

Department of Zoology

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Question Bank

B.Sc. Botany Honours

University of Calcutta

PART I

PAPER I

Answer Q1 and any four from the rest

1. Answer any five of the following [2x5]
 - a. State 2 conditions for conjugation in *Paramecium*.
 - b. How many booklungs are there in Scorpion? State their location.
 - c. What are the functions of vicid glands?
 - d. Distinguish between polyp and medusa.
 - e. What are the functions of Renette cells in *Ascaris sp.*
 - f. Comment on the nematocyst in the Cnidarians.
 - g. What is the fate of infra-intestinal ganglion in *Pila sp.*?
 - h. Why madreporic canal of starfish is also called stone canal?

2. a) Discuss the present status of the king crab in the context of the affinities with the related phyla. b) What are the different types of gill found in prawn? c) What are biramous appendages? [6+3+1]
3. a) Define Coral reef. b) Distinguish between fringing reef and barrier reef. c) Describe the factors responsible for the development of the coral reefs. d) Comment on the biodiversity of the coral reef. [2+4+2+2]
4. a) Describe the role of the coxal gland in the osmoregulation of *Limulus*. b) Why is *Paramecium* known as heterokaryotic animal? Give an account of ciliary movement in *Paramecium*. [4+(2+4)]
5. a) Draw and label the component parts of a typical water vascular system of *Asterias sp.* and give a flowchart showing the mechanism of water flow through it. b) Write a short note on circumvallation and circumfluence.
6. a) Give an account of the mechanism of tracheal respiration in an arthropod. b) State the importance of cephalopod giant fibre. [6+4]
7. state the systematic position (up to subclass) of any four of the following and justify your answer by writing at least 2 diagnostic characters of each taxon. [2.5x4]

- a) *Chaetopterus sp.* b) *Cyclops sp.* c) *Cycon sp.* d) Portuguese man of war e)
Aplysia sp. f) *Antedon sp.*

Paper I (Unit II)

Answer Q1 and any four from the rest

1. Answer any five of the following [2x5]
 - a) What are forming face and maturing face of golgi?
 - b) What are autophagosomes?
 - c) What is chromatosome?
 - d) What is meant by balanced lethal system? Give an example.
 - e) Distinguish between nullisomy and monosomy.
 - f) State the role of β clamp loader in DNA replication.
 - g) Mention the advantages of confocal microscope over optical microscope.
 - h) State the differences in working principles of SEM & TEM.
2. a) What are the roles of fatty acid and cholesterol in membrane fluidity? b) How cytosol is protected from acid hydrolases of lysosome? c) Explain briefly the active transport through plasma membrane with diagram.
3. a) Name the different enzymes present in the inner mitochondrial membrane. b) State the structural and functional difference between RER and SER. c) Write short notes on mitochondrial DNA. [2+4+4]
4. a) What is the functional significance of telomere DNA? b) Write two distinguishing features of Z-DNA and B-DNA? c) Draw and describe the structure of nucleosome. [2+2+(2+4)]
5. a) Compare and contrast mutagen and carcinogen. b) Describe transition and transversion types of mutation. c) What do mean by Bombay Phenotype? d) State the genotype of Patau and Down syndrome.

$[(1\frac{1}{2}+1\frac{1}{2})+(1\frac{1}{2}+1\frac{1}{2})+(2+2)]$
6. 'Star' is a dominant mutation in the 2nd chromosome of *Drosophila*. 'Aristaless' and 'dumpy' are two recessive mutations in the same chromosome. A cross is made between 'Star' and homozygous 'aristaless' and 'dumpy' flies. The F₁ 'Star' females were then backcrossed to homozygous 'aristaless' 'dumpy' males, the following phenotypes were obtained as a result

Phenotypes	Numbers
Star	958
aristaless Star	8
aristaless	153
aristaless dumpy	916
Star dumpy	99
dumpy	4

 - a) What are the recombination distances and linkage order between each of these genes? b) What is the coefficient of coincidence and interference? c) What classes of phenotypes are missing and why? [(4+2)+(1+1)+2]
7. a) Describe a suitable experiment to detect sex-linked mutation in *Drosophila*. b) Describe the rho-dependent mechanism of transcription termination. c) What do you mean by degeneracy of genetic code? [4+3+3]
8. a) Mention the role of SRY in human sex determination. b) *Drosophila* and humans have same sex-chromosome composition (♀ XX: ♂ XY). Is the process of sex determination in both same? c) State the function of DNA gyrase. d) What are snRNPs? [3+5+1+1]

Part I
Paper II (Unit I)

Answer Q1 and any four from the rest.

1. Answer any five of the following
 - a. Define isoelectric pH.
 - b. Define saponification number.
 - c. What is mutarotation?
 - d. What is uricotelism?
 - e. State the functional significance of vitreous humor in mammals.
 - f. What do you mean by Haldane effect?
 - g. What is synaptic delay?
 - h. What do you mean by homeothermy?
 - i. State the physiological significance of basilar membrane.

