

- 6.a.i. In the ripening of the fruits green colour is converted to red colour is due to a biochemical reaction. Colourless precursor is converted into to coloured product with a help of either gene A or gene B, thus having either an "A" allele or a "B" allele produces colour, but lack of either allele will produce a green colour. 10 3 1 2
- (1) What will be the ratio obtained in F₂ generation. Support it with checker board?
- (2) What type of interaction is this and give the various genotypic character produced
- ii. Elaborate on the technique that involves the fusion of protoplasts to form a hybrid cell and develop a hybrid plant / animal. Justify with an example. 8 3 2 2,3
- b. In a test cross, phenotype of the off springs are same but their numbers differ, due to which of the following condition. 1 2 1 2
- (A) Increased number of crossover (B) Whether they are closely / distantly linked
- (C) Whether the alleles are in (D) Decreased number of cross over repulsion / coupling
- c. Which of the following can be used as a measure to construct a linkage map of the Hfr chromosome? 1 2 3 2,3
- (A) Frequency of recombination (B) Time of entry
- (C) Locus of mutation (D) Transfer of 'f' factor
- 7.a.i. What is the effect on the expression of a gene's location in a chromosome is changed often by translocation. Support with the diagram. 3 3 2 2,3
- ii. Female *Drosophila* heterozygous for ebony (e⁺/e) scarlet (st⁺/st) and spineless (ss⁺/ss) were test crossed and the following progeny were obtained. 3 2 2,3
- Wild type – 70
- Ebony, scarlet – 71
- Ebony, spineless – 334
- Ebony, scarlet, spineless – 80
- Scarlet – 378
- Spineless – 64
- (1) Find the order of the gene 5
- (2) Find the map distance between the loci ebony-scarlet and the distance between ebony-spineless 7
- (3) Calculate the coefficient and interference and discuss on it 3
- b. The loops in lampbrush chromosome indicate site for 1 2 3 2,3
- (A) Crossing over (B) Transcription
- (C) Linkage (D) Replication
- c. In cattle if r1 gives red colour coat, r2 gives white coat. Cross between both produce r1r2. What type of interaction is this? 1 3 2 2,3
- (A) Epistasis (B) Complete dominance
- (C) Codominance (D) Incomplete dominance

* * * * *

Reg. No.

B.Tech. DEGREE EXAMINATION, JUNE 2023

OPEN BOOK EXAMINATION

Third Semester

18BTC104T – GENETICS AND CYTOGENETICS

(For the candidates admitted from the academic year 2020-2021 to 2021-2022)

- Specific approved THREE text books (Printed or photocopy) recommended for the course
- Handwritten class notes (certified by the faculty handling the course / head of the department)

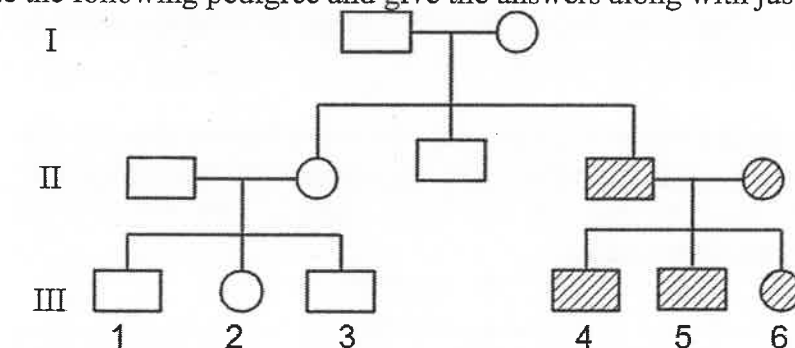
Time: 3 Hours

Max. Marks: 100

Answer FIVE questions
(Question No. 7 is compulsory)

1.a.i. Analyze the following pedigree and give the answers along with justification.

Marks BL CO PO
3 1 2



The pedigree above is a track of the presence of attached earlobes through a family's generation.

- (1) What type of inheritance is seen? 2
- (2) If individual III 6 married a man who was homozygous for unattached earlobes. What is the expected progeny ratio? 4
- (3) Give the genotype of all the members in the pedigree 4
- ii. When a male pig from a line of true breeding black, solid hooved pigs was crossed to a female from a breed of red, cloven hooved pigs, their progenies looked alike with regard to colour and hooves. These progeny were mated to members of the same breed as their mother. The offspring from this cross were: 8 4 1 2
- 11 black cloven hooved: 8 black solid hooved: 14 red cloven hooven and 10 red solid hooved. For each of these two genes (coat colour and hoof type) determine which allele is the dominant one. Explain your reasoning on the phenotype of the progeny produced by the first mating in the problem?
- b. Dominant epistasis ratio with A as epistatic gene 12:3:1 corresponds to which of the following? 1 2 1 2
- (A) A_B_ : A_bb : aaB_ (B) aaB_ : aabb : aab_
- (C) AAB_ : A_B_ : aabb (D) A___ : aaB_ : aabb
- c. A female with XXXX chromosome will have the following number of Barr bodies. 1 2 1 2
- (A) 4 (B) 3
- (C) 2 (D) 1

