Total No. of Printed Pages: **9** No. of Questions : **50**

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PET 2024 (9007) Doctor of Philosophy(Biotechnology)

(To be filled by the Candidate)

Candidate Seat Number
(As per Admit card)

OMR Sheet Number

Invigilator's signature with Date

Candidate's Seat No. in Words :_____

Name of the Center :_____

Paper Code & Name of Examination : **9007 - Doctor of Philosophy(Biotechnology)**

Date: **03/10/2024** **PET 2024 - EXAMINATION**

Time: **One Hours** Total Marks: **100**

Important Instructions for the candidate

1. Write your seat number and OMR Sheet number on the question paper in the earmarked space
2. This question paper carries Fifty (50) Multiple-choice type questions and each question carries 2 Marks
3. At the commencement of examination, the question paper will be given to the student.
4. Each question has four alternative responses marked (A) (B) (C) and (D). You have to darken the circle as indicated below on the correct response against each question
   Example: where (C) is correct answer

5. Your responses to the answer are to be indicated in the OMR Sheet. If you mark at any place other than in the circle in the OMR Sheet it will not be evaluated.
6. Rough work is to be done at the end of this question paper.
7. You have to return OMR answer sheet and question paper to the invigilator at the end of examination compulsorily and must not carry with you outside the examination hall.
8. Use only Black / Blue ball point pen
9. Use of any type of calculator or log table etc. is prohibited.
10. There is no negative marking for incorrect answers

विद्यार्थ्यांसाठी महत्त्वाच्या सूचना

1. परीक्षार्थींनी आपला आसन क्रमांक या पृष्ठावरील वरच्या कोपऱ्यात तसेच आपणास दिलेल्या उत्तर पत्रिकेचा क्रमांक त्याखाली लिहावा.
2. या प्रश्नपत्रिकेतील सर्व प्रश्न सोडवणे अनिवार्य आहे.
3. परीक्षा सुरू झाल्यावर विद्यार्थ्याला प्रश्नपत्रिका दिली जाईल.
4. प्रत्येक प्रश्नासाठी (A) (B) (C) (D) अशी चार विकल्प उत्तरे दिली आहेत, त्यातील योग्य उत्तराचा रकाना खाली दर्शविल्याप्रमाणे ठळकपणे काळा निळा करावा.
   उदा: जर (C) हे उत्तर योग्य असेल तर

5. या प्रश्नपत्रिकेतील प्रश्नांची उत्तरे ओएमआर उत्तर पत्रिकेतच दर्शवावीत इतर ठिकाणी लिहिलेली उत्तरे तपासली जाणार नाहीत.
6. प्रश्नपत्रिकाच्या शेवटी कोऱ्या जागेवरच कच्चे काम करावे
7. परीक्षा संपल्यानंतर विद्यार्थ्यांनी मूळ ओ. एम. आर उत्तरपत्रिका पर्यवेक्षकाकडे परत करणे आवश्यक आहे तथापि प्रश्नपत्रिका व ओ. एम. आर. उत्तरपत्रिका आपल्याबरोबर नेण्यास विद्यार्थ्याला परवानगी नाही.
8. फक्त काळ्या किंवा निळ्या बॉलपेनचाच वापर करावा
9. कॅल्क्युलेटर किंवा लॉग टेबल वापरण्यास परवानगी नाही
10. चुकीच्या उत्तरासाठी गुण कपात केली जाणार नाही

Q. No. **Question**

1. Which of the following best illustrates the role of a well-defined research methodology in ensuring the reproducibility of biotechnological experiments?
(A) It allows researchers to accurately predict outcomes.
(B) It minimizes the need for control groups in experiments.
(C) It provides a standardized procedure that others can follow to achieve the same results.
(D) It guarantees the success of the experiment regardless of external variables.

2. From among the followings, how does translational research bridge the gap between basic scientific discoveries and clinical applications in biotechnology?
P. By applying laboratory findings directly to human clinical trials.
Q. By focusing exclusively on theoretical research.
R. By translating laboratory findings into potential treatments and therapies.
S. By minimizing the importance of regulatory approvals.
(A) ONLY P **(B)** P & Q
(C) P & R **(D)** Q & R

3. How does the positivist paradigm influence the design and implementation of biotechnological research?
(A) By ensuring that experiments are conducted under controlled conditions to test hypotheses
(B) By prioritizing qualitative data over quantitative data.
(C) By maxmizing the need for reproducibility in research.
(D) By minimizing the need for reproducibility in research.

