

20/12/24  
[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1069

Unique Paper Code : 2232013501

Name of the Paper : Principles of Immunology

Name of the Course : B.Sc. (H) Zoology (NEP)

Semester : V

Duration : 2 Hours

Maximum Marks : 60

### Instructions for Candidates

1. Write your Roll. No. on the top immediately on receipt of this question paper.
2. Attempt four questions including Question No. 1 which is compulsory.
3. Draw well-labelled diagrams wherever necessary.

1. (i) Define the following terms (Any four): (1×4=4)

(a) Extravasation



- (b) Paratope
- (c) Avidity
- (d) Opsonization
- (e) Anaphylatoxin

(ii) Differentiate between the following: (Any three):  
(2×3=6)

- (a) Primary and Secondary Immune Response
- (b) Innate and Adaptive Immunity
- (c) Exogenous and Endogenous Antigens
- (d) Salk and Sabin Vaccine

(iii) Expand the following: (Any six): (0.5×6=3)

- (a) PAMPs
- (b) MASP
- (c) MAC
- (d) CLIP
- (e) DTH

(f) ADCC

(g) ISCOM

(iv) Write the contribution of the following: (1x2=2)

(a) Elie Metchnikoff

(b) Jules Bordet

2. (i) Draw the basic structure of Immunoglobulin. Compare the structure and functions of IgA and IgM. (8)
- (ii) Explain the experiments on the basis of which Immunoglobulin structure was deduced. (7)
3. (i) Explain the cytosolic pathway for processing of endogenous antigens. (8)
- (ii) What is complement system. Explain Classical pathway of complement activation. (7)
4. (i) Describe Gell and Coomb's classification of hypersensitivity. (8)
- (ii) What are the cardinal features of adaptive immunity. (7)

5. (i) Give an account of different kinds of vaccines. (8)
- (ii) Describe the structure and function of Class I and Class II MHC. (7)
6. Write short notes (Any three): (3x5=15)
- (i) Clonal Selection Theory
- (ii) Properties of Cytokines
- (iii) B cell and T Cell Epitopes
- (iv) Autoimmunity
- (v) Monoclonal Antibodies and their applications

19/12/24  
[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1107

Unique Paper Code : 32232013502

Name of the Paper : Cell and Molecular Biology

Name of the Course : B. Sc. (Hons) Zoology (NEP-UGCF 2022)

Semester : V

Duration : 2 Hours

Maximum Marks : 60

### Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **Four** Questions, including Question No. 1 which is compulsory.
3. Draw neat labelled diagrams wherever necessary.

1. (a) Define the following (**Any Four**) : (4×1=4)

- (i) Yamanaka factors
- (ii) Ribozyme
- (iii) Silencer elements

P.T.O.

(iv) Central Dogma

(v) Split genes

(b) Differentiate between (**Any Three**) :  $(3 \times 2 = 6)$

(i) Euchromatin and Heterochromatin

(ii) Apoptosis and Necrosis

(iii) Activators and Repressors

(iv) Totipotent and Pluripotent Stem cells

(c) Expand the following :  $(0.5 \times 6 = 3)$

(i) CPSF

(ii) CREB

(iii) NELF

(iv) RNP

(v) ORF

(vi) CAP- cAMP

(d) State the reasons :  $(2 \times 1 = 2)$

(i) Why transcription occurs in 5' to 3' direction only?

- (ii) Why primase is required for DNA replication but not for transcription?
2. (a) Discuss the mechanism of DNA replication in a bacterial cell. (10)
- (b) Discuss the salient features of Genetic code. (5)
3. (a) Define Apoptosis and write down its hallmark features. Explain the intrinsic pathway in regulation of apoptosis with the help of suitable examples. (10)
- (b) Design an experiment to prove that DNA replication is semi-conservative. (5)
4. (a) With the help of suitable diagram describe the process of transcription in Eukaryotes. (10)
- (b) Write down the main differences between eukaryotic and prokaryotic translation. (5)
5. (a) What is cell signalling and importance of second messengers? Write the major differences of hormone signalling mechanism of nuclear receptor pathway and cell surface receptor pathway? (10)

