10/5/B

~~SET A~~

Sl- NO. 00 Q.P.: 6255

Unique Paper code	:	2491601
Name of the Paper	:	DC 1.14 / Concepts of Genetics
Name of the Course	:	B. Sc (Hons) / Biochemistry
Semester	:	Semester VI
Duration	:	3 Hours
Maximum Marks	:	75

Instructions for Candidates

Attempt five questions in all. Question No. 1 is compulsory.

Use of scientific calculator / log tables may be allowed.

2018
Concepts in Genetics

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

a) A gene that has multiple phenotypic effects.
b) Donor bacteria with high frequency of recombination.
c) Heterozygote at an advantage over both homozygotes.
d) Non-coding RNA involved in dosage compensation in mammals.
e) Region of homology between X & Y chromosomes.
f) An affected individual who first brings attention for pedigree analysis.

(1 x 6 = 6)

(B) Match the following:

a)	T.H. Morgan	(i)	Natural Selection
b)	Mary Lyon	(ii)	Sex linked Inheritance
c)	H. Nilsson-Ehle	(iii)	Microbial genetics
d)	Joshua Lederberg	(iv)	Barr Body
e)	Alfred Wallace	(vi)	Quantitative inheritance

(1 x 5 = 5)

(C) Define the following (*any four*)

a) Trisomy
b) Codominance
c) Linkage
d) Karyotype
e) Consanguinity

(2 x 4 = 8)

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

(3)

(B) Explain epistasis giving two suitable examples.

(3)

(C) Discuss the applications of the following in genetics giving suitable examples:

(a) Genetic markers
(b) Molecular clocks
(d) Test cross
(e) Tetrad analysis

(2 x 4 = 8)

3(A) Differentiate between:

(a) Specialized and Generalized transduction.
(b) Maternal effect and Maternal Inheritance.
(c) Autopolyploidy and Allopolyploidy
(e) Allopatric and Sympatric speciation

(3 x 4 = 12)

(B) A man and woman are heterozygous for a gene and if they have four children, what is the chance that all four will also be heterozygous?

(2)

4.(A) The genetic map distance measured over a long interval of chromosome is generally underestimated. Explain why?

(3)

(B) Give two examples of extensions of Mendelian inheritance and explain the basis of the observed ratio.

(6)

(C) Explain the inheritance of leaf colouration in *Mirabilis jalapa* (4'O clock) plant.

(5)

5(A) What are homeotic genes? Explain using Drosophila as an example.

(3)

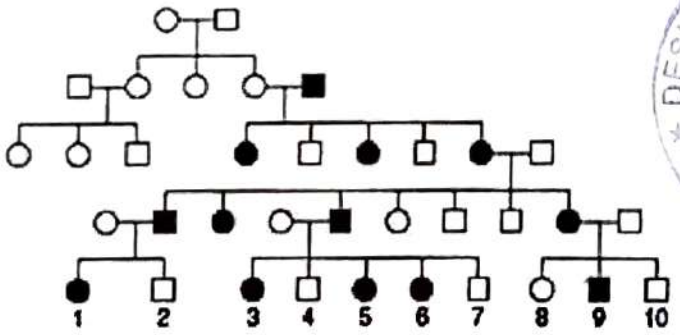
(B) Explain the basis of non-disjunction as a proof for chromosomal theory of inheritance.

(5)

(C) Explain the basis of sex determination in *Drosophila*. How does it differ from humans?

(6)

6(A) Propose the most likely mode of inheritance for the following pedigree. Justify your choice.



(4)

(B) State Hardy Weinberg law. What are the assumptions underlying Hardy Weinberg equilibrium.

(5)

(C) Explain somatic cell hybridisation and state its applications:

(5)

7(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

(a) Determine the order of these genes.

(b) Construct the genetic map.

(2,3)

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

(6)

(C) What is phenocopy? Explain giving suitable example.

(3)

8. Write short notes on (*any four*):

(a) Familial Down's Syndrome
(b) Genomic Imprinting
(c) Complementation test
(d) *Arabidopsis* as a model organism
(e) Lethal Genes

(3.5 x 4 = 14)

15/5/18

~~SET A~~

Sl- NO. 07 Gf 6256

Unique paper code	:	2491602
Name of paper	:	Immunology
Name of the course	:	B.Sc. (Hons.) Biochemistry
Semester	:	VI
Duration	:	3 hours
Maximum Marks	:	75

Instructions for candidates

Write your roll no. on top immediately on receipt of this question paper.
Attempt five questions in all.
Question No. 1 is compulsory.