2. a) State the biochemical steps of β -oxidation of fatty acids. b) What do you mean by allosteric modulation of enzyme action? How does allosteric inhibition differ from non-competitive inhibition? c) What are the differences between oxidative phosphorylation and substrate level phosphorylation? [4+(3+1)+2]
3. a) Mention the steps of glycogenesis. b) State the role of PLP in transamination. c) Explain ornithine cycle. [3+3+4]
4. a) How does oxidative phosphorylation occur in mitochondria. Give the chemical name of Complex I in electron transport chain. b) Give a description of the histological structure of retina with labeled diagram. [4+1+(3+2)]
5. a) Distinguish between R- and T-states of hemoglobin. b) How oxygen is transported in blood? c) What do you mean by Young Helmholtz theory of colour vision. [3+5+2]
6. a) Name the factors that determine ultra-filtration in the glomerulus. b) State the roles of antidiuretic hormone and aldosterone in urine formation. c) Write the process of synaptic transmission with diagram. [2+(2+2)+4]
7. a) State the role of hypothalamus in regulating body temperature in human. What do you mean by non-shivering thermogenesis? What is Q_{10} ? b) State with a flow chart how does auditory impulse travel from cochlea to auditory cortex. [(3+2+1)+4]
8. write short notes on (any four) [2.5x4]
 - a) Carnitine shuttle
 - b) Cori cycle
 - c) E.C. Number
 - d) Malate aspartate shuttle
 - e) Juxta glomerular apparatus.

Part I
Paper I (Unit I)

1. Answer Q1 and any four from the rest
 - a. Distinguish between Oligochaeta and Polychaeta.
 - b. What is siphonoglyph?
 - c. Comment on the aschelminthes assemblage.
 - d. What are the functions of caudal glands of nematodes?
 - e. Define polymorphism.
 - f. Mention the giant cell associated with the excretory system of *Ascaris sp.* at the juvenile stage.
 - g. What is osphradium? State its function.
 - h. Differentiate between starfish and brittle star.
2. Discuss the present status of *Limulus sp.*
3. a) Discuss in details the modifications of polyp and medusa with particular reference to polymorphism in *Siphonophora*. b) Comment in brief the firing sequence of nematocysts in phylum Cnidaria.
4. a) Compare the water vascular system of Asterozooids and Holothurozooids. b) State the location and function of Tiedemann's body. c) Describe the phylogenetic importance of larval forms of echinoderms.
5. What is the significance of conjugation in *Paramecium sp.*
6. a) What is respiration? b) Describe the structures involved in the aquatic mode of respiration in arthropods. c) What is the difference between kinetosome and kinetodesma?
7. Describe with suitable diagnostic features the classes in which the following animals are included:
 - i) *Euplectella sp.*
 - ii) *Spongilla sp.*
 - iii) *Astrosclera sp.*
 - iv) Sea hare
 - v) Sea cucumber

Part I
Paper I (Unit II)

Answer Q1 any four from the rest

1. Answer any five of the following
 - a. Upon analysis, it is found that a DNA molecule has 35% A. What are the percentages of other bases?
 - b. Define syndrome and give two examples of it.
 - c. How would you recognize 3' end of a tRNA.
 - d. What is Barr body?
 - e. What is pericentric inversion?
 - f. Mention the nature of lenses in electron microscope.
 - g. What is numerical aperture?
2. a) Why lysosomes are regarded as the 'suicidal bag'? How autophagosome is formed? b) Describe the different forms of lysosomes and their distinctive role in animal cells. c) Explain briefly facilitated diffusion through plasma membrane. [2+4+4]
3. a) Describe a suitable experiment to prove that DNA replication is semiconservative. b) Explain wobble hypothesis. c) State two important features of 47, +21. [5+3+2]
4. a) What is a deletion loop? b) DNA synthesis is semidiscontinuous – explain. c) What is Shine-Dalgarno sequence? d) Explain -10 and -35 sequences. [2+4+2+2]

5. a) Explain with a flow chart the initiation event of transcription in *E.Coli*. b) Why is DNA pol 1 regarded as a talented enzyme? c) Explain the role of EF-Tu and EF-Ts. [4+3+3]
6. Stern and Bridges crossed a stock of *Drossophila* carrying the dominant eye mutation Star to a stock homozygous for recessive mutations aristaless and dumpy. The F1 Star females were then test-crossed and the following phenotypes were observed.

Phenotype	Number
Aristaless, dumpy	918
Star	956
Aristaless, star	7
Dumpy	5
Aristaless	132
Star, dumpy	100

- a) Determine the correct gene order.
- b) Prepare a chromosome map showing recombination distances.
- c) What is the degree of interference?
- d) Which phenotype classes are missing and why? [2+(3+1)+2+2]
7. a) How does inactivation of x-chromosome occur in human?
- b) State how are two Okazaki fragments ligated.
- c) What is C-value? Why is it regarded as a paradox? [3+3+4]

Part I
Paper II (Unit I)

Answer Q1 and any four from the rest

1. Answer any five of the following
- Mention the sources of C and N in urea cycle.
 - What is anomerism?
 - What happens when $[S]=K_m$?
 - What is the role of stria vascularis?
 - What is thermoneutral range?
 - What do you mean by scotopic vision?
- 2.a) Enumerate the role of PLP in transamination of alanine to pyruvate.
b) Distinguish between saturated and unsaturated fatty acids.
c) Define uricotelism.
3. a) Describe the process of glycogenolysis.
b) What is glycogenin?
c) Classify enzymes with example according to IUBMB.
4. a) Describe the photochemical changes that take place in the retina.
b) What is hyperthermia?
5. a) Describe the countercurrent multiplier system in the kidney of mammals.
b) What are the components of JGA?

- c) Explain the trichromatic theory of colour vision.
- 6.a) Elucidate electrical and chemical synapses.
- b) Impulse transmission is faster in myelinated fibres – explain.
- c) How are the hair cells of the organ of Corti stimulated/

7. Write short notes on

- a) Quaternary structure
- b) Glycosidic linkage
- c) Neuromuscular junction
- d) R and T states of hemoglobin.

