⑥   Your Roll No. 2019

Sr. No. of Question Paper : 7366   J

Unique Paper Code   : 32491501

Name of the Paper   : Concepts in Genetics

Name of the Course   : **B.Sc. (Hons) Biochemistry**

Semester   : V

Duration : 3 Hours   Maximum Marks : 75

Instructions for Candidates

1.   Write your Roll No. on the top immediately on receipt of this question paper.

2.   Attempt **five** questions in all.

3.   Question No. **1** is compulsory.

4.   Use of scientific calculator/log tables may be allowed.

1.   (a) Mention the term that best describes the following :

         (i) Autosomal traits expressed in one gender only.

         (ii) A test used to determine whether two mutations occur at the same locus or at different loci.

P.T.O.

(iii) Region of homology between X and Y chromosomes.

(iv) An individual in a family having a trait or disease from whom a pedigree is constructed.

(v) A chromosome inversion that does not include the centromere in the inverted region.

(vi) A gene that influences many phenotypes.

(vii) An individual possessing two different alleles at a locus.

(viii) Cell having genetically dissimilar organelles within its cytoplasm.

(ix) Organism having two copies of a gene occasionally in an otherwise haploid genome. $(1 \times 9 = 9)$

(b) Discuss the application of the following in genetics (any four) :

(i) Genetic marker

(ii) Molecular clock

     (iii) Somatic cell hybridization

     (iv) Karyotyping

     (v) Tetrad analysis   (2×4=8)

(c) An organism has 20 chromosomes in its somatic cell. How many chromosomes will it have in following conditions?

     (i) Monosomy

     (ii) Autotriploidy   (1×2=2)

2. Differentiate the following :

     (i) Physical map and genetic map

     (ii) Allopatric and Sympatric speciation

     (iii) Specialised and Generalised Transduction

     (iv) Maternal effect and Maternal inheritance
                                    (3.5×4)

3. (a) In *Drosophila melanogaster*, forked bristles are caused by an allele (X^f) that is X linked and recessive to an allele for normal bristles (X^+). Brown eyes are caused by an allele (b) that is

autosomal and recessive to an allele for red eyes (b^+). A female fly that is homozygous for normal bristles and red eyes mates with a male fly that has forked bristles and brown eyes. The F1 are intercrossed to produce the F2. Elucidate genotypes, phenotypes and the respective proportions in F2 generation of this cross.   (4)

(b) Explain the mechanism of dosage compensation in humans. How does it differ from *Drosophila*?

(6)

(c) Name the disorders associated with the following karyotype :

   (i) 47, +13

   (ii) 47, +18

   (iii) 45, X

   (iv) 46, 5p-   (1×4=4)

4. Write short notes on (any four) :

(a) Tri-nucleotide repeat expansion diseases

(b) Multiple alleles

(c) Homeotic genes of *Arabidopsis*

(d) Robertsonian translocation

(e) Factors contributing to genetic variation

<div align="right">(3.5×4)</div>

5. (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 test cross:

ch --- b^+ --- cn ------------------→ 105

ch^+ --- b^+ --- cn^+ ---------------→ 750

ch^+ --- b --- cn -------------------→ 40

ch^+ --- b^+ --- cn -----------------→ 4

ch --- b --- cn ---------------------→ 753

ch --- b^+ --- cn^+ -----------------→ 41

ch^+ --- b --- cn^+ -----------------→ 102

ch --- b --- cn^+ -------------------→ 5

<div align="right">P.T.O.</div>

(i) Determine the linear order of the genes on the chromosome.

(ii) Calculate the genetic distances between the three loci.

(iii) Determine the coefficient of coincidence and the interference for these three loci.