1A. Write true or false for the following statements. If false, give the correct answer.

a. Hen egg albumin is a better immunogen for chicken than for goat.
b. When anti bovine gamma globulin monoclonal antibodies from Balb\c mice are injected into another Balb\c mice, idiotypic antibodies are produced.
c. IgG functions more effectively than IgM in bacterial agglutination.
d. Transfer of antibodies to an individual generates active immunity.
e. UV killed viral preparation will not activate T cytotoxic cells.
f. IgM is the first immunoglobulin produced in a primary immune response to an antigen.
g. VH is twice the length of VL.
h. Factor H binds to C5b67 and inhibits the complement pathway.
i. A graft transferred between different species is isograft.
j. Fixed macrophages found in the kidney are called Kupffer cells.

(1x10=10)

B. Fill in the blanks

a. Skin secretes ----------, an antimicrobial protein that kills *E. coli.*
b. --------- are substances that when mixed with an antigen and injected with it help to enhance the immunogenicity of the antigen.
c. A congenital birth defect in which NK cells are absent is called ----------.
d. Mechanisms that permit Immunoglobulins to be synthesized either as membrane bound or secreted form are called----------.
e. ---------cells express CD 8.
f. Toll like receptors have an exterior region that contains many -------- repeats.
g. The strength of multiple interactions between a multivalent antibody and antigen is called----------.
h. ---------- tumor cell lines are unable to express Class I MHC molecules.
i. Somatic hypermutation is targeted to the ---------- region of antibody.
j. --------- class of antibody can cross the placenta.

(5)

C. Give one significant contribution of each of the following Scientists:

a. Jules Bordet
b.. W. Dreyer & J. Bennett
c. Rodney R. Porter & Gerald M. Edelmann
d. Ishizaka

(4)

2A. Define antigen and immunogen. What properties a molecule should have to act as an immunogen?

(4)

B. Explain the steps of inflammation and how it helps to overcome infection?

(4)

C. Describe the structure of Thymus and explain the two step selection process that thymocytes undergo in the thymus.

(6)

3A. Explain the formation of MAC complex by the complement pathways using flow chart and explain the alternate pathway for activation of complement.

(7)

B. The epithelial cells of mucous membrane lining the gastrointestinal tract have certain specialized cells called M cells. Explain their structure & function.

(3)

C. Explain the sequence of events that occur in the development of type III hypersensitive reaction.

(4)

4A. What are recombination signal sequences (RSS)? What is their function in gene rearrangement of antibodies?

(6)

B. What are the consequences of differential RNA processing of heavy chain primary transcript?

(4)

C. Define the terms pleiotropy, synergy, redundancy and antagonism with respect to cytokine action.

(4)

5A. What is the role of interleukin 2, perforins and Fas ligand in cell mediated immunity?

(7)

B. What do you understand by Antibody dependent cell mediated cytotoxicity?

(4)

C. Describe the mechanism of action of commonly used immunosuppresive drugs, azathioprine, cyclosporine and FK 506.

(3)

6A. What is the function of bone marrow stromal cells in the maturation of B cells?

(4)

B. Draw the structure of TCR CD3 complex. What is the function of CD3 complex?

(4)

C. Explain the structure of immunoglobulin G and function of its various domains.

(6)

7A. Discuss in detail how endogenous antigens are processed in the cytosolic pathway?

(5)

B. Explain the structure of Class I MHC molecules.

(4)

C. Explain the alternate pathway of complement activation.

(5)

8. Write short notes on the following

a. Grave's Disease
b. DNA Vaccines
c Oxidative burst in macrophages
d PAMP

(3.5x4)

(1)

[This question paper contains 4 printed pages.] 10/5/18

Your Roll No.....

Sr. No. of Question Paper : 6435 **HC**

Unique Paper Code : 32491601

Name of the Paper : Genetic Engineering and Biotechnology

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

Semester : VI

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.

1. (a) Comment on the following statements.