Part I
Paper I (Unit I)

Answer Q1 and any four from the rest

1. Answer any five of the following questions
 - a) In which groups of animals you can see the canal system and the water vascular system?
 - b) Define metamerism. Give example.
 - c) Write the function of tube feet.
 - d) Distinguish between ctenidium and taenidium.
 - e) What is pleurobranch?
 - f) Comment on the role of choanocyte cells in Porifera.
 - g) What is the function of renette cells in nematodes?
 - h) Justify the concept of Aschemminthes superphylum status.
 - i) Illustrate the functions of nematocyst cells.
2.
 - a) State the unique features of phylum Apicomplexa. Cite two examples.
 - b) State the salient features of class Gasptropoda.
 - c) Distinguish the characteristics of class Polychaeta and class Oligochaeta.
3.
 - a) Describe the structure of a terrestrial respiratory organ of arthropod. state the mechanism of respiration in arthropod.
 - b) Write an example of an arthropod living in water and respiring in air and one living on land but respiring in water.
 - c) What are the respiratory organs present in king crab.
4.
 - a) Describe the diagnostic features of phylum Platyhelminthes.
 - b) Which class includes free living platyhelminths? Mention its diagnostic features with example.
5.
 - a) State two examples of gastropods exhibiting protoneurous nervous system. What do you know about streptoneurous condition?
 - b) Define commissures and connectives. State the fate of parietal ganglia of gastropod after torsion.
6. To which phyla and classes the following animals belong? Mention two diagnostic characters of the concerned classes.
 - i) silver fish
 - ii) mud crab
 - iii) leech.

Part I

Paper I (Unit II)

Answer Q1 and any four from the rest

1. answer any five of the following questions
 - a) distinguish between primosome and replisome.
 - b) What do you mean by "TGN"?
 - c) Distinguish between incomplete dominance and co-dominance.
 - d) What is Wobble hypothesis? Who proposed it?
 - e) What do you mean by the term co-translational processing?
 - f) Mention the function of mitochondria.
 - g) What is Robertsonian translocation?
 - h) Mention two differences between phase contrast and light microscope.
 - i) What are polytene chromosomes? Mention its significance.

2. The following phenotypes were obtained from a cross between *Drosophila sp.* females heterozygous for 3 alleles, approximated vein, curled wing and striped thorax (+ app, + cu, +sr) and male homozygous for these alleles:

Phenotypes	Number
+ + +	337
app cu sr	348
+ cu sr	58
app + +	49
+ + sr	55
app cu +	48
+ cu +	3
app + sr	2
Total	900

- a) Find out the genotype of the parents.
 - b) Analyze the correct gene order.
 - c) Construct a linkage map of app cu sr.
 - d) Determine the "coefficient of coincidence" and interference.
 - e) How would you determine that whether any two given genes are linked or not.
3.
 - a) Distinguish between diffusion and facilitated diffusion.
 - b) How the cytosol is protected from acid hydrolases?
 - c) Distinguish between cis-Golgi and trans-Golgi.

Part I
Paper II (Unit I)

Answer Q1 and any four from the rest

1. answer any five of the following questions
 1. What is JGA?
 2. What is action potential?
 3. What do you mean by T form of hemoglobin?
 4. Differentiate between fibrous and globular proteins.
 5. Distinguish between ureotelism and uricotelism.
 6. What is Cori cycle?
 7. What is Michelis-Menten constant?
 8. Name a blocker of electron transport specifying its site of action.
2.
 - a) Define neurotransmitter.
 - b) Add a note on refractory period.
 - c) Describe how an electrical impulse is generated in the rod cells of retina.
3.
 - a) Schematically enumerate how does mitochondria carry out oxidative phosphorylation.
 - b) Explain the role of pyridoxal phosphate in transamination.
 - c) Name one reducing and one non reducing disaccharide that can be generated from glucose, showing their structure.
4.
 - a) Write down the significance of oxygen dissociation curve.
 - b) Differentiate between cortical and juxtamedullary nephrons.
 - c) Describe the role of hypothalamus as a thermostat.
5.
 - a) What is glycogenesis? How is glucose formed from lactate?
 - b) Distinguish between competitive and non-competitive inhibition of enzymes, with particular emphasis on their effect on K_m and V_{max} .
6.
 - a) Give an account of ornithine cycle of urea synthesis in mammals. Specify the sources of N and C of urea.
 - b) How are fatty acids activated before oxidation? Explain carnitine shuttle.
 - c) What are essential amino acids?
7.
 - a) Differentiate between transamination and deamination. Explain oxidative deamination with an example.
 - b) Explain E.C. number with an example.
 - c) Mention the roles of branching and debranching enzymes in glycogen metabolism.
8. Write short notes on
 - a) Structure of Organ of Corti
 - b) Chloride shift
 - c) Leak channels and gated channels
 - d) Young-Helmholtz theory of color vision

Part I

Answer Q1 and any three from the rest

1. Answer any ten questions
 - a) Distinguish between polyp and medusa.
 - b) Comment on 'facultative anaerobes' in the context of platyhelminthes.
 - c) Mention the location and function of radula.
 - d) What is chiasmoneury?
 - e) Differentiate between kinetosome and kinetodesma.
 - f) Mention two functions of the contractile vacuoles in *Paramecium sp.*

- g) What is the difference between prostomium and pygidium?
- h) Name a reducing and a non-reducing disaccharide.
- i) What is iodine number?
- j) What do you mean by competitive inhibition? Give example.
- k) Define action potential.
- l) What do you understand by Young Helmholtz theory of colour vision?
2. a) Give the taxonomic position of the following organisms(up to class) with diagnostic characters.
 9. *Achatina sp.* ii) Devi fish
- b) Draw and describe the nervous system of a gastropod you have studied.
3. a) Determine the systematic position of the following animals
 - i) *Nereis sp.* ii) *Hirudinaria sp.*
- b) Give an account of the nuclear changes during conjugation in *Paramecium sp.*
4. Enumerate the classificatory model and diagnostic features of the phylum Cnidaria. Comment on the polymorphism in Siphonophora.
5. a) How can you derive the Lineweaver Burk plot from the Michaelis-Menten equation?
 - b) What is anomerism? Explain with structure.
 - c) State the influence of pH on enzyme activity.
6. Draw a labeled diagram of the histological structure of a mammalian retina.

