

# GU-RET 2016

GAUHATI UNIVERSITY RESEARCH ELIGIBILITY TEST

## BIOTECHNOLOGY

Booklet Series : **A**

Invigilator's Name and Signature
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BOOKLET NO.

OMR SHEET NO.

ROLL NO.

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TIME : 2 HOURS 20 MINUTES

TOTAL MARKS : 80

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Number of Pages in this Booklet : 13

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### Instructions for Candidates

1. Write your Roll No. and OMR Sheet No. in the boxes provided above.
2. This paper consists of two sections : **Section B** with 50 (fifty) multiple choice questions (MCQ) and **Section C** with 6 (six) descriptive questions. Each MCQ has 4 (four) answers, out of which **ONLY** one is correct. You have to darken the circle (on the OMR Sheet) for the correct answer corresponding to the question given in this booklet.

Example : (A) (B) (C) (D)

where (C) is the correct answer. No marks will be given for markings made in this booklet. The descriptive questions in **Section C**, **MUST** be answered in the space provided in this booklet. **No extra pages will be provided in any case.**

3. Use a BLACK ball point pen in your OMR Sheet.
4. Read the instructions given inside this booklet before attempting to answer any questions.
5. **DO NOT** write your name, roll no, phone no, or anything, or put any marks anywhere in this booklet, otherwise your candidature will be disqualified.
6. If you are found to resort to any kind of unfair means such as carrying extra material other than pen, pencil, watch, eraser, and scale, or copying from somebody or from external material, your candidature will be disqualified.
7. Mobile phones, programmable calculators, log tables or any other tables, wearable smart devices such as smart Android watches or objects of similar nature **CAN NOT** be used inside the examination hall.
8. At the end of the examination, you have to return this booklet and the OMR Sheet back to the invigilator.
9. There is no negative marks for incorrect answer.

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## Section B (50 Marks)

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- Animal cell culture technology is maximally used in the production of
  - insulin
  - interferons
  - vaccines
  - edible proteins
- Which of the following viruses is used for bio-control of insect pests of plants?
  - Cauliflower mosaic virus
  - Cucumber mosaic virus
  - Nuclear polyhedrosis virus
  - None of the above
- Which vector would be the most appropriate for cloning of 150 kb fragment DNA?
  - pBR-322
  - $\lambda$  vector
  - YAC
  - pUC-18
- Worldwide, the most common vitamin deficiency is that of
  - ascorbic acid
  - folic acid
  - vitamin A
  - vitamin D
- Why might you want to search a database for a protein motif?
  - A specific motif may impart a specific function to the molecule. You could then identify groups of protein that may have similar functions
  - Presence of a specific motif in several proteins indicates that they are likely to be all from the same species
  - Absence of a specific motif from one of a pair of otherwise similar protein indicate that they are produced by alternative splicing of the same gene
  - All of the above
- Which of the statements is false about an electrophile?
  - Electron deficient species
  - An acidic reagent
  - A reagent which attract an electron deficient site in a molecule
  - A species which seeks a pair of electrons
- Which statement is true regarding the action of an enzyme?
  - An enzyme usually binds the substrate more tightly than transition state
  - An enzyme usually binds the product more tightly than the transition state
  - An enzyme stabilizes the transition state for the reaction more than the ES complex
  - An enzyme usually binds S and p with equal affinity
- Compared to the hydrides of water and other non metallic elements (N, C, S), water has
  - the lowest boiling point
  - the lowest freezing point
  - the highest boiling point and the lowest freezing point
  - the highest viscosity
- Protein gels (SDS-PAGE) are usually run vertically while DNA gels (agarose) are run horizontally. A student desires to run a protein gel horizontally and DNA gel vertically. Which of the following statements will best explain his results?
  - The protein gel experiment will not work because proteins need more gravity to move compared to DNA since proteins are larger molecules than DNA. DNA gel will run fine.
  - Both the protein and DNA experiments will not work. Protein gels have to run vertically and DNA gels horizontally.
  - Both protein and DNA gel experiments will work as the principles behind their functioning do not depend on gravity.
  - The protein gels will work because of the presence of peptide bonds while DNA gel will not work as phosphates in DNA will bind to polyacrylamide and will inhibit movement of DNA.