- (b) What is end replication problem? Discuss the role of telomerase in replication of 5' end of linear chromosome. (5)

6. Write short notes (**any three**): (3×5=15)

(a) Alternative splicing

(b) Lac Operon

(c) Synthesis of rRNA

(d) RNA editing

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1126

I

Unique Paper Code : 2232013503

Name of the Paper : Fundamentals of Genetics

Name of the Course : B.Sc. (H) Zoology (NEP)

Semester : V

Duration : 2 Hours

Maximum Marks : 60

**Instructions for Candidates**

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any **four** questions, including Question No. 1, which is compulsory.

1. (a) Distinguish between the following (**Any three**)  
(2×3=6)

- (i) Co-dominance and Incomplete dominance
- (ii) Coupling and Repulsion
- (iii) Sex-influenced and sex-limited inheritance
- (iv) Conservative and replicative transposons

P.T.O.

(b) Define the following (**Any three**) (1×3=3)

- (i) Multiple alleles
- (ii) Episome
- (iii) Heterosis
- (iv) Pleiotropy

(c) Give the significant contribution of the following scientists (**Any three**) (1×3=3)

- (i) Alfred Sturtevant
- (ii) William Bateson
- (iii) C B Bridges
- (iv) Barbara McClintock

(d) Give reasons for the following (**Any two**) (1.5×2=3)

- (i) Some XX humans were found to be males and XY humans were found to be females.
- (ii) A cross between pure line sinistrally-coiled shell female *Limnaea* and dextrally coiled shell male *Limnaea* yielded all sinistrally-coiled shell progeny.
- (iii) For a paracentric inversion, with rare exceptions, recombinant chromosomes are not stable and will not lead to viable offspring.

2. (a) What do you understand by gene interactions? Discuss any two types of gene interactions (with suitable examples) that cause deviation from the Mendel's dihybrid ratio. (10)

(b) Explain the sex-linked inheritance with any one example. (5)

3. (a) A female *Drosophila* heterozygous at three loci-  $cu/cu^+$  (curved vs. straight wings),  $e/e^+$  (ebony vs. gray bodies),  $st/st^+$  (scarlet vs. red eyes) was test crossed with completely homozygous recessive males. The following progeny were observed.

|        |       |        |   |     |
|--------|-------|--------|---|-----|
| $cu$   | $e$   | $st^+$ | = | 366 |
| $cu^+$ | $e^+$ | $st$   | = | 380 |
| $cu$   | $e$   | $st$   | = | 24  |
| $cu^+$ | $e^+$ | $st^+$ | = | 30  |
| $cu^+$ | $e$   | $st$   | = | 89  |
| $cu$   | $e^+$ | $st^+$ | = | 105 |
| $cu$   | $e^+$ | $st$   | = | 2   |
| $cu^+$ | $e$   | $st^+$ | = | 4   |

(i) Are the three genes linked? Give reason for your answer.

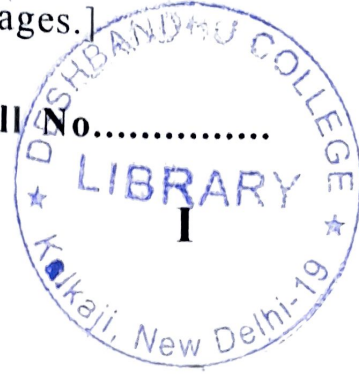
(ii) What is the order of genes?

(iii) Determine the map distance and construct a linkage map.