Part I

1. Answer any ten
 - a) What is the function of caudal glands in Nematodes?
 - b) What is 2nd genetic code?
 - c) What do you mean by polycistronic mRNA?
 - d) What is Wobble hypothesis? Who proposed it?
 - e) Mention two differences between SEM and TEM.
 - f) What is the difference between mutagen and carcinogen?
 - g) What do you mean by sex chimera? Why is this only found in fruitflies?
 - h) What is deamination? Name the enzyme involved in the deamination of glutamate.
2. a) The following phenotypes were obtained from a cross between *Drosophila* females heterozygous for 3 alleles, approximated vein, curled wing and striped thorax (+ app, + cu, + sr) and male homozygous for these alleles:

Phenotypes	Number
+ + +	337
app cu sr	348
+ cu sr	58
app + +	49
+ + sr	55
app cu +	48
+ cu +	3
app + sr	2
Total	900

- b) What are the recombination distances and linkage order between each of these genes?

- c) What is the coefficient of coincidence?
- d) State briefly the charging of tRNA in *E. Coli*.
3. a) Suppose the *E.coli* synthesizes DNA at a rate of 100,000 nucleotides per minute and takes 40 minutes to replicate its chromosome.
- i) How many base pairs are present in the entire *E. Coli* chromosome?
 1. What is the physical length of the chromosome if it were opened into a circle?
 - b) What is polysome? State why transcription and translation are coupled in Prokaryotes.
4. a) Distinguish between active and passive transport.
- b) What is oxidative phosphorylation? What do you mean by "SRP"?
- c) Define resolution. How it can be increased?
5. a) Briefly explain the role of base analogs and base modifiers in molecular mutation.
- b) Elaborate the cause and physical features of individuals with Klinefelter's syndrome.
6. a) What do you mean by β -oxidation? Write the steps of β -oxidation of a saturated fatty acid containing odd number of carbon atoms.
- b) Enumerate the roles of the following enzymes in metabolism (any three)
- | | | |
|--|-----------------------|---------------------------|
| (i) Phosphofructokinase 1 | (ii) Citrate synthase | (iii) Glycogen synthase |
| (iv) α -ketoglutarate dehydrogenase | (v) PEPCK | (vi) Alanine transaminase |
7. a) How can you derive the Lineweaver Burk plot from the Michaelis-Menten equation?
- b) What are the sources of C and N in the arginine-urea pathway? Explain the pathway briefly.
- c) Comment on creatinine as a nitrogenous waste product.
8. a) What is action potential? State the ionic basis of generation of action potential.
- b) Describe synaptic transmission in brief.

Paper III (Unit I)

Short Questions

1. Why heterodont dentition is present in man?
2. Give at least two reptilian features of Monotremes.
3. What is diastema? Give the dental formula of *Cavia sp.*
4. What is zugdisposition?
5. What is keratin fibre horn? Where is it found?
6. What are the intrinsic factors involved in neoteny?
7. State the importance of notochord in *Branchiostoma sp.*
8. How does individual bat recognize its own call when in a roost?
9. What do you mean by 'zugdisposition' and 'zugunruhe'?
10. What is rumination?
11. Define echolocation.
12. Write the differences between lizards and snakes.
13. What are filoplumes?
14. Distinguish between nerve cord and notochord.
15. What is filter feeding?

Broad Questions

- Place the following animals (any four) into their respective class and subclass/order with reasons, mentioning at least two characters for each taxon (up to order for Amphibia and Reptilia and up to subclass for the rest)
 - Necturus sp.*
 - Columba sp.*
 - Anabas sp.*
 - Macropus sp.*
 - Petromyzon sp.*
 - Sphenodon sp.*
- Define dentition. Elaborate the anatomy of a mammalian canine with diagram.
 - Why running birds cannot fly?
- Distinguish between holobranch and hemibranch gill.
 - Describe the structure of a poison gland.
 - Describe the role of swim bladder as a hydrostatic organ.
- Describe the structure & functional significance of pharynx in *Branchiostoma sp.*
 - Give an account of structural organization of *Petromyzon sp.*
- Define migration. State the factors controlling bird migration. How birds navigate during migration? Describe the pathway of food transfer in a ruminant stomach.
- Describe the aortic arches found in bony fish and amphibian, with proper diagram. Draw and describe the structure of a typical flight feather of bird.
- Place the following animals into their respective subclasses with reasons:
 - Cryptobranchus sp.*
 - Catla sp.*
 - Tylotriton sp.*
 - Rhacophorus sp.*
- Compare the aortic arches of a reptile and a mammal.
 - What is nephrotome? Describe the structure of opisthonephric kidney found in different groups of vertebrates.
- Mention four differences between non-poisonous snakes and cite Indian examples.
 - Describe the structure of a typical feather of bird with suitable diagram.
- Describe the progressive and retrogressive features of *Ascidia sp.* during its development with suitable diagrams.
 - Distinguish between the Proteroglyphous and Opisthoglyphous fangs.
- What is paedogenesis?
 - How does it differ from neoteny?
 - What are the extrinsic and intrinsic factors involved in neoteny?
 - Describe the movement of food in a ruminant stomach.

