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## B.Tech DEGREE EXAMINATION, MAY 2024

Third Semester

### 18BTC104T - GENETICS AND CYTOGENETICS

(For the candidates admitted during the academic year 2018 - 2019 to 2021 - 2022)

**Note:**

- i. **Part - A** should be answered in OMR sheet within first 40 minutes and OMR sheet should be handed over to hall invigilator at the end of 40<sup>th</sup> minute.
- ii. **Part - B** and **Part - C** should be answered in answer booklet.

**Time: 3 Hours**

**Max. Marks: 100**

#### PART - A (20 × 1 = 20 Marks)

Answer all Questions

Marks BL CO

- |  |   |   |   |
|--|---|---|---|
| 1. A tall plant crossed with a dwarf plant yielded, 1:1 ratio of tall:dwarf. The genotype of the tall plant is<br>(A) TTtt (B) TT<br>(C) tt (D) Tt   | 1 | 1 | 1 |
| 2. In humans, females are said to be<br>(A) hologametic (B) heterogametic<br>(C) parthenogenetic (D) homogametic   | 1 | 1 | 1 |
| 3. The number of barr bodies present in a normal female is<br>(A) 0 (B) 1<br>(C) 2 (D) 3   | 1 | 1 | 1 |
| 4. When a disease is prevalent in males alone in the family, then it is said to be<br>(A) Y-linked (B) X-linked<br>(C) Autosomal dominant (D) Autosomal recessive  | 1 | 1 | 1 |
| 5. The highest degree of condensation during chromosome organization can be seen in<br>(A) Nucleosome core (B) chromatin fibre<br>(C) solenoid (D) metaphase chromosome  | 1 | 1 | 2 |
| 6. In a cross between YR/yr x yr/yr parents the expected proportions of the offsprings are Yr/yr-10, yR/yr-10, YR/yr-40 and yr/yr-40. What is the distance between the genes Y and R?<br>(A) 10 map unit (B) 15 map unit<br>(C) 20 map unit (D) 5 map unit | 1 | 4 | 2 |
| 7. Which among the following histones binds to linker DNA?<br>(A) H1a (B) H2<br>(C) H2a (D) H1   | 1 | 2 | 2 |
| 8. If a white rabbit breeds with a black rabbit and grey offspring's were observed then, it could be an example for<br>(A) Heterodominance (B) Complete dominance<br>(C) Co-dominance (D) Incomplete dominance   | 1 | 3 | 2 |
| 9. The chromosomal aberration, double trisomy is represented as<br>(A) 2n+1 +1 (B) 2n+2<br>(C) 2n+1 (D) 2n-1-1   | 1 | 3 | 3 |
| 10. During meiosis, when does chromatid disjunction occur?<br>(A) Prophase (B) Anaphase<br>(C) Metaphase (D) Telophase   | 1 | 2 | 3 |

11. The gene mutation in which the codon for one amino acid is changed into a codon for another amino acid is	1	2	3
(A) Silent mutation			
(B) Nonsense mutation			
(C) Missense mutation			
(D) sequence Polymorphism			
12. The fluorescent pattern obtained using quinacrine for staining	1	5	3
(A) AT-banding			
(B) C-banding			
(C) Q-banding			
(D) G- banding			
13. Klinefelters syndrome is represented as	1	3	4
(A) 47, XYY			
(B) 46, XYY			
(C) 46, XXY			
(D) 47, XXY			
14. The cell division at the stage of Metaphase could be stopped by	1	2	4
(A) Phytohemagglutinin			
(B) Colchicine			
(C) Heparin			
(D) EDTA			
15. The following is an example for duplication in eye shape in Drosophila	1	1	4
(A) Colour blind gene			
(B) Notch gene			
(C) Bar gene			
(D) Sex-linked gene			
16. A locus is said to be polymorphic when the frequency of the most common allele is	1	4	5
(A) 99			
(B) 0.99			
(C) 1			
(D) 0.5			
17. The population that is more susceptible to genetic drift is	1	3	5
(A) Small population			
(B) Large population			
(C) Island population			
(D) All population			
18. One population may contribute to change in allele frequency of another population in case of	1	2	5
(A) Mutation			
(B) Selection			
(C) Migration			
(D) Population			
19. A colour blind son will be born when the	1	2	5
(A) Mother is normal and father is colour blind			
(B) Mother is colour blind and father normal			
(C) Both mother and father are carrier			
(D) Father is normal			
20. In a random mating population the frequency of 2 alleles p and q is	1	3	5
(A) $p+q=0.1$			
(B) $p+q=1$			
(C) $P-q=1$			
(D) $p=q$			

**PART - B ( $5 \times 4 = 20$  Marks)**

Answer **any 5** Questions

**Marks BL CO**

21. Human beings carrying the dominant allele T can taste the substance phenylthiocarbamide. In a randomly mating population in which the frequency of this allele is 0.4, what is the probability that a particular taster is homozygous?	4	4	5
22. Explain the law of segregation representing a hybrid cross.	4	2	1
23. Define linkage. Write about its types and its arrangements on a chromosome	4	2	3
24. Give a note on structural aberration and its types	4	1	3
25. Explain the structure and the features of lampbrush chromosomes	4	1	2
26. Write short notes on FISH technique.	4	4	3
27. Do lethal genes exhibit lethality? Why?	4	3	4

**PART - C ( $5 \times 12 = 60$  Marks)**

Answer **all** Questions

**Marks BL CO**

28. (a) Explain the law of independent assortment with examples. 12 2 1  
(OR)  
(b) What is multiple allelism? Give a detailed account on multiple allelism observed in humans.
29. (a) In *D. melanogaster*, cherub wings (ch), black body (b), and cinnabar eyes (cn) result from recessive alleles that are all located on chromosome 2. A homozygous wild-type fly was mated with a cherub, black, and cinnabar fly, and the resulting F1 females were test-crossed with cherub, black and cinnabar males. The following progeny were produced from the testcross:  
ch b<sup>+</sup> cn 105  
ch<sup>+</sup> b<sup>+</sup> cn<sup>+</sup> 750  
ch<sup>+</sup> b cn 40  
ch<sup>+</sup> b<sup>+</sup> cn 4  
ch b cn 753  
ch b<sup>+</sup> cn<sup>+</sup> 41  
ch<sup>+</sup> b cn<sup>+</sup> 102  
ch b cn<sup>+</sup> 5  
Total 1800  
i. Determine the linear order of the genes on the chromosome (which gene is in the middle?).  
ii. Calculate the recombinant distances between the three loci.  
ii. Determine the coefficient of coincidence and the interference for these three loci.  
(OR)  
(b) What is allelic and non-allelic interaction. Explain with examples.
30. (a) How karyotyping analysis could be done to detect a syndrome? Explain. 12 2 3  
(OR)  
(b) Explain Stern's experiment to prove crossing over in *Drosophila*.
31. (a) Describe the somatic cell hybridization techniques to locate a gene on a chromosome in humans. 12 4 4  
(OR)  
(b) Give a detailed account on structural and numerical aberration.
32. (a) Genotypes of leopard frogs from a population in central Kansas were determined for a locus (M) that encodes the enzyme malate dehydrogenase. The following numbers of genotypes were observed:  
  
Genotype Number  
M1 M1 20  
M1 M2 45  
M2 M2 42  
M1 M3 4  
M2 M3 8  
M3 M3 6  
  
Total 125  
  
Calculate the genotypic and allelic frequencies for this population.  
(OR)  
(b) Compare and contrast the effects of mutation, migration, genetic drift, and natural selection on genetic variation within populations and on genetic divergence between populations.

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