   (i) M13 based vectors are suitable for DNA sequencing.

   (ii) *E.coli* strains used as hosts for recombinant DNA technology are devoid of restriction systems.

   (iii) Taq DNA polymerase may not be the best enzyme for PCR.

   (iv) Adapters are different from Linkers.

P.T.O.

(v) It is better to use an expression vector with an inducible promoter rather than a strong promoter.

(vi) $CaCl_2$ treatment is given to *E. coli* cells before transformation.

(b) Write the application of the following enzymes :

(i) Reverse Transcriptase

(ii) Terminal transferase

(iii) Polynucleotide Kinase

(iv) Bal31

(v) RNase H (9,10)

2. (a) Differentiate between :

(i) Cosmid and Phagemid

(ii) PCR and Reverse transcriptase PCR

(iii) Cointegrate and Binary vector of Ti plasmid

(b) Compare and contrast the various plasmid vectors used in yeast. (3,3,2,6)

3. (a) What are the parameters kept in mind while designing primers for PCR?

(b) How can PCR be used for :

(i) Site directed mutagenesis

(ii) Gene Amplification

(c) Describe the principle of blue-white selection for screening of recombinant clones. (5,6,3)

4. (a) Draw the slab gel profile of the DNA fragment whose sequence by the Sanger's dideoxy method has been found to be 5'- TAC TGG TTA TTT ACC TCC GAG-3'. Also draw the slab gel profile of its complementary strand.

(b) Which restriction modification system is preferred in genetic engineering? Explain why?

(c) Explain Real time PCR in detail. (5,5,4)

5. (a) Explain the procedure of pyrosequencing. How it is more sensitive than Sanger's dideoxy method?

(b) Justify why recombinant factor VIII gene of eukaryotes could not be expressed in prokaryotes while insulin can?

(c) Name any two fusion tags used in expression vectors and how they help in purification of recombinant proteins. (5,4,5)

6. (a) What is gene therapy? Explain with the help of a suitable example.

(b) Discuss the unique features of Ti plasmid used for transformation of plant cells.

(c) Discuss two sequence independent methods of screening recombinant clones. (5,5,4)

7. (a) Diagrammatically explain different steps of cDNA synthesis for library preparation.

(b) Discuss two methods of gene transfer in animal cells.

(c) A linear DNA is digested with *EcoR*I and *Hind*III separately and then in combination. The following fragments are observed on the gel. Use this information to draw a restriction map

*EcoR*I	8.5Kb	5.0Kb	3.0Kb		
*Hind*III	9.5Kb	6.0Kb	1.0Kb		
*EcoR*I and *Hind*III	6.0Kb	4.0Kb	3.0Kb	2.5Kb	1.0Kb

(5,5,4)

8. Write down short notes on the following :

(a) Oligonucleotide synthesis

(b) Sanger's DNA Sequencing method

(c) Protein Engineering (4,5,5)

(2)

[This question paper contains 6 printed pages.]

2018

Your Roll No.....

Sr. No. of Question Paper : 6436 **HC**

Unique Paper Code : 32491602

Name of the Paper : Immunology

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

Semester : VI

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, including Question No. **1** which is compulsory.

1. (a) Indicate whether each of the following statements is true or false. Provide the correct answer if false.

(i) Monoclonal antibodies can precipitate protein antigens more effectively than polysaccharides.

(ii) Colostrum is rich in IgG.

(iii) A DNA vaccine only induces a response to a single epitope.

P.T.O.

(iv) All immunoglobin molecules on the surface of a given B cell have the same idiotype.

(v) Interaction of B7 with CTLA-4 leads to activation of T cells.

(vi) Antihistamines are effective for the treatment of delayed type hypersensitivity reactions.

(vii) Human skin is resistant to colonization by *E.coli* despite constant exposure to it.

(viii) Nucleated cells tend to be more resistant to complement mediated lysis than RBCs.

(ix) Mast cells express receptors for IgA on their membranes.

(x) RBCs express MHC class I molecules on their membranes. (10)

(b) Name the following :

(i) A cell surface molecule that initiates respiratory burst.

(ii) A cellular component of the immune system that is impaired in old age.

(iii) A molecule expressed on T cells but absent on Macrophages & B cells.