Paper III (Unit II)

Short Questions

- State the sources and function of inhibin.
- What is catecholamine?
- State the full form and function ADH.
- Differentiate between estrus and menstrual cycle.
- State the steps of formation of norepinephrine.
- Comment on the structure and function of corpus luteum.
- What is mesangial cell? State its function.
- What is ecdysone?
- Name the macrophage of liver. State its function.
- What is metanephric blastema?

11. What is the full form of MSH? Mention its function.
12. What is corpus luteum? Name the principal hormone secreted from it.
13. State the significance of ABP.
14. What is paracrine secretion? Give example.
15. Distinguish between type I and type II diabetes mellitus.
16. Mention the difference between mutagen and carcinogen.
17. What is delamination?
18. Distinguish between radial and spiral cleavage.
19. Define linkage group.
20. SRP binds to (i) ribosomes (ii) signal sequence of the growing polypeptide chain (iii) ribosome and signal sequence of the growing polypeptide chain (iv) ER membrane.
21. The free energy derived from proton movement down the electrochemical gradient in ATP synthase is used for (i) ATP breakdown (ii) transfer of electron across ETC (iii) liberation of ATP in mitochondrial matrix (iv) ATP synthesis.
22. Give two examples of multiple allelic trait.
23. What is Ito's cell? State its function.
24. State the cause of Addison's disease.
25. What is macula densa? Where is it located?
26. Draw the molecular structure of a steroid nucleus indicating the position of carbon atoms.
27. What do you mean by the term 'paracrine'? Give example.
28. What do you mean by spontaneous and induced ovulators?
29. State the source of inhibin in male and female mammals. What is its function?
30. Mention the location and function of filtration slit.
31. What is the liver macrophage?
32. State the function of Ito's cells.
33. State the symptoms of exophthalmic Goiter.
34. What is aspect ratio?
35. Define neoteny.
36. What is venous heart?
37. Define PGCs.
38. What is resact?
39. Devine vitellogenesis.
40. State the source of aromatase? What is its function?
41. What is the full form of PNMT? State its function.

Broad Question

Group A

1. a) Describe the structure of a thyrocyte with diagram.
b) Comment on blood testis barrier.
c) Describe the cell types of endocrine pancreas.
2. a) Describe the histological structure of renal corpuscle with suitable diagram.
b) State any two functions of liver.
3. a) What are the broad divisions of inductive interaction? Explain the same briefly.
b) What do you mean by reciprocal and sequential inductive events?
c) Comment on paracrine factors.

OR

- a) What is fertilization? Comment on the acrosomal reaction and sperm penetration in sea urchin.
- b) What is resact? Explain the process of capacitation.
4. a) What is fate map? How can it be constructed?
- c) Briefly describe the development of eye in chick with special reference to lens formation.
5. a) How does Golgi distinguish between proteins that are destined for lysosome and proteins that are destined otherwise?
- b) The following are the number of persons in the two populations with respect to their MN blood group:

	MM	MN	NN
Population A	1500	3000	500
Population B	1000	2000	200

If random mating occurs between them, what will be the genotypic frequency of the MM, MN and NN persons and the gene frequencies of M and N in the following generation?

- c) State the importance of red cell ghosts.
6. a) Three of the many recessive mutations in *Drosophila* that affect the body color, wing shape or bristle morphology are black(b) body versus grey in wild type; dumpy(dp), obliquely truncated wing versus long wings in the wild type and hooked(hk) bristles at the tip versus not hooked in the wild type. From a cross of dumpy female with a black and a hooked male, all the F₁ are wild type for all three characters. The test cross of an F₁ female with a dumpy, black, hooked male gave the following results:

Phenotype	Number
Wild type	169
Black	19
Black hooked	301
Dumpy hooked	21
Hooked	8
Hooked, dumpy, black	172
Dumpy black	6
Dumpy	304
Total	1000

What are the recombination distances and linkage order between each of these genes? what is the coefficient of coincidence?

- b) What is Bombay phenotype?
- c) What is 'balanced lethal stock'?
7. a) Briefly discuss the role of different genes in mammalian sex determination.
- b) Mention the main difference between mammalian and *Drosophila* sex determination. What is transition and transversion? What are sexual gynandromorphs?

OR

- a) What is silent mutation? Explain whether 'Wobble hypothesis' can explain it or not.
- b) What is frameshift mutation? How can it be corrected?
- c) Briefly point out the abnormalities found in Turner and Klinefelter's syndrome.
8. Comment on the slow block polyspermy. Elucidate the role of male pronucleus in fertilization. Define fertilization. Define fertilization cone.
9. Comment on the role of egg membrane. Describe in details the metaphase II block in Oögenesis.
10. Distinguish between exocrine and endocrine glands with suitable example. State the exocrine liver histology under light microscope. Briefly enumerate the hypofunctional disorders of Thyroid gland.