(2,3,2)

(b) Phenylketonuria, a metabolic disease in humans, is caused by an autosomal recessive allele. If two heterozygous carriers marry and plan a family of five children, what is the probability that atleast three children will be unaffected? (5)

(c) Give reasons for Mendel's success in genetic crosses with pea plant. (20)

6. (a) What is epistasis? Explain with a suitable example giving reasons for the modified dihybrid phenotypic ratio. (5)

(b) Explain how Benzer used complementation test to determine the structure of rII locus of T4 bacteriophage. (5)

(c) How does bacterial conjugation result in recombination? Briefly explain the origin of F strain. (4)

7.   (a) Discuss the role of segmentation genes in *Drosophila* development giving examples for each class.   (6)

      (b) State Hardy Weinberg law. Calculate allelic, genotypic and phenotypic frequencies in a population of 20,000 individuals in which 50 individuals are detected positive for a recessive disorder, Tay-Sachs disease.   (5)

      (c) Give contributions of the following scientists :

          (i) Alfred Sturtevant

          (ii) Zinder and Lederberg

          (iii) Sutton and Boveri   ($1 \times 3 = 3$)

8.   (a) Explain with diagram how chromosomal inversion suppresses the recovery of cross over products.   (5)

      (b) The genes A, B, G, H, I and T are tested in all possible pairs for co transduction with phage P1. Only the following pairs were found to co-transduce :

        G and H; G and I; T and A; I and B; A and H

        What is the order of the genes along the chromosome?   (2)

(c) The following pedigree has been provided to you. Answer the following questions :
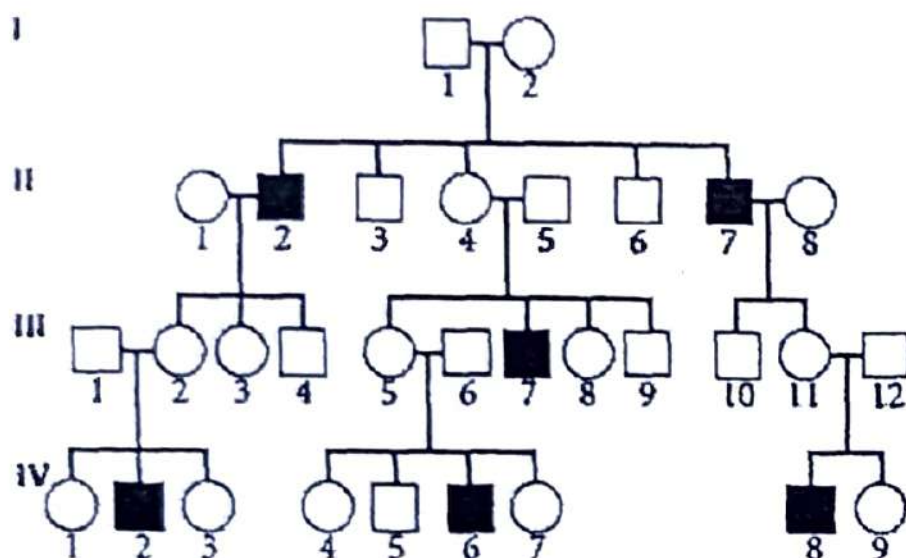
(i) What is the most likely mode of inheritance of the trait and why?

(ii) Mention carrier individuals, if any in the pedigree.

(iii) What factors complicate the analysis of inheritance patterns of genetic traits in humans?   (3,2,2)

⑦

Sr. No. of Question Paper : **7367** J

Unique Paper Code : 32491502

Name of the Paper : Gene Expression and Regulation

Name of the Course : **B.Sc. (H) Biochemistry**

Semester : V

Duration : 3 Hours   Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.

2. Answer **five** questions in all including Question No. **1,** which is compulsory.

1. (a) Comment on the following :

    (i) The ribosome is able to differentiate between initiator and internal methionine in prokaryotes though methionine has single codon.

(ii) The leucyl-tRNA synthetase has a proof reading function that ensures the fidelity of the aminoacyl reaction, but histidine t RNA synthetase lacks such proof reading activity.

(iii) Class II Promoters are different than class I promoters in eukaryotes.

(iv) Genetic code is universal and degenerate.

(v) Cooperative binding of repressor molecule to its operator site is physiologically significant for gene regulation.

(vi) Poly A Polymerase function differs from DNA dependent RNA polymerase.

(b) Define the following :

(i) Transcriptome

(ii) Insulators

(iii) Operator

(iv) Polyribosomes

(v) Promoter escape

(c) What is the sequence of the template and coding strands of the DNA that encodes the RNA sequence given below

5'-GGCAUGCAUUACGGCAUCACACUAGGGAUC-3'   (12,5,2)

2. (a) Explain with example how one gene can be under positive as well as negative regulation.