(iv) An acute phase protein.

(v) Specialised macrophages found in brain.

(vi) A cytokine that is an endogenous pyrogen.

(vii) Scientist who gave the role of phagocytosis & antitoxins in immunity.

(viii) Cells that can reconstitute the entire immune system, if all of an animals immune system is destroyed.

(ix) The first immune cells that extravasate to the site of infection. (9)

2. (a) Give an overview of induction of immune response, showing co-ordination between Innate and Adaptive immunity. (**Only Flow Chart depicting each step**)

(b) Discuss briefly how Tc cells result in the destruction of target cells (calcium dependent manner).

(c) Draw a neat well labelled diagram of IgG. (6,5,3)

3. (a) Mention different pathways responsible for the activation of complement. Explain any one pathway that results in the formation of membrane attack complex. Discuss key activators and major activities generated.

(b) Draw a neat well labelled diagram of Lymph node depicting the location of different immune cells.

(c) Discuss briefly all the characteristics for an antigen to be immunogenic. (6,4,4)

4. (a) Discuss briefly T cell development and differentiation.

(b) Discuss briefly clinical manifestations of graft rejection.

(c) Discuss antigen independent phase of B Cell development. (5,5,4)

5. Differentiate between: **(Any four)**

(i) Primary immune response and secondary immune response

(ii) T dependent antigens and T independent antigens

(iii) B cell epitope and T cell epitope

(iv) MHC-I and MHC II

(v) Active immunization and passive immunization

(3×5×4)

6. (a) Explain the pathway for presentation of antigen by virus infected cells to T lymphocytes.

(b) Mention the mechanisms used for generation of antibody diversity. Explain any three.

(c) Dendritic cell is the most potent antigen presenting cell. Discuss briefly. (6,5,3)

7. (a) Discuss briefly the sequence of events involved in the development of allergic reactions. Mention its clinical manifestations.

(b) Mention autoantigens, major effectors and the associated symptoms for the following diseases:

(i) Myasthenia gravis

(ii) Type I diabetes mellitus

(iii) SLE

(c) Define PAMPs and PRRs. (6,6,2)

8. Write short notes on: **(Any four)**

(i) Erythroblastosis fetalis

(ii) Adjuvants

(iii) Natural killer cells

(iv) Inflammation

(v) DNA vaccine

(vi) TLR4 (3.5×4)

(3)

[This question paper contains 6 printed pages.] 14/5/18

Your Roll No.....

Sr. No. of Question Paper : 9405A **HC**

Unique Paper Code : 32497904

Name of the Paper : Molecular Basis of Infectious Diseases

Name of the Course : **B.Sc. (Hons) Biochemistry : DSE–4**

Semester : VI

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 including Q. No. **1** which is compulsory.

1. (a) Define the following :

(i) Vector

(ii) Zoonosis

(iii) Viremia

(iv) Parasitism

(v) Bactericidal

(vi) Antigenic drift

(vii) Viroid

(viii) Epidemic

(ix) Definitive host (1×9)

(b) Give full forms of the following and explain their significance in biology of infectious diseases :

(i) LPS

(ii) AZT

(iii) DPT

(iv) DOTS

(v) PAMPS (2×5)

2. Differentiate between the following :

(a) Endotoxin and exotoxin

(b) Attenuated and recombinant vaccines

(c) Trophozoite and cystic stage

(d) Naked and enveloped virus (3.5×4=14)

3. Schematically outline the following :

(a) Replication of HIV virus

(b) Lifecycle of *Plasmodium vivax*

(c) Action of cholera toxin

(d) Pathogenisis of Candida infection (3.5×4=14)

4. Explain the mechanism behind the following :

(a) Formation of pseudomembrane in Diphtheria patients

(b) Characteristic recurring episodes of chills, fever and sweats in Malarial patients.

(c) Formation of a tubercule and a subsequent granulomas in patients of pulmonary tuberculosis.

(d) HCV mediated hepatocellular carcinoma.

(3.5×4=14)

5. Comment on the following :

(a) Opportunistic infections and malignancies are common in patients of untreated HIV infection

(b) Eosinophilia and high IgE titre are observed during helminthic infections

(c) Researchers have not been able to synthesize effective vaccine against Influenza virus

(d) One of the major concerns today is the development of MDR tuberculosis

(e) Victims of road and field accidents are immediately treated with ATS

(f) Interferons are used in effective antiviral therapy.