11. Briefly elaborate the roles of ecdysone and bursicone in insect metamorphosis. Mention the parts of neurohaemal system of an insect. Why juvenile hormone is called so? Write the role of J.H. in insect metamorphosis.
12. Differentiate poisonous snake from non-poisonous one with suitable example. Describe the structure of a poison gland and give an account of the associated muscles involved in biting mechanism of poisonous snakes.
13. How can an individual bat discriminate between the echoes of its own call and those of others?
14. Write down the systematic positions of the following animals with reasons.
 - (a) *Salamandra sp.*
 - (b) *Pipa sp.*
 - (c) *Ichthyophis sp.*
 State the general characteristics of the class in which these animals belong.
15. How do steroid hormones initiate biosignalling mechanism in a target cell? Describe the process of biosynthesis of insulin. How do the gonadotrophins control the process of spermatogenesis?
16. Elucidate the role of LH & estrogen in ovulation. State the role of calcitriol in Ca^{2+} metabolism. Comment on the regulation of aldosterone secretion. How does glucagon promote glycogenolysis?
17. Draw & label the structure of a graafian follicle. What do you mean by Δ^4 & Δ^5 pathways of steroid biosynthesis? What are Herring bodies?
18. What do you understand by Malpighian corpuscles? What is J.G. complex? Where it is located? State its histology & function? Give an account of pedicel & podocyte.

Group B

1.
 - a) Elucidate the process of formation of T3.
 - b) Classify hormones based on their solubility.
 - c) Distinguish between cretinism and myxedema.
 - d) State the physiological role of FSH in spermatogenesis.
2.
 - a) Mention the steps of biosynthesis of aldosterone.
 - b) What do you understand by feedback regulation of hormone release?
 - c) State the role of gonadotrophins during the follicular phase of the menstrual cycle.
3.
 - a) Distinguish between the roles of PTH and calcitonin in calcium homeostasis.
 - b) What is a second messenger? Mention the role of calcium as second messenger.
 - c) Elucidate the mechanism of action of an adrenocortical steroid hormone.
4.
 - a) What is calcitriol? Why is it considered a hormone? Mention its biosynthetic pathway.
 - b) Comment on the roles of glucagon on carbohydrate metabolism.
 - c) Distinguish between Δ^4 and Δ^5 pathway.
5. State the principle of ELISA over RIA? Name two enzymes used in ELISA. Comment on the application of RIA in biomedical researches. Name the radioactive labels used in RIA.
6.
 - a) What are the differences between neurosecretory cells and neuron?
 - b) Comment on the roles of Ecdysone and Bursicon in the context of insect endocrine glands.
 - c) Schematically elucidate the endocrine orchestra of moulting and metamorphosis in a typical insect.
7.
 - a) Give a brief account of the hormonal control of spermatogenesis in mammals.
 - b) Discuss briefly the steps involved in the synthesis of insulin from preproinsulin.
 - c) Distinguish between follicular and luteal phase of menstrual cycle.
8.
 - a) State the mechanism of action of a hormone where IP_3 and DAG are the second messengers.
 - b) Explain the role of insulin in carbohydrate metabolism.
 - c) Mention the steps of biosynthesis of calcitriol from cholecalciferol.
9.
 - a) Comment on the roles of Vit. D_3 in Ca^{2+} metabolism.

- b) what do you mean by Δ^4 and Δ^5 pathways of testosterone biosynthesis?
 - c) Classify hormones on the basis of receptors.
 - d) Comment on the hypothalamo-hypophyseal-thyroid axis.
10. a) Describe in brief the major endocrine glands of the insect.
- b) Comment on the interplay of insect hormones with particular reference to moulting and metamorphosis.
11. A) Enumerate the exocrine and endocrine parts of liver.
- b) Describe the EM view of hepatocyte.
 - c) What do you know about insulin-dependent and non insulin-dependent diabetes?
 - d) State the cause of hypogonadism.
12. a) State the steps of biosynthesis of calcitriol.
- b) Name a cryoprotectant. What is its role in cryopreservation?
 - c) Elucidate the mechanism of action of glucagon in maintaining blood glucose level.
 - d) How can you distinguish between proestrus and estrus phase by observing vaginal smears of rat?
13. a) Mention the different cell types of adenohypophysis. Name the hormones produced by each of them.
- b) List the various secondary sex characters of male and female.
 - c) What are the basic differences between RIA and ELISA techniques?
 - d) What do you mean by 'second messenger'?
14. a) Elucidate the role of adenylyl cyclase in hormone action.
- b) Describe the role of PTH in calcium metabolism.
 - c) What is the role of TSH in the biosynthesis of thyroid hormones?
 - d) Why are chromaffin cells so named?

OR

- a) Mention the steps of biosynthesis of testosterone via the Δ^5 pathway.
 - b) Mention the particular cells that produce (i) aromatase, (ii) ABP.
15. a) Mention the role of LH and estrogen in ovulation.
- b) Describe the process of biosynthesis of aldosterone.
 - c) Explain negative feedback mechanism with respect to the hypothalamo-pituitary-thyroid axis.
 - d) Name two different types of ELISA technique.

Paper IV (Unit I)

Short Question

1. What is radial cleavage?
2. What is convergent extension?
3. What is mid blastula transition?
4. What is the tentative time required for the progression of the spermatogonial stem cells to develop into a mature sperm?
5. What is the chief constituent of vitellogenin?
6. Define induction, competence and reciprocal induction.
7. What is the major function of distal centriole in the sperm cell?
8. Comment on the major role of N-cadherin during spermatogenesis.
9. Distinguish between totipotent and pluripotent stem cells.
10. Comment on the role of N-Cadherin.
11. Define spermateleosis.
12. What is capacitation?
13. Justify the role of paracrine factors.

14. What are the differences between cleavage and later mitotic divisions?
15. What are bottle cells?
16. Define convergent extension with diagram.

