गया, उन्हें निरस्त कर दिया जाएगा।

5. प्रत्येक प्रश्न के अंक समान हैं। आपके जितने उत्तर सही होंगे, उन्हीं के अनुसार अंक प्रदान किये जायेंगे।
6. सभी उत्तर केवल ओ. एम. आर. उत्तर-पत्रक (OMR Answer Sheet) पर ही दिये जाने हैं। उत्तर-पत्रक में निर्धारित स्थान के अलावा अन्यत्र कहीं पर दिया गया उत्तर मान्य नहीं होगा।
7. ओ. एम. आर. उत्तर-पत्रक (OMR Answer Sheet) पर कुछ भी लिखने से पूर्व उसमें दिये गये सभी अनुदेशों को सावधानीपूर्वक पढ़ लिया जाये।
8. परीक्षा समाप्ति के उपरान्त परीक्षार्थी कक्ष निरीक्षक को अपनी OMR Answer Sheet उपलब्ध कराने के बाद ही परीक्षा कक्ष से प्रस्थान करें। परीक्षार्थी अपने साथ प्रश्न-पुस्तिका ले जा सकते हैं।
9. निगेटिव मार्किंग नहीं है।
10. कोई भी रफ कार्य, प्रश्न-पुस्तिका के अन्त में, रफ-कार्य के लिए दिए खाली पेज पर ही किया जाना चाहिए।
11. परीक्षा-कक्ष में लॉग-बुक, कैलकुलेटर, पेजर तथा सेल्युलर फोन ले जाना तथा उसका उपयोग करना वर्जित है।
12. प्रश्न के हिन्दी एवं अंग्रेजी रूपान्तरण में भिन्नता होने की दशा में प्रश्न का अंग्रेजी रूपान्तरण ही मान्य होगा।

महत्वपूर्ण : प्रश्नपुस्तिका खोलने पर प्रथमतः जाँच कर देख लें कि प्रश्न-पुस्तिका के सभी पृष्ठ भलीभाँति छपे हुए हैं। यदि प्रश्नपुस्तिका में कोई कमी हो, तो कक्षनिरीक्षक को दिखाकर उसी सिरीज की दूसरी प्रश्न-पुस्तिका प्राप्त कर लें।