- (iv) Calculate the coefficient of coincidence and interference. (2+2+3+2=9)
- (b) Explain the cytological basis of crossing over with the help of an experiment. (6)
4. (a) Discuss the molecular basis of spontaneous and induced mutations. Differentiate between aneuploidy and polyploidy with suitable examples. (5+4=9)
- (b) Describe the Ac-Ds elements in maize. Comment on the significance of P elements. (4+2=6)
5. (a) Compare the mechanisms of dosage compensation in humans and *Drosophila*. How many Barr bodies will be observed in the individuals with Klinefelter syndrome and with Patau syndrome? (7+2=9)
- (b) Compare the phenomena of nuclear and extranuclear inheritance. Explain the inheritance of pigmentation in *Ephesia*. (3+3=6)
6. Write short notes on **any three** of the following : (3×5=15)
- (a) ClB method of detection of mutations
- (b) Retrotransposons
- (c) Infective heredity in *Paramecium*
- (d) Penetrance and Expressivity

01/01/2025  
[This question paper contains 4 printed pages.]

Your Roll No.....



Sr. No. of Question Paper : 1265

Unique Paper Code : 2233010013

Name of the Paper : DSE-13, Reproductive Biology  
and Assisted Reproductive  
Techniques

Name of the Course : B.Sc. (H) Zoology, (NEP-  
UGCF)

Semester : V

Duration : 3 Hours

Maximum Marks : 90

**Instructions for Candidates**

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any **five** questions in all including question No. 1, which is compulsory.

1. (a) Define (1×5=5)

- (i) Luteotrophic factors
- (ii) Vasectomy
- (iii) Azoospermia
- (iv) Capacitation Reaction
- (v) Ovulation

P.T.O.

(b) Differentiate between any **five** :  $(2 \times 5 = 10)$

- (i) Secondary and Graffian follicle
- (ii) Mullerian duct and Wolffian duct
- (iii) Adenohypophysis and neurohypophysis
- (iv) Menopause and Menarche
- (v) Follicular phase and luteal phase
- (vi) Acrosome reaction and cortical reaction

(c) Expand the acronyms  $(1 \times 5 = 5)$

- (i) HRE
- (ii) MMP
- (iii) GPCRs
- (iv) ICSI
- (v)  $3\beta$  HSD

(d) Give another name for :  $(1 \times 5 = 5)$

- (i) Chorionic or placental somatomammotropin
- (ii) Dark region around the nipple
- (iii) The white scar tissue formed in the ovary which replaces the corpus luteum
- (iv) Condition caused due to undescended testes
- (v) Hormones released from pituitary that cause the release of other hormones

(e) State whether the following statements are true or false : (1×5=5)

- (i) The GnRH release process is almost invariably pulsatile in all female and male mammals studied
- (ii) Aromatisation of testosterone converts it into  $17\beta$ -estradiol.
- (iii) AMH produced by the fetal Leydig cells causes regression of the Fallopian tubes, uterus and upper portion of the vagina in the male fetus.
- (iv) The SRY gene is located at the long arm of the Y chromosome (Yq53.3).
- (v) Measurement of the fructose content in the semen can provide an index of the secretory activity of the prostate gland.

2. (a) Diagrammatically explain the structure of testis. Add a note on the functions of the various cellular components in the testis. (9)
- (b) Discuss sperm transport and maturation in the male genital tract. (6)

3. (a) Discuss the two cell hypothesis of estrogen biosynthesis in females. (9)
- (b) What are the features of a good contraceptive? (6)
4. (a) Diagrammatically explain the changes in the mammary gland according to the reproductive stage of the females. Add a note on the hormonal regulation of mammogenesis. (8)
- (b) The term “progesterone” means “for gestation (or pregnancy)”. Describe how progesterone helps prepare the female body for pregnancy and helps maintain pregnancy. (7)
5. (a) What are the primary causes of infertility in women? Discuss any three. (7)
- (b) Describe any two ART methods that help in the management of infertility in women. (8)
6. Write short notes on **any three** : (5×3=15)
- (a) Composition of semen
- (b) Diapause
- (c) Negative Feedback system
- (d) Hormonal regulation of menstrual cycle

16/12/24  
[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5837

Unique Paper Code : 32231501

Name of the Paper : Molecular Biology

Name of the Course : B.Sc. (Honours) Zoology,  
CBCS-LOCF

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, including question No. 1 which is compulsory.