- 2.a.i. A tall dominant plant (a^+) over dwarf (a) and fruit forming (f^+) is dominant over non-fruit forming (f), height and fruit formation are linked with 20% crossing over. A certain tall, fruit forming (a) crossed with a dwarf, fruitless produced 81 tall fruit forming : 7a dwarf, fruitless, 22 tall fruitless and 17 dwarf fruit forming.
Another tall fruit forming (b) was crossed with a dwarf, non-fruit forming produced 21 tall fruitless 18 dwarf fruit forming: 5 fruit forming and 4 dwarf fruitless. Represent on the chromosomes the arrangement of the gene in these two tall, fruit forming plants.
If these 2 plants are crossed what phenotype classes would be expected and in what proportion.
- ii. In neurospora the gene a , b and c are present on the q arm of the chromosome. A cross between 3 wild type and mutant gene gave the following ascospore composition.
Ascospore 1 – + + + c Ascospore 3 – a + +
Ascospore 2 – + b c Ascospore 4 – a b +
Give the crossover type that resulted in this ascus formation, if double or triple crossover were involved, were they 2 strand, 3 strand or 4 strand multiple crossover.
- b. A heterozygous gray bodied (b^+) normal winged (vg^+) female fruit fly test crossed with a recessive male gave the following progenies: Gray normal –90, gray vestigial –10, black normal –10 and black vestigial –90. What is the distance between the gene b and Vg .
(A) 10 MU (B) 20 MU
(C) 5 MU (D) 90 MU
- c. Multiples of the haploid set of chromosomes is called as
(A) Euploidy (B) Aneuploidy
(C) Position effect (D) Duplication
- 3.a.i. A couple had got a female with retarded sexual development, sterile, short status, webbing of the skin in neck region, cardiovascular abnormalities and hearing impair.
(1) What is the defect that is observed?
(2) What technique will be recommend by you to the couple to study the normal condition of the second pregnancy?
- ii. The chromosome arranged in a study was found to be $2n-1$. Identify the type of mutation and add on the explanation.
- b. Which among the following is Transversion?
(A) A to G (B) C to T
(C) C to G (D) C to U
- c. The exchange of chromosome segment between homologous chromosome is called as
(A) Inversion (B) Simple translocation
(C) Reciprocal translocation (D) Crossing over

- 4.a.i. *E.coli* with the character amp^- is identified. What experiment will be performed to identify the location of the mutant gene amp^- with respect to time of entry to the recipient cell? As a result, the following chart is determined

Hfr A	bio	glu	amp	cys	try
Hfr B	xyl	met	try	cys	amp
Hfr C	amp	cys	try	met	xyl
Hfr D	xyl	thr	lac	bio	glu
Hfr E	amp	glu	bio	lac	Thr

Indicate the relative location of each gene, the position where F factor is integrated in each of the Hfr and also the direction of chromosome transfer.

- ii. To understand the order of two mutant gene $his\ 1$ and $his\ 2$ in $his\ A$ gene in *E.coli* reciprocal three point cross was used. The $his\ A$ gene is relatively linked to $thr\ A$ gene in *E.coli*. In each cross amp^+ recombinant were selected on minimal medium containing threonine but no histidine and then test for thr^+ or thr^- by replica plating onto plates containing no threonine. The results were obtained as

Donor	Recipient	thr allele in his^+ recombinant	Percent thr^+
$thr^+ his\ 1$	$thr^- his\ 2$	320 thr^+ : 370 thr^-	50
$thr^+ his\ 2$	$thr^- his\ 2$	30 thr^+ : 280 thr^-	17

What is the order of $his1$ and $his1$ relative to outside marker thr ?

- b. Merozygotes can be _____
(A) Heterogenotics (B) Homogenotics
(C) Both heterogenotics and (D) Homozygous homogenotics
- c. Merozygotes are
(A) Haploids (B) Diploids
(C) Partial diploids (D) Triploids
- 5.a.i. A man and woman both having normal colour vision had 3 children, including male with colour blind. The incident of colour blind male in the population from which this couple came is 0.40 which is high for x-linked colour blindness. If the colour blind males marries a female with normal vision, what is the chance that their first child will be colour blind?
- ii. In a population only the "A" and "B" allele are present in the ABO system; there are no individuals with type 'O' blood or with allele 'O'. If 200 people have type A blood, 75 have type AB blood and 25 have type B blood. What are the allelic frequency of this population?
- b. A genes has three alleles A_1 , A_2 , A_3 . The frequency of A_1 and A_2 is 0.4 and 0.2 respectively. What is the frequency of A_2A_3 heterozygotes?
(A) 0.16 (B) 0.32
(C) 0.04 (D) 0.14
- c. The frequency of an allele in a large randomly mating population is 0.2 what is the frequency of heterozygous carrier.
(A) 0.25 (B) 0.2
(C) 0.35 (D) 0.32