4. Which of the following characteristics is essential for a research question in biotechnology to be testable?
(A) It should not be specific and clearly defined.
(B) It should encompass broad, general concepts.
(C) It must be measurable and capable of being empirically investigated.
(D) It should avoid any association with existing scientific literature.

5. Which of the following approaches is most effective in identifying research gaps in biotechnology?
I. Conducting a thorough literature review to understand the current state of knowledge.
II. Focusing exclusively on popular topics in the field.
III. Analyzing recent publications to pinpoint inconsistencies or unanswered questions.
IV. Relying on personal experience without considering existing research.
(A) I & IV **(B)** I & III
(C) II & IV **(D)** II & III

6. Which of the following best describes the advantage of using high-throughput screening (HTS) in biotechnology research?
(A) It allows for the simultaneous analysis of thousands of samples or compounds.
(B) It simplifies the data analysis process by reducing the complexity of the data collected.
(C) It provides in-depth, qualitative insights into a small number of samples.
(D) It focuses exclusively on manual, one-at-a-time testing methods.

7. How do bioinformatics software tools enhance the interpretation of genomic data in biotechnology research?

(A) By integrating and analyzing large datasets to identify genetic variations and patterns.
(B) By providing only visual representations without data analysis.
(C) By focusing solely on manual data entry and basic calculations.
(D) By limiting data analysis to pre-defined templates.

8. How does the application of multivariate analysis enhance the interpretation of complex biological datasets in biotechnology?

(A) By analyzing multiple variables simultaneously to identify patterns and relationships.
(B) By focusing only on univariate data and ignoring interactions between variables.
(C) By simplifying data to single-variable analyses without considering interactions.
(D) By providing a visual representation of data without statistical rigor.

9. Why is it important to clearly define the scope and limitations of a biotechnological study in a research manuscript?

(A) To provide readers with a clear understanding of the study's context and boundaries, enhancing the credibility of the findings.
(B) To focus solely on the theoretical aspects without discussing practical limitations.
(C) To limit the manuscript to only positive results without acknowledging potential weaknesses.
(D) To simplify the writing process by avoiding detailed descriptions of limitations.

10. Of the following, how can tailoring a biotechnology presentation to a diverse audience enhance its effectiveness?

1. By adjusting the complexity of technical content to match the audience's background and expertise.
2. By using clear, non-technical language and relevant examples to make the content accessible.
3. By focusing solely on advanced technical details without considering the audience's level
4. By limiting the presentation to a specific subgroup of experts.

(A) 1 **(B)** 1 & 2
(C) 1,2 & 3 **(D)** 1,2,3 & 4

11. Which among the following is a primary genuine ethical concern related to the cultivation of Bt Brinjal?

(A) Huge increases in crop yield will bring the prices down
(B) Potential environmental impact on biodiversity
(C) Generation of resistant pests
(D) Increase in shelf life lead to increase in production cost

12. How can researchers effectively manage and mitigate the risks of contamination in biotechnological experiments?

I. By implementing stringent aseptic techniques
II. Regularly validating the cleanliness of equipment and workspace.
III. By focusing only on theoretical models
IV. By using rigorous protocols for sample handling and storage
V. By avoiding the use of high-risk biological materials

(A) I,II **(B)** I,II, III
(C) I,II,IV **(D)** II,III, V

13. How does the application of Bayesian statistics improve the analysis of complex biotechnological data compared to frequentist methods?

A. By incorporating prior knowledge and updating probabilities with new data, providing a more flexible and adaptive analysis.
B. By focusing only on p-values and hypothesis testing without considering prior information.
C. By allowing for the integration of multiple sources of data and refining estimates based on prior distributions.
D. By simplifying statistical analysis to focus solely on data summaries and descriptive statistics.