1. **All** parts of this question are compulsory :

(i) Define : (5)

(a) Replication fork

P.T.O.

- (b) Repressor
- (c) Consensus sequence
- (d) Polymerase switching
- (e) Nonsense codon

(ii) Differentiate between the following : (8)

- (a) Group I and Group II introns
- (b) Cistron and operon
- (c) DNA pol alpha and DNA pol epsilon
- (d) Shine- Dalgarno and Kozak sequences

(iii) Expand the following : (5)

- (a) MCM
- (b) RISC
- (c) DNA
- (d) PCNA
- (e) CTD

(iv) What is the contribution of the following scientists : (5)

(a) Rosalind Franklin

(b) Andrew Fire

(c) Marshal Nirenberg

(d) Arthur Kornberg

(e) Yonath & Ramakrishnan

(v) Draw the structure of (2×2)

(a) C-G Base pair

(b) 5' – 7 Methylguanosine Cap

2. Explain with suitable diagrams the mechanism of RNAi. (12)

3. (a) Explain the salient features of Watson Crick model of DNA double helix with suitable diagram. (8)

(b) In Eukaryotes (except cells displaying polyteny), Replication occurs only once during a cell Cycle. Justify the statement. (4)

4. (a) Justify ribosomes as ribozymes. (4)
- (b) Discuss briefly the post transcriptional modification of mRNA in eukaryotes. (8)
5. (a) Explain the functioning of *lac* operon. Supplement your answer with diagrammatic illustrations. (6)
- (b) Initiation of translation in eukaryotes. (6)
6. (a) Explain the classic experiment performed by Matthew Meselson and Franklin Stahl to prove that DNA Replication is semi-conservative. (6)
- (b) Explain the experiment conducted by Nirenberg and Khorana to decipher the Genetic Code. (6)
7. Write short notes on following (**any three**): (4,4,4)
- (i) Role of enzymes in transcription
- (ii) Trombone model
- (iii) Mis-match repair mechanism
- (iv) DNA polymerase I

19/12/24  
[This question paper contains 8 printed pages.]

Your Roll No.....



Sr. No. of Question Paper : 5891

Unique Paper Code : 32231502

Name of the Paper : DSC – Principles of Genetics

Name of the Course : **B.Sc. (Hons.) Zoology**  
**(CBCS-LOCF)**

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 including Question no. 1 which is compulsory.

1. (a) Define the following terms (**any five**) : (1×5=5)

(i) Transposon

(ii) Synteny

(iii) Phenocopy

P.T.O.

(iv) Heteroplasmy

(v) Euploidy

(vi) Map distance

(b) Differentiate between the following **(any four)** :  
(2×4=8)

(i) Polygenic inheritance and pleiotropy

(ii) Sex-influenced and sex-limited traits

(iii) Auxotrophs and prototrophs

(iv) Intergenic and intragenic suppressor mutation

(v) First division and second division segregates

(c) Write the contribution of the following geneticists  
**(any five)** (1×5=5)

(i) William Bateson

(ii) Walter Stanborough Sutton

- (iii) Barbara McClintock
- (iv) Thomas Hunt Morgan
- (v) Y.M. Bhende
- (vi) Carl Erich Correns

(d) Give reason for the following **(any two)** ( $2 \times 2 = 4$ )

- (i) After the cross between Hfr and F- bacterial cell, recipient cell remains F-.
- (ii) Father has blood group A and mother has blood group AB, however, daughter has blood group O.
- (iii) For a paracentric inversion, with rare exceptions, recombinant chromosomes are not stable and will not lead to viable offspring.