(b) How is lysogeny in lambda phage established and maintained?

(c) Write down mode of inhibition by the following :

(i) α-Amanitin

(ii) Puromycin

(iii) Cycloheximide

(iv) Tetracycline   (5,5,4)

3. Explain the following in detail :

    (i) Autoregulation of ribosomal protein synthesis.

    (ii) Eukaryotic transcription initiation is more complex than prokaryotic transcription initiation.

    (iii) Polyadenylation of mRNA.   (5,5,4)

4. (a) Explain how sigma factor regulates gene expression.

    (b) Describe regulation of transcription of tryptophan operon by intrinsic terminator sequence.

    (c) Justify the statement that gene silencing is mediated by deacetylation and Methylation.

                                     (5,5,4)

5. (a) Give the mechanism of alternate splicing with one example.

    (b) Describe key experiment to prove the triplet nature of the genetic code.

(c) SR proteins interact with pre mRNA to ensure selection of correct splice site. Comment.

(5,5,4)

6. Justify the following :

(i) Yeast galactose operon is regulated by both activation and repression.

(ii) Eukaryotic translation initiation is more complex than prokaryotes.

(iii) Si RNA mediates gene regulation through RISC complex. (5,5,4)

7. (a) Outline the steps of the ubiquitin mediated protein degradation pathway in eukaryotic cells.

(b) Describe the processing of primary transcript of tRNA.

(c) Diagramatically explain elongation phase of protein translation. (5,5,4)

P.T.O.

8.   Write short notes on the following : (5, 5, 4)

     (i)   Wobble hypothesis

     (ii)   Exon shuffling

     (iii)   Spliceosome assembly

[This question paper contains 4 printed pages]

Your Roll No. : ...2019...

Sl. No. of Q. Paper : **7860** **J**

Unique Paper Code : 32497908

Name of the Course : **B.Sc.(Hons.) Biochemistry : DSE - 1**

Name of the Paper : Basic Microbiology

Semester : V

Time : 3 Hours **Maximum Marks : 75**

Instructions for candidates :

(a) Write your Roll No. on the top immediately on receipt of this question paper.

(b) Attempt **five** questions in all, including Question **NO.1** which is compulsory.

1. (a) Define : 1×9=9

    (i) Algal Reefs

    (ii) Dikaryon

    (iii) Heterothallism

    (iv) Virions

    (v) Endospore

    (vi) Pyrenoid

P.T.O.

(vii) Protomer

(viii) Alpanospores

(ix) Prions

(b) Give the contribution of following scientists :

2×5=10

(i) Carl Woes

(ii) Robert Koch

(iii) R. H. Whittaker

(iv) Alexander Fleming

(v) Elie Metchnikoff

2. Differentiate between :

3.5×4=14

(a) Rickettsia and Chlamydia

(b) Sexual cycle and Parasexual cycle in fungus

(c) Lytic and Lysogenic life cycle of temperate phage

(d) Rhodophycea and Phaeophycea

3. (a) Describe the one step growth curve of bacteriophage.

5

(b) Give the applications of microbiology.

5

(c) Discuss the various types of assexual spores of fungi.

4

4. (a) Explain with the help of diagram the life cycle of Basidiomycetes. 5

(b) What is meant by pure culture ? Does it exist in natural environment ? Explain. 4

(c) Mention the attributes Euglena shared with plants and animals. 3

(b) Comment on morphology of bacteria with examples. 2

5. (a) Give **one word** for the following : 1×6=6

(i) Red body present near the anterior end of motile algae

(ii) Specialized flat hyphae formed when in contact with suitable host's plant cell

(iii) Opening through which food is ingested in protozoa

(iv) Bacteria living in high salt conditions

(v) Proteinaeous structure in algae

(vi) Compact mass of hyphae that can survive the winter

(b) Explain Baltimore classification of viruses with examples. 6

(c) Give the name of disease caused by :   2

    (i) Rickettsia

    (ii) *Claviceps purpurea*

6. (a) Discuss briefly the various characteristic features of protozoa.   5

   (b) Explain the life cycle of HIV virus.   5

   (c) Give the application of algae in the field of agriculture, industry, environment and food.