Broad Question

1. a) Describe in short the meiotic phases of oogenesis.
b) Comment on oocyte maturation.
c) What do you mean by vitellogenesis?
2. a) Describe, in brief, the major events of gastrulation in frog.
b) What is a fate map? Describe the processes by which fate map can be constructed.
3. a) State the significant differences observed during the formation of blastula in frog and chick.
b) State the functions of placenta.
c) What is gray crescent?
4. a) Give a brief description of the formation of neural tube in chick with proper diagrams.
b) What are embryonic stem cells? State the important properties of stem cells.
5. a) Describe in details the RTK pathway in the context of organizer concept.
b) Comment on the functions of prechordal plate and chorda mesodermal plates in connection with the primary organizer.
6. a) Define cryo preservation. What is cryoprotectant?
b) describe in details the oocyte preservation for mammals.
7. a) Explain and justify the inductive interactions.
b) Define the reciprocal and sequential inductive events.
c) Briefly explain the genetic specificity of the induction.
8. a) What is a fate map? State its significance.
b) Briefly trace the development of eye in chick with special reference to lens formation with proper illustration.
9. Classify eggs depending on the amount of yolk present in them. State the role of yolk in cleavage.
10. a) State the role of primitive streak in gastrulation of chick.
b) Give an account of the significant differences observed during the formation of blastula in frog and chick.

PRACTICAL QUESTIONS

1. Dissect and display the specimen provided. Draw & label your dissected work of the specimen as per question.
2. Dissect, display and mount the workout material of the specimen provided.
3. Laboratory note book.
4. Viva voce.

Group B

5. Stain the histological sections of the tissue provided & mount the stained section(s) properly. Draw, label & identify the tissue.
6. Identify the sections (A-D) with reasons
7. Identify the slides(E-F) provided
8. Laboratory note book
9. Viva voce.

PART III
Paper VI
Unit I

SHORT QUESTIONS

- a) Differentiate between eon and era.
- b) Comment on microsphere.
- c) Differentiate between mean and mode? State the advantage of median over mean.
- d) Mention the mathematical relation between mean, median and mode? The mean marks obtained by 30 students are 35.5 and the mode is 35. Calculate the median.
- e) What are plesiomorphic and apomorphic characters?
- f) State the importance of neotype in taxonomy?
- g) Define bee space and bee bread.
- h) What is supersedure?

2. a) The oxygen consumption rate (mm/hr) of 10 carp fishes are given before and after irradiation.

Fish No.	1	2	3	4	5	6	7	8	9	10
Before irradiation	3.2	2.7	2.9	3.0	2.8	2.9	2.8	3.2	3.1	3.0
After irradiation	2.7	2.5	2.6	2.6	2.5	2.6	2.4	2.8	2.5	2.5

Find out whether or not the mean oxygen consumption varies before and after irradiation.

- b) What is correlation coefficient?
- c) What are the criteria for applying t-test?

3.a) Distinguish between allopatric and sympatric speciation with examples.

- b) Explain importance of numerical taxonomy both in taxonomic and evolutionary studies.
- c) Discuss the limitations of biological species concept.

4. a) What are the major types of distribution?

- b) Comment briefly on discontinuous distribution.
- c) Illustrate Wegner's Continental drift theory.

5.a) What are the characteristics of living matter? Comment on the abiotic origin of organic compounds.

- b) Illustrate briefly the cyanogens theory and Akabori hupothesis in the light of origin of life.

6.a) Describe in details the prospective steps of formation of biomolecules in the context of origin of life. Comment on Strecker's synthesis.

- b) Justify the concept of First Life in the tune of proteinoids.

8.a) Define pest management.

- b) Comment on agro-ecosystem.
- c) Define IPM in the light of critical aspect.

Part III
Paper V, Unit II

1. Short Questions

- a) Characterize eusociality.
 - b) What is round dance?
 - c) What is sign stimulus?
 - d) What is selectable marker? Give one example.
 - e) What do you mean by catabolic repression?
 - f) Define cistron.
 - g) Give a single construct of a cloning vector.
2. a) Write a short note on cDNA library?
b) What are shuttle vectors and what are their advantages?
c) What result would you get if you run two separate PCR reactions, one with dNTP and one with a mixture of dNTP and di-deoxy NTP?
3. a) What do you mean by one gene one polypeptide hypothesis?
b) Briefly describe the genetics of Sickle cell anemia.
c) Define RAPD and RFLP.
4. a) Briefly describe the mechanism of Nucleotide excision repair.
b) Describe the role of leader region in the attenuation of trp operon.
5. a) Explain the role of gRNA in RNA editing.
b) What is retrotransposon?
c) What do you mean by LINES and SINES?
6. a) What do you mean by diauxic growth curve?
b) Briefly describe the negative control of lac operon.
c) Define splicing and briefly describe different mechanisms of splicing.
7. a) Who first proposed the term pheromone?
b) What is wagging dance? How is it performed with respect to the sun and direction of food?
c) What is trophallaxis?

Part III
Paper VI, Unit II

1. Short Questions

- a) Define net reproductive rate.
 - b) When is an ecological pyramid inverted?
 - c) What is edge effect?
 - d) What is species abundance?
 - e) Illustrate briefly B.R.P. and M.A.B.
 - f) What is telemetry?
 - g) Mention the salient recommendations of Kyoto protocol.
 - h) Name the causative agents of Minamata and Itai-Itai disease.
2. a) What is biotic potential? Which factor of nature opposes it?