(e) Expand the following abbreviations **(Any three)**

( $1 \times 3 = 3$ )

- (i) CLB

(ii) HGPRT

(iii) ORF

(iv) PAR

(f) Predict the sex of the following individuals with given chromosome compositions (A= haploid set of autosomes) (1×2=2)

(i) 2X, 3A (*Drosophila*)

(ii) XXXY (Human)

2. (a) How do epistatic interactions modify Mendelian dihybrid ratios? Explain with suitable examples. (7)

(b) What is Robertsonian translocation? With the help of a suitable example, explain its consequences in humans. (5)

3. (a) Discuss an experiment that provided evidence for cytological basis of crossing over. (4)

(b) In *Drosophila melanogaster*, kidney shaped eye (k), cardinal eye (cd), and ebony body (e) are recessive traits. If the homozygous kidney, cardinal females are crossed with homozygous ebony males, the F1 offsprings are all wild type. If heterozygous F1 females are mated with homozygous recessive males, following F2 progenies are obtained :

(2+3+3)

| Phenotypes              | Number |
|-------------------------|--------|
| Kidney, cardinal        | 880    |
| Ebony                   | 887    |
| Kidney, ebony           | 64     |
| Cardinal                | 67     |
| Kidney                  | 49     |
| Ebony, cardinal         | 46     |
| Kidney, ebony, cardinal | 3      |
| Wild                    | 4      |

(i) Are the three genes linked? Explain your answer.

(ii) Determine the order of genes and construct the genetic map.

(iii) Calculate the coefficient of coincidence and interference. Comment on the significance of interference.

4. (a) What is interrupted mating technique? How is interrupted mating technique used in bacterial chromosomal mapping? (7)

(b) With the help of a suitable example, explain the concept of penetrance and expressivity. (5)

5. (a) What is spontaneous mutation? Discuss molecular basis of spontaneous mutations. (7)

(b) Three different Hff strains of *E. coli* transfer their genes in the order and with entry times as given below. Using these results, construct a genetic map of the donor cell. Show the distances between the adjacent marker pairs. (5)

|                      |     |     |     |     |     |
|----------------------|-----|-----|-----|-----|-----|
| Hfr strain A markers | Pro | Met | Xyl | Mal | Str |
| Entry time (in mins) | 7   | 19  | 24  | 41  | 52  |
|                      |     |     |     |     |     |
| Hfr strain B markers | Ade | His | Gal | Pro | Met |
| Entry time (in mins) | 9   | 23  | 48  | 56  | 68  |
|                      |     |     |     |     |     |
| Hfr strain C markers | Mal | Str | Ser | Ade | His |
| Entry time (in mins) | 3   | 14  | 21  | 44  | 58  |

6. (a) Explain extranuclear inheritance of killer trait in *Paramoecium*. (5)

(b) Compare the mechanisms of dosage compensation in humans and *Drosophila*. How many Barr bodies will be observed in the individuals,

(i) with Klinefelter syndrome

(ii) with Patau syndrome? (6+1)

7. Write short notes on **(any three)**: (4+4+4)

(a) Chemical mutagens

(b) Ty elements in yeast

- (c) Antibiotic resistance in *Chlamydomonas*
- (d) Generalized and specialized transduction
- (e) Gene mapping by somatic cell hybridization

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 6003

I

Unique Paper Code : 32237909

Name of the Paper : Immunology (DSE)

Name of the Course : B.Sc. (H) Zoology CBCS-  
LOCF

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, including Question No. 1 which is compulsory.
3. Draw well labelled diagram wherever necessary.

1. (a) Define : (5)
  - (i) Opsonin
  - (ii) Cross-reactivity
  - (iii) Abzymes
  - (iv) Clonal selection theory
  - (v) Arthus Reaction

P.T.O.

(b) Differentiate between the following : (10)

- (i) Active immunization and Passive immunization
- (ii) Affinity and Avidity
- (iii) Primary immunodeficiency and Secondary immunodeficiency
- (iv) Hypersensitivity type-1 and hypersensitivity type-2
- (v) T<sub>H</sub> cells and T<sub>c</sub> cells

(c) Expand the following : (3)

- (i) TAP
- (ii) ISCOM
- (iii) PAMPs
- (iv) CLIP
- (v) ADCC
- (vi) IFN

(d) Give the immunological significance :