10. Compare the  $[H^+]$  of gastric juice (assume  $p^H = 1.4$ ) to that of blood plasma (assume  $p^H = 7.4$ )
- The  $[H^+]$  of gastric juice is 6 times higher (7.4 - 1.4)
  - The  $[H^+]$  of gastric juice is  $10^6$  times higher
  - The  $[H^+]$  of blood plasma is 6 times higher than gastric juice
  - The  $[H^+]$  of blood plasma is  $10^6$  times higher
11. The statistical test can be utilized to validate the statement "people having higher cholesterol suffer from hypertension" is
- Student "t"-test
  - Regression analysis
  - Pearson correlation coefficient
  - ANOVA
12. Which of the following is a replacement vector?
- $\lambda$ gt-10
  - Charon-32
  - pUC-18
  - None of the above
13. Transcription factors are
- Regulatory proteins
  - Enzymatic proteins
  - Structural proteins
  - None of the Above
14. Which vector use  $\alpha$ -complementation for selection?
- pBR-322
  - pUC-18
  - Cosmid
  - YAC
15. CaMV is a
- Constitutive promoter
  - Tissue-specific promoter
  - Stress specific promoter
  - None of the above
16. Gene silencing and gene knockout is a process which are
- Same
  - Different
  - Partially same
  - None of the above
17. RNA is generally analyzed for the location of hairpin folds. Which of the sequences below could form a mini hairpin structure?
- AGG UUU CCU
  - AGG UUU GGA
  - AGG UUU AGG
  - None of the above
18. In purification of plasmid DNA by EtBr-CsCl density gradient centrifugation, CsCl bound to the plasmid DNA is removed by
- Centrifugation
  - Chromatography
  - Dialysis
  - Lysozyme treatment
19. How is it possible for ions to be at equilibrium across a plasma membrane and yet not be at the same concentration on both sides?
- Because the mobility of ions is restricted across the plasma membrane
  - Because there is a charge difference across the plasma membrane
  - Because of voltage gated ion channels in the plasma membrane
  - Because of the presence of leak in ion channels in the plasma membrane
20. For the sequence of dsDNA given below, identify the set of primers required to amplify this DNA by PCR
- 3' GACTCCA.....TACAACC 5'  
5' CTGAGGT.....ATGTTGG 3'
- 5' GGTTGTA and 5' GACTCCA
  - 5' CTGAGGT and 5' CCAACAT
  - 5' ACTCAGT and 5' ATGTTGG
  - None of the above

21. Two proteins have the same molecular mass and have identical net charge at pH 7. The best way to separate them would be to use
- SDS-polyacrylamide gel electrophoresis
  - Native gel electrophoresis
  - Cation-exchange chromatography
  - Anion-exchange chromatography
22. The cycle threshold is
- The total number of cycles performed during a real-time PCR reaction
  - The cycle that a sample crosses a certain point during a real-time PCR reaction
  - The cycle number that a sample enters the plateau phase of PCR
  - None of the above
23. Phage M13 vectors are widely used for
- Obtaining single stranded copies of cloned DNA suitable for DNA sequencing
  - Obtaining double stranded copies of cloned DNA suitable for DNA sequencing
  - Obtaining fragments of cloned DNA suitable for DNA sequencing
  - Obtaining double stranded copies of cloned DNA suitable for electrophoresis
24. Which type of restriction enzymes are commonly used in rDNA technology?
- Type I
  - Type II
  - Type III
  - Type IV
25. The standard error is a statistical measure of
- The normal distribution of scores around the sample mean
  - The extent to which a sample mean is likely to differ from the population mean
  - The clustering of scores at each end of a survey scale
  - The degree to which a sample has been accurately stratified
26. Which is the most abundant protein enzyme in the living world?
- Nitrogenase
  - Chlorophyllase
  - RuBisCo
  - DNA polymerase
27. Naturally favorable state of molecular oxygen is
- singlet
  - doublet
  - triplet
  - quadruplet
28. An isoenzyme could be evolutionary outcome of
- Gene duplication
  - Polyploidisation
  - Alternative splicing
  - All the above
29. Which of the following amino acids is essential for right handed triple helix of collagen?
- Gly
  - Lys
  - Hyp
  - Pro
30. Which of the following is a reducing sugar?
- Pectin
  - Chitin
  - Cellulose
  - Glycogen
31. The offspring of heterozygous parents ( $Aa$  at a single locus) are 25%  $AA$ , 50%  $Aa$  and 25%  $aa$ . Which of the following concept govern the process?
- The parents are diploid organisms
  - All alleles assort independently
  - The gametes combine at random
  - The  $a$  allele is recessive lethal