(A) A , B **(B)** B , C
(C) A , C **(D)** C , D

14. How does the incorporation of interdisciplinary approaches enhance the effectiveness of research methodologies in biotechnology?

1. By narrowing the scope of research questions.
2. By combining knowledge from different fields to address complex problems.
3. By fostering innovation and novel solutions.
4. By limiting the need for specialized equipment.

(A) 1 & 4 **(B)** 2 & 3
(C) 1 & 3 **(D)** 2 & 4

15. What is the significance of real-world evidence (RWE) in the context of translational research in biotechnology?

I. It is only relevant for theoretical research.
II. It provides data on how new treatments perform in everyday clinical practice.
III. It simplifies the design of preclinical studies.
IV. It helps in refining and optimizing therapies based on real-world patient experiences.

(A) I & III **(B)** II & IV
(C) II & III **(D)** I & IV

16. What is the significance of adopting a post-positivist paradigm in biotechnological research?

(A) It accepts the use of empirical data and measurements.
(B) It acknowledges the limitations of positivist approaches and incorporates reflexivity and critical evaluation.
(C) It solely relies on qualitative data and subjective interpretations.
(D) It emphasizes the importance of triangulating data from multiple sources to enhance research validity.

17. Why is it essential to include a comprehensive methods section in a biotechnological research paper?

(A) To allow for the replication of the study by providing detailed descriptions of experimental procedures.
(B) To focus solely on the results and conclusions without discussing methods.
(C) To provide a brief overview of techniques without detailed protocols.
(D) To limit the manuscript to key findings and implications.

18. What role does the analysis of negative or null results play in identifying research gaps in biotechnology?

a. It highlights areas where expected outcomes were not achieved, suggesting further investigation is needed.
b. It confirms that all potential research avenues have been exhausted.

c. It challenges existing hypotheses and opens new directions for inquiry.
d. It validates the sufficiency of current research methodologies.

(A) a ,b & c **(B)** a, c & d
(C) a ,& c **(D)** b & c

19. How can integrating experimental data with computational models advance biotechnological research?
(A) By providing predictive insights and simulations that enhance the interpretation of experimental results.
(B) By limiting the data collection to only experimental observations.
(C) By simplifying the data collection process to focus exclusively on computational models.
(D) By focusing solely on qualitative aspects of the experimental data.

20. What is the impact of using integrative omics software on personalized medicine approaches in biotechnology?
I. It combines data from genomics, proteomics, and metabolomics to tailor treatments to individual patients.
II. It focuses solely on one type of omics data without integration.
III. It enhances the ability to identify biomarkers and predict individual responses to therapies.
IV. It limits the application of personalized medicine to generalized treatment protocols.

(A) I & II **(B)** I & III
(C) I & IV **(D)** III & IV

21. Which among the followings is/are important to assess the assumptions of statistical tests before applying them to biotechnological data?
A. To ensure that the test results are valid and reliable by meeting the necessary assumptions
B. To focus solely on exploratory data analysis without considering test assumptions
C. To avoid misleading conclusions and incorrect interpretations of the data.
D. To simplify the data analysis process by ignoring test assumptions.

(A) A **(B)** A, & B,
(C) A & C **(D)** B & D

22. Why is it important to critically review and revise a biotechnology manuscript before submission?
(A) To identify and correct errors, improve clarity, and ensure that the manuscript meets high-quality standards.
(B) To focus solely on the initial draft without further revisions.
(C) To simplify the review process by minimizing changes to the manuscript.
(D) To limit the manuscript to the original content without additional modifications.

23. What role does audience feedback play in refining oral communication skills for presenting biotechnological research?
I. It provides insights into how well the content is understood and highlights areas for improvement
II. By focusing only on self-assessment without considering audience perspectives
III. It helps in adjusting the presentation style and content based on real-time reactions and questions.
IV. By limiting interactions to avoid distractions from the main content.

(A) I & II **(B)** I & III
(C) III **(D)** III & IV

24. What is the role of a well-structured abstract in a biotechnology research article?

(A) To summarize the key objectives, methods, results, and conclusions, enabling readers to quickly assess the relevance of the study.
(B) To provide a detailed analysis of the research methodology and data.
(C) To include extensive background information and theoretical context.
(D) To focus on future research directions and implications.