- (i) Colostrum is very much essential for the new born infants. (2)
- (ii) IgM is the first antibody produced in primary immune response. (2)

(e) Give the contributions of the following scientists :  
(4)

(i) Niels Jerne, David Talmadge, and F. Macfarlane Burnet

(ii) Edward Jenner

(iii) Karl Landsteiner

(iv) Gerald M. Edelman and Rodney R. Porter

(f) Give the function of the following : (3)

(i) APCs

(ii) MALT

(iii) CLIP

2. (a) What is delayed type hypersensitivity? Describe immunological response during DTH. (7)

(b) What are epitopes. Describe the properties of B cell and T cell epitopes? (5)

3. (a) What is Haematopoiesis? Discuss the various cells of immune system. (8)

(b) Discuss the basic properties and functions of cytokines. (4)

4. (a) Describe the initiation and activation of classical pathway of the complement system. (6)
- (b) Describe how monoclonal antibodies are produced by hybridoma technology. (6)
5. (a) What are lymphoid organs? Elucidate the structure and function of the spleen. (7)
- (b) Describe the various barriers of the innate immune system. (5)
6. (a) Describe the pathway for processing and presentation of exogenous antigens. (6)
- (b) Define immunogenicity. Discuss the various factors that influence the immunogenicity. (6)
7. Write short notes on (any **three** of the following) :  
(3×4=12)
- (a) MHC-class I molecule
- (b) ELISA
- (c) Autoimmunity
- (d) DNA Vaccine

[This question paper contains 4 printed pages.]

Your Roll No.....



**Sr. No. of Question Paper : 6120**

**I**

Unique Paper Code : 32237909

Name of the Paper : DSE : IMMUNOLOGY

Name of the Course : **B.Sc. (Honors) Zoology**

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. Question No. 1 is compulsory.
3. Attempt **five** questions in all.
4. Draw neat labelled diagrams wherever necessary.

1. (a) *Define* the following terms : (5)

- (i) Avidity
- (ii) Diapedesis
- (iii) Antigenicity
- (iv) Cross presentation
- (v) Memory cells

P.T.O.

(b) *Distinguish* between the following : (10)

- (i) Conformational and neoantigenic determinants
- (ii) Allotype and idiotypic
- (iii) Cathepsins and proteasome
- (iv) Variolation and vaccination
- (v) Active vs passive immune responses

(c) *Expand* the following : (3)

- (i) PAMP
- (ii) MLR
- (iii) TAP
- (iv) TLR
- (v) SMAC
- (vi) GALT

(d) Write the *contribution(s)* of the following scientists : (2)

- (i) George Snell and Jean Daussat
- (ii) Edward Jenner

(e) Immunological significance : (4)

- (i) Acute-phase proteins

(ii) ICAMs

(iii) Adjuvants

(iv) J-chain

(f) Give reasons : (3)

(i) Cells of the myeloid lineage are the first responders to infection.

(ii) Fever is good for health.

(iii) Secondary immune responses are always fast and furious

2. (a) Compare and contrast the pathways of antigen processing and presentation to T cells. (8)

(b) Discuss various theories of lymphocyte development and maturation. (4)

3. (a) What is the immunological significance of vaccines ? Discuss various types thereof. (8)

(b) Classify the cytokines based on their structure and function. (4)

4. (a) Discuss various complement pathways that lead to the formation of a membrane attack complex (MAC). (9)
- (b) Differentiate between innate and adaptive immune responses. (3)
5. (a) Describe the structure and functions of class I and class II MHC molecules. (6)
- (b) Define autoimmunity. Explain various immunodeficiencies with examples. (6)
6. (a) Elucidate the detailed process of production of monoclonal antibodies. Mention their applications. (18)
- (b) What is the principle of the technique ELISA? Explain various types of it with suitable diagrams. (4)
7. Write short notes on any **THREE** : (3×4=12)
- (i) Adjuvants, their types and functions
  - (ii) Rheumatoid arthritis
  - (iii) Factors determining antigenicity
  - (iv) Type I hypersensitive reactions