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# BRAINWARE UNIVERSITY

Term End Examination 2023

Programme – B.Sc.(BT)-Hons-2018/B.Sc.(BT)-Hons-2019/B.Sc.(BT)-Hons-2020

Course Name – Bio-mathematics/Bio-Mathematics

Course Code - BBT504C2/BBTD502C

( Semester V )

Full Marks : 60

Time : 2:30 Hours

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

### Group-A

(Multiple Choice Type Question)

1 x 15=15

1. Choose the correct alternative from the following :

- (i) Identify the following has been criticized as a pessimistic theory?
  - a) Lotka-Volterra Model
  - b) Gompertz theory
  - c) Malthusian Theory
  - d) Evolution theory
- (ii) Identify the blank For a population, the intrinsic rate of increase is the .....per capita growth rate.
  - a) Minimum
  - b) Maximum
  - c) Average
  - d) None of them
- (iii) Define carrying capacity ?
  - a) total number of individuals
  - b) maximum number of individuals a population can intake
  - c) minimum number of individuals a population can intake
  - d) None of them
- (iv) Explain If  $dH/dt = rH - pH$  is the prey equation in Lotka-Volterra model (H= prey population, P = predator population), what does 'r' mean?
  - a) The proportion of predator encounters
  - b) Death rate of prey
  - c) Carrying capacity of the habitat
  - d) Biotic potential of prey
- (v) Trace that, In the Michaelis–Menten enzyme kinetics model, enzyme reactions are not influenced by .....
  - a) Product concentration
  - b) Substrate concentration
  - c) enzyme concentration
  - d) both product and enzyme concentration
- (vi) Infer the derive process of the Michaelis-Menten equation, which one of the following is used?
  - a) Laws of mass action
  - b) Geometric progression
  - c) Arithmetic progression
  - d) none of them
- (vii) Establish that An epidemic that becomes unusually widespread and even global in its reach is referred to as a .....

- a) Pandemic  
c) Endemic
- b) Epidemic  
d) Exodemic
- (viii) Examine Which of the following is a steady-state for S-I epidemic model? ( $p$  = relative recovery rate,  $N$  = total population)
- a)  $S=0, I=N$   
c)  $S=p$
- b)  $S=N, I=0$   
d)  $I=0$
- (ix) Complete the sentence "S-I-R model was proposed by ..."
- a) Kermack and McKendrick  
c) Watson and Crick
- b) Mathew and Perry  
d) Clerk and Subhramaniam
- (x) Explain The geometric growth equation is .....
- a)  $N_t = \lambda N_{t-1}$   
c)  $N_{t-1} = \lambda N_t + 1$
- b)  $N_t = \lambda N_t + 1$ .  
d)  $N_t = \lambda N_t$
- (xi) Select which one of the following is an assumption of Monod equation?
- a) Nutrient depletion occurs continuously as a result of reproduction  
c) There should not be any growth-limiting nutrient
- b) Growth chamber should be cleaned  
d) Flow of air should be considered in the model
- (xii) Conclude the Monod function:
- a) Monotonically increasing with no limit  
c) Monotonically decreasing with no limit
- b) Monotonically increasing with specific limit  
d) Monotonically decreasing with specific limit
- (xiii) Measure the next number: 8, 12, 18, 27, .... ?
- a) 36  
c) 40.5
- b) 38.5  
d) 42
- (xiv) Infer the logic In a close system bioreactor. There is
- a) No exchange of energy  
c) No exchange of concentration
- b) No exchange of mass  
d) None of them
- (xv) Originate the mean infection period of a certain disease is 14 days, what will be the removal rate?
- a) 0.7 days<sup>-1</sup>  
c) 0.3 week<sup>-1</sup>
- b) 0.07 days<sup>-1</sup>  
d) 0.1 week<sup>-1</sup>

### Group-B

(Short Answer Type Questions)

3 x 5=15

2. Define SIR Disease model with and example? (3)
3. Give an example of a epidemic disease and calculate the disease model with the classical equation of SIR model? (3)
4. Modify the equation of SIR model and differentiate it with three individual parameter of susceptible, infections and Recovery or removed as differential equation (3)
5. Originate the factorial value of  $13!/9!$ ? (3)
- OR
6. Propose the Hardy weinberg Principle and prepare the equation? (3)
6. illustrate the Age Structure Model? (3)
- OR
- Examine, how do you think  $s(t)$  should vary with time? How should  $r(t)$  vary with time? (3)
- How should  $i(t)$  vary with time? (3)

### Group-C

(Long Answer Type Questions)

7. Justify the Beverton Holt model and explain the curve? (5)

8. Define Stage structure Model in a population with distinct growth. (5)
9. Define Spatial models and mention its types with definition and diagram. (5)
10. Differentiate between SIR Model and SIS model ? (5)
11. Compare the dynamic system modelling to an outbreak of Spruce Budworm population. (5)

**OR**

- Conclude the prey predator theory and Justify R in Lotka Volterra Model? (5)
12. Determine Covid disease as an Epidemic model and give a diagrammatic view of this. (5)

**OR**

- Examine coronavirus disease mathematically with the Ordinary Differential Equation (ODE) and Fraction Differential Equation? (5)

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