(g) Infection and recovery from one serotype of dengue confers lifelong immunity that is serotype specific

(2×7=14)

6. Explain the mechanism of action of following drugs :

(a) Ampicillin

(b) Chloroquin

(c) Acylovarin

(d) Rifampicin

(e) Flucytosin

(f) Piperazine

(g) Tamiflu

(2×7=14)

7. Discuss the symptoms, diagnosis and treatment of the following diseases :

(a) Typhoid

(b) Amebiasis

(c) Rabies

(d) Pertussis

(3.5×4=14)

8. Discuss the following :

(a) Compare and contrast the pathogenesis of HAV and influenza.

(b) Pathogens have developed strategies to evade the host immune response.

(c) Poor inflammatory response to ringworm leads to a chronic infection. (5,5,4)

[This question paper contains 4 printed pages.]

12/5/18

Your Roll No.....

Sr. No. of Question Paper : 9406 **HC**

Unique Paper Code : 32497906

Name of the Paper : Advanced Cell Biology

Name of the Course : **B.Sc. (Hons) Biochemistry : DSE–3**

Semester : VI

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.

1. (a) Give subcellular location and significance of **(any five)** :

   (i) Catalase

   (ii) Glycocalyx

   (iii) Axonemal Dynein

   (iv) Lamins

   (v) Alpha-actinin

   (vi) TOC Complex (2×5=10)

P.T.O.

(b) Give reasons for :

(i) Apical and basolateral domains of an intestinal cell membrane are functionally distinct.

(ii) Cancer patients undergoing chemotherapy often need bone marrow transplantation.

(iii) Inner mitochondrial membrane is analogous to chloroplast thylakoid membrane.

(iv) *Wee1* kinase mutant yeast cells are smaller in size than normal cells. (2,2,2,3)

2. (a) Define the following terms :

(i) Restriction Point

(ii) Proto-oncogene

(iii) Treadmilling

(iv) Karyopherin

(v) Facillitated Diffusion (2×5=10)

(b) List the properties and therapeutic use of embryonic stem cells. How can pluripotency be induced in somatic cells? (4)

3. (a) What does MPF consist of? Describe the three experimental approaches that led to the discovery of MPF. (6)

(b) Illustrate how acid hydrolase enzymes are targeted to lysosomes. (5)

(c) What is kinetochore complex? How does the function of kinetochore complex vary in mitosis versus meiosis I? (3)

4. Differentiate between :

(i) Microfilaments and Intermediate filaments

(ii) SEM and TEM

(iii) Anaphase A and Anaphase B mechanism of chromosome movement

(iv) Gap junctions and Plasmodesmata

(v) Focal adhesion and Adherens Junctions (3,3,3,3,2)

5. (a) Explain the process of cotranslational translocation of proteins into ER. Why are these two processes coupled? (5)

(b) Explain the intrinsic pathway of apoptosis with diagram. List two signals that can initiate this process. (5)

(c) If the number of chromosomes is 20 and the amount of DNA is C in a mammalian gamete, how many chromosomes and what amount of DNA will be present in a somatic cell at :

(i) End of S phase

(ii) End of Cell division (2×2=4)

6. (a) Explain how proteins are targeted to mitochondrial matrix from cytoplasm. (5)

(b) Give the basis of following diseases **(any two)** :

(i) Gaucher's disease

(ii) Zellweger syndrome

(iii) Epidermolysis Bullosa Simplex (2×2=4)

(c) Explain how confocal microscopy gives images of better contrast and detail over conventional fluorescence microscopy. (5)

7. (a) Explain the basis of two regulatory points in the meiosis of vertebrate oocytes. (4)

(b) Explain the structure and function of nuclear pore complex. Draw a well labelled diagram. (5)

(c) What are motor proteins? Explain the correlation between their role in vesicular transport and the direction of movement with examples of each class. (5)

8. Write short notes on the following :

(a) Role of different coat proteins in vesicular transport

(b) FACS

(c) Quality control pathway in ER

(d) Role of integrins in cell-matrix interactions

(3.5×4=14)

(100)