    4

7. (a) "Microorganisms are diverse with respect to their morphology and distribution" explain.

    4

   (b) Write an application of fungus in the field of mycotoxin, industry, food and agriculture.

    4

   (c) How is poxvirus different from poliovirus.

    6

8. Write short notes on :

   (a) Symbiotic associations   5

   (b) Economic importance of Bacteria   5

   (c) Reproduction in protozoa   4

(9)

[This question paper contains 4 printed pages]

Your Roll No. : ...2019...........

Sl. No. of Q. Paper : **7996**   **J**

Unique Paper Code : 32497903

Name of the Course : **B.Sc.(Hons.) Biochemistry : DSE - 2**

Name of the Paper : Molecular Basis of Non - Infectious Diseases

Semester : V

Time : 3 Hours   **Maximum Marks : 75**

Instructions for candidates :

(a) Write your Roll No. on the top immediately on receipt of this question paper.

(b) Attempt **five** questions in all, including Question **NO.1** which is compulsory.

1. (a) Justify the following statements :   2×7=14

   (i) Angiogenesis favours a cancer cell to become malignant

   (ii) Oxidized LDL is highly atherogenic

   (iii) Insulin resistance is commonly seen in PCOS

   (iv) Viruses can cause cancer

P.T.O.

    (v) Increased waist circumference is associated with Type-2 Diabetes mellitus

    (vi) Anemia can cause hypoxia without ischemia

    (vii) Vitamin B12 deficiency is common in vegans

(b) Identify the following (any **five**) :

$1 \times 5 = 5$

    (i) A motor neuron disease

    (ii) A disease due to lack of dopamine

    (iii) A disease due to growth factor receptor defect

    (iv) Disease due to defective lipoprotein receptor

    (v) A non standard amino acid that is biomarker for CVD

    (vi) A disease transmitted by ritual cannibalism

2. (a) An eight month old infant is admitted with a history of wheezing, coughing and recurrent respiratory infections. The chloride content was found to be high in the sweat. What is the most probable diagnosis ? Discuss the biochemical basis and the management of the diagnosed condition.

6

(b) Discuss the mechanism of hormonal carcinogenesis with suitable examples.

4

(c) What are the most common causes of Dementia ? 4

3. (a) Differentiate between : 2.5×4=10

    (i) Anorexia and Bullimia

    (ii) Hypertrophic and Hyperplastic obesity

    (iii) Anorexia nervosa and Bullemia

    (iv) Osteoporosis and Osteomalacia

(b) Type-2 Diabetes mellitus predisposes to cardiovascular diseases. Explain. 4

4. (a) What are the causes of hypertension ? Discuss the implications of essential hypertension on CVD. 5

(b) Discuss with two examples how oncogenes result in uncontrolled proliferation of cells.

6

(c) PCOS is an endocrine disorder. Explain.

3

5. Explain the use of the following drugs with their mechanism of action (any **seven**) :

2×7=14

    (i) Diuretics

    (ii) Herceptin

    (iii) Tamoxifen

    (iv) ACE inhibitors

    (v) Metaformin

    (vi) Gleevec

    (vii) L-DOPA

    (viii) Statins

6. Discuss the causes of the following diseases, their main symptoms and the abnormal products that accumulate.　　3.5×4=14

   (i) Sickle cell anemia

   (ii) Phenylketonuria

   (iii) Maple syrup urine disease

   (iv) Huntington's disease

7. (a) Discuss the molecular basis of Alzheimer's disease. What are the symptoms associated with the late stage of progression of disease ?

   　　5

   (b) What is the function of the ubiquitin proteasome pathway ? What are the consequences of a malfunction in this pathway ?　　5

   (c) Discuss the stages of cancer development.

   　　4

8. Write short notes on the following :

   　　3.5×4=14

   (a) Clotting disorders

   (b) Parkinson's disease

   (c) Atherosclerosis

   (d) Protein energy malnutrition