32. Classical enzyme kinetics does not apply to one of the following enzymes. Which one?
- (A) Isocitrate dehydrogenase  
 (B) Glucose-6-phosphatase  
 (C) Catalase  
 (D) Arginase
33. Which set of amino acids are exclusively glucogenic?
- (A) Asp, Ala, Trp  
 (B) Ser, Leu, Ile  
 (C) Val, Met, Cys  
 (D) Phe, Tyr, Thr
34. Which is the most oxidizing compound known in biological reactions?
- (A) P680<sup>+</sup>  
 (B)  $\frac{1}{2}$ O<sub>2</sub>  
 (C) NAD<sup>+</sup>  
 (D) O<sub>2</sub>
35. Buffering effect is maximum at
- (A) Optimal pH  
 (B) Optimal pKa  
 (C) Same pH and pKa  
 (D) Independent of buffer concentration
36. An allele has different effects depending on whether it was inherited from father or mother. This is most likely due to
- (A) Sex-linkage  
 (B) Imprinting  
 (C) Penetrance  
 (D) Epistasis
37. Which of the following is not a mass analyzer used in proteomic studies?
- (A) Time-of-flight (TOF)  
 (B) ion trap  
 (C) Isobaric tags for relative quantification (iTRAQ)  
 (D) Fourier transform ion cyclotron
38. Which of the following disease is not caused by *E.coli*?
- (A) urinary tract infections (UTI)  
 (B) neonatal meningitis  
 (C) Botulism  
 (D) intestinal diseases (gastroenteritis)
39. Which CD antigen is present in all T-cells and has a constant structure and associated with T cell receptor cell membrane:
- (A) CD3  
 (B) CD4  
 (C) CD5  
 (D) CD8
40. Which type of hypersensitivity reaction is covered under or is associated with delayed allergy
- (A) Anaphylactic reactions  
 (B) Cytotoxic reactions  
 (C) Toxic-complex syndrome  
 (D) Cell mediated hypersensitivity
41. If the molar amount of G in a DNA sample is 20%, what is the molar amount of T in the sample?
- (A) 20%  
 (B) 30%  
 (C) 40%  
 (D) 60%
42. RNA synthesis occur in the direction of
- (A) 5 → 3  
 (B) 3 → 5  
 (C) Both way  
 (D) None of the above
43. Antibiotics such as ciprofloxacin and fluoroquinolones work by inhibiting a specific enzyme. This enzyme is normally associated with replication. What is the name of this enzyme?
- (A) DNA ligase  
 (B) Topoisomerase (DNA gyrase)  
 (C) Primase  
 (D) Single strand binding protein

44. Flowcytometry is usually not used for determining
- (A) Cell size
  - (B) Cell structure
  - (C) Cell granularity
  - (D) Cell surface marker expression
45. Robert Koch suggested the Koch's postulates based on his initial studies on
- (A) *Mycobacterium tuberculosis*
  - (B) *Mycobacterium leprae*
  - (C) *Bacillus anthracis*
  - (D) *Bacillus cereus*
46. Amino acid which frequently replace each other in the bacterial cell wall
- (A) Meso-diaminopimelic acid and *L*-lysine
  - (B) *D*-glycine and *D*-alanine
  - (C) *D*-glutamic acid and *L*-Aspartic acid
  - (D) *L*-Asparagine and *L*-lysine
47. What other enzyme is often associated with a restriction endonuclease in bacterial cells?
- (A) DNA methyltransferase
  - (B) DNA ligase
  - (C) DNA polymerase
  - (D) RNA polymerase
48. A virus that has the ability to cross the placenta from an infected mother to the fetus?
- (A) Zoonotic
  - (B) Teratogenic
  - (C) Oncogenic
  - (D) Cytopathic
  - (E) Virulent
49. One of the following is not penicillinase susceptible?
- (A) Amoxicillin
  - (B) Penicillin G
  - (C) Piperacillin
  - (D) Cloxacillin
50. Which of the following statements is true about blood agar and chocolate agar?
- (A) Blood agar contains blood and chocolate agar contains cocoa
  - (B) Chocolate agar is a type of blood agar in which only serum is added
  - (C) Chocolate agar is a type of blood agar in which the RBC's are lysed
  - (D) Chocolate agar is a type of blood agar with added chocolate

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**Section C (30 Marks)**

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**Answer any 5 (five) from the following**

1. Define and differentiate between ORF and structural gene. (Marks : 6)
2. What is *cos* site of  $\lambda$  genome and  $\lambda$  vector and its importance? Are  $\lambda$  genome and  $\lambda$  vector same? (Marks : 6)
3. Define and differentiate between genome editing and RNA editing with example. (Marks : 6)
4. Gene expression can be controlled with the help of RNA molecule. Explain the method with an example. (Marks : 6)
5. Define expressed- sequence tag (EST). How are ESTs created? How ESTs are used in genomic studies? (Marks : 6)
6. Describe three different methods for inferring the function of gene by examining its DNA sequence. (Marks : 6)

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Space for Answers (Section C) : for Questions 1 to 6 (6 pages)

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GU-RRET 2018

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Space for Answers (Section C) : for Questions 1 to 6 (6 pages)

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GU-RFET 2019

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Space for Answers (Section C) : for Questions 1 to 6 (6 pages)

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GU-RREF 2019

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Space for Answers (Section C) : for Questions 1 to 6 (6 pages)

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GU-RFET 2019

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Space for Answers (Section C) : for Questions 1 to 6 (6 pages)

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GU-RREF 2019