25. What approaches can be used to manage the challenges associated with interdisciplinary collaboration in biotechnological research?

I. By establishing clear communication channels
II. By defining roles and responsibilities among team members.
III. By focusing solely on the contributions of individual disciplines
IV. By fostering a collaborative environment
V. By encouraging mutual understanding of different disciplinary perspectives.
VI. By avoiding collaboration with other disciplines to maintain focus on specific research areas

(A) I, III, V
(B) I,II,IV V
(C) III,IV V
(D) IV, V, VI

26. During which of the following stages of meiosis, does the synaptonemal complex breakdown leading to the separation of two homologous chromosomes?

(A) Zygotene
(B) Pachytene
(C) Diplotene
(D) Diakinesis

27. If a naive T cell recognizes an antigen-MHC complex on an appropriate antigen-presenting cell or target cell, it will be activated, initiating :

(A) A primary response
(B) A secondary response
(C) A prophylactic response
(D) Degranulation of mast cells

28. Which of the following statements is most correct about the differential Gram stain?

(A) Crystal violet differentially stains Gram positive cells.
(B) Gram's iodine differentially stains Gram positive cells.
(C) Alcohol differentially destains Gram negative cells.
(D) Safranine differentially stains Gram negative cells.

29. If the genotypes of a husband and a wife both are AaBb. How many different phenotypes and homozygous genotypes are possible among the blood types of their children?

(A) 3 phenotypes 2 homozygous genotypes :
(B) 4 phenotypes and 2 homozygous genotypes
(C) 3 phenotypes 4 homozygous genotypes :
(D) 4 phenotypes 4 homozygous genotypes

30. In non-competitive inhibition, ...

(A) Inhibitor binds to the active site of enzyme
(B) Inhibitor binds at a site other than active site and may bind to either E or ES complex
(C) Inhibitor binds to a site other than active site and binds only to the ES complex
(D) Inhibitor binds at a site other than active site and binds only to E

31. A hybrid operon was constructed by fusing the structural genes of *trp* operon and promoter region of lac operon. Efficient expression of this chimeric operon will require

(A) Presence of both lactose and glucose
(B) Absence of lactose and presence of glucose
(C) Presence of both lactose and tryptophan
(D) Presence of lactose and absence of glucose

32. Thanatophoric dysplasia, in which growth plates of ribs and limbs fail to proliferate leading to the death of baby soon after its birth is due to mutations in ..... pathway.

(A) RTK **(B)** JAK-STAT
(C) Hedgehog **(D)** Wnt

33. Which one of the following programs is used for finding distantly related (or remote) protein homologs?

(A) BLASTN **(B)** BLASTX
(C) PSI-BLAST **(D)** TBLASTX

34. Monod equation for the specific growth rate, confirms the -------- form of mathematical equation

(A) Parabola **(B)** Hyperbola
(C) Ellipse **(D)** Straight line

35. The -------is a measure of the efficiency of conversion of any one substrate into biomass

(A) Yield factor **(B)** Growth
(C) Specific growth rate **(D)** All

36. The destruction of micro-organisms by steam may be described as----------order chemical reaction

(A) A first **(B)** A zero
(C) Second **(D)** Multi

37. A cultured skin fibroblast cell of a goat 'P' was fused with an enucleated ovum of a goat 'Q'. The resultant activated early embryo was then transplanted into a pseudopregnant (surrogate) female goat 'R' of the same strain as 'Q'. On completion of gestation, a female goat 'S' was born. With the exception of mitochondrial DNA, 'S' is a clone of _____.

(A) Only P **(B)** Only Q
(C) Only R **(D)** Both P and R

38. CRISPR/Cas9 is an example of bacterial adaptive immunity. The transcription of CRISPR loci generates small crispr-RNAs (crRNA) to specifically target viral DNA, but not CRISPR loci, by forming complex with guide RNA and Cas9 nuclease. This prevention of autoimmunity is due to the:

(A) Absence of protospacer adjacent motif sequence in CRISPR loci.
(B) Absence of DNA sequence complementary to crRNA in CRISPR loci.
(C) Absence of DNA sequence complementary to guide RNA in CRISPR loci.
(D) Methylation of CRISPR loci.

39. Aspartic acid (Asp) is specified by the codon GAU and .GAC. After mutation, Asp is changed to Alanine .represented by GCX, where X may be A, U, C and G. The .reversion of the mutation could only be done with .reactive oxygen species. The nature of mutation is .considered to be

(A) Transition **(B)** Transversion
(C) Either transition or transversion **(D)** Depurination

40. You have created a fusion between the trp operon, which encodes the enzymes for trptophan biosynthesis, under the regulatory control of the lac operator. Under which of the following conditions will trptophan synthase be induced in the strain that carries the chimeric operator fused operons?

(A) Only when both lactose and glucose are absent.
(B) Only when both lactose and tryptophan are present.
(C) Only when lactose is absent and glucose is present.
(D) Only when lactose is present and glucose is absent.

41. Bacteriophage T4 infects E. coli and injects its DNA inside the cell. The transcription of viral genes occurs in three stages: immediate early, early and late. All the promoters on viral genome are available, but the control takes place at the level of

(A) Promoter strength.
(B) Modification of host RNA polymerase.
(C) Synthesis of new polymerases.
(D) turn over rate of RNA synthesis.

42. Which property of nanoparticles makes them particularly useful for targeted drug delivery?

(A) Their large size
(B) Their ability to change color
(C) Their high surface area-to-volume ratio
(D) Their metallic nature

43. In ELISA, which of the following enzymes are conjugated to antibodies for detection of the analyte?P. Alkaline phosphatase Q. TrypsinaseR. Horseradish peroxidase S. Amylase

(A) P and R
(B) P and Q
(C) Q and S
(D) R and S

44. Emerging viruses such as SARS-CoV2 cause epidemics. Which of the following process(es) contribute to the rise of such viruses? P) Mutation of existing virus; Q) Jumping of existing virus from current to new hosts; R) Spread of virus in the new host population S) Replication of virus outside a host

(A) P and Q
(B) R and S
(C) P, Q and R
(D) P, Q, R and S

45. Determine the correctness or otherwise of the following Assertion [a] and the Reason [r]. Assertion [a]: In multicellular organisms, cells of different lineages have different gene expression profiles. Reason [r]: Alternative splicing is the only mechanism to generate protein diversity

(A) Both [a] and [r] are false
(B) Both [a] and [r] are true and [r] is the correct reason for [a]
(C) Both [a] and [r] are true but [r] is not the correct reason for [a]
(D) [a] is true but [r] is false

46. Which of the following statements about monosaccharides is correct?
P — Epimers of monosaccharides differ in chemical properties.;
Q — In aldoses, C1 is the anomeric carbon.;
R — Anomers differ in configuration at the glycosidic carbon.;
S — Epimers differ in configuration at any carbon other than glycosidic carbon

(A) R and S
(B) P and Q
(C) Q, R and S
(D) P, Q, R and S

47. A mutation in the DNA sequence that replaces a single adenine (A) with guanine (G) occurs within a gene coding for a protein. Which of the following could be the most significant consequence of this mutation?

(A) The protein will be shorter than usual.
(B) The protein will have a completely different structure and function.
(C) The protein might fold incorrectly, affecting its function.
(D) There will be no significant impact on the protein's function.

48. If a genetic mutation causes a change in the primary structure of a protein, which of the following is most likely to happen?

(A) Only the primary structure will be affected; the protein's function remains unchanged.
(B) The protein may misfold, potentially leading to loss or alteration of function.
(C) The mutation will automatically lead to the formation of a non-functional protein.
(D) The mutation will not affect the protein if it occurs in a non-critical region.

49. If a drug specifically inhibits the formation of hydrogen bonds, which level of protein structure is most directly affected?

(A) Primary structure
(B) Secondary structure
(C) Tertiary structure
(D) Quaternary structure

50. CDC42BPB kinase is not known to play any important role in ---------- in skin cancer

(A) actin cytoskeleton organization
(B) cellular migration
(C) Invasion
(D) conferring immunotherapy responsiveness

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