- b) Explain the exponential growth equation.
- c) If a population with initial population number(N_0) of 100 grows exponentially with 'r' value of 0.5/month, what will be the population number after 4 months?
- 3. a) What is fundamental niche? Comment on niche width.
- b) How niche can be considered as n-dimensional hypervolume?
- c) Explain how resource partitioning influences competition.
- 4. a) Define biodiversity.
- b) Explain suitably the mega diversity zones and biodiversity hotspots with special reference to India.
- c) Comment on the keystone species.
- 5. a) Give a brief account of the sources of water pollution in India. What are the agents responsible for lowering the pH of rain water?
- b) Write down the major effects of noise pollution. Add a note on the global warming potential of CFCs.
- 6. a) What do you mean by resource management?
- b) Describe the strategies of ex-situ conservation.
- 7. Write short notes on
 - a) Photochemical smog
 - b) Main objectives of EIA
 - c) Waste water treatment
 - d) Objectives of Project Tiger

Part III
Paper VI & VII

1. Short Questions

- a) Define Zoogeography.
- b) What is protobiogenesis?
- c) Define keystone species.
- d) What do you mean by habituation?
- e) Comment on intra-specific and inter-specific association.
- f) Distinguish between primary and secondary succession.
- g) Define holotype.
- h) Distinguish between taxonomy and systematic.
- i) What is phenogram?
- j) Explain Law of priority.
- k) What is photochemical smog?
- l) What is eutrophication.
- 2. a) Explain the concept of climax.
- b) What is resource partitioning? Describe resource partitioning with the help of suitable graphical model.
- 3. a) Distinguish between specific mortality and ecological mortality. Briefly discuss the logistic and exponential growth forms.
- b) Distinguish between density dependent and density independent factors.
- 4. Explain sympatric speciation with example. How does it differ from allopatric speciation? Discuss about the principal and merits of cladistic classification.
- 5. a) Write the significance of the conditioned and unconditioned stimuli in Pavlovian conditioning theory of learning.

- b) comment on hydrosere and xerosere.
 - c) State how a community is replaced by another during the course of ecological succession.
6. a) Differentiate microtaxonomy from macrotaxonomy. What is biological species concept? Discuss about the limitations of biological species concept. What is Linnean hierarchy? Distinguish between subspecies and race.

Part III
Paper V

1. Short Questions

- a) Differentiate between mutualism and symbiosis.
 - b) What is pasteurization?
 - c) Distinguish between pure and mixed culture.
 - d) Characterize the mature cyst of *Entamoeba histolytica*.
 - e) What is complement?
 - f) Define Major histocompatibility complexes.
 - g) What is molecular mimicry?
 - h) What is Epitope?
2. Briefly describe the causative organism of filariasis. Comment on the pathogenicity of *Entamoeba sp.* Add a note on the control measures of mosquito. What is rhabditiform larva?
3. a) State briefly the pathogenicity and control measures of cholera.
b) What is PKDL? Mention two symptoms.
c) State the necessity of sterilization in microbiological procedures.
4. a) Describe the different phases of the bacterial growth curve.
b) What are the symptoms of shigellosis?
c) Explain the advantages and disadvantages of using solid media. Name two commonly used methods of microbial control.
5. a) Who proposed the five kingdom classification? Explain it.
b) Give the composition and use of any two complex media.
c) State the necessity of sterilization in microbiological procedure.
6. Write short notes on
a) Innate immunity b) Natural Killer Cell c) Monoclonal antibody.
7. a) Discuss briefly the experiment of Benzer in rII locus of T4 bacteriophage to prove intraallelic recombination.
b) How can you apply cis-trans test to understand the allelic nature of two recessive mutants?
c) What is intraallelic complementation?

Part III

1. Short Questions

- a) Distinguish between parasites and parasitoids.
 - b) What is zoonosis? Give an example of each of a zoonotic protozoan and helminth disease.
 - c) Distinguish between soft ticks and hard ticks.
 - d) Define symbiosis with an example.
 - e) Distinguish between realized and potential natality.
 - f) Comment on carrying capacity.
 - g) Define biotic potential.
 - h) What is animal translocation?
 - i) What do you mean by telemetry?
 - j) Comment on apparent lopsidedness in the light of biodiversity.
 - k) Justify the statement 'Golden Freedom in wilderness'.
 - l) What is cladogram?
 - m) Define apomorphy.
 - n) What is sister group.
 - o) What do you mean by PM_{2.5}?
2. a) State the role of mosquitoes as vectors of human diseases.
- b) How can you differentiate bacteria on the basis of the chemical composition of their cell wall?
- c) Rate of respiration of fishes and their frequencies are given. Find out the mean of this data:
- | | | | | | | | | |
|----------------------|------|-------|-------|-------|-------|-------|-------|-------|
| Rate of respiration: | 1-10 | 11-20 | 21-30 | 31-40 | 41-50 | 51-60 | 61-70 | 71-80 |
| Frequency | 3 | 11 | 7 | 4 | 10 | 5 | 7 | 3 |
3. a) Briefly discuss the logistic and exponential growth forms.
- b) What is ecological pyramid?
- c) When can this ecological pyramid be inverted?
4. a) Differentiate between *in-situ* and *ex-situ* conservation.
- b) Correlate the concept of sustainable development in the light of conservation.
- c) Describe the recent strategies of *in-situ* conservation.
5. a) Define taxon.
- b) Mention the importance of taxonomy in studying biology.
- c) What is systematic? Distinguish between phenetic and cladistic systematic.
6. a) Discuss in details the concept of Noosystem.
- b) Define DNA Barcoding in the context of biodiversity.

Part III
Paper V, Unit I

1. Short Questions

- a) Distinguish between infestation and infection.
 - b) Define symbiosis.
 - c) What is a pure culture?
 - d) Who proposed the Five-kingdom classification? Mention its drawback.
 - e) Name one disease each caused by hard and soft ticks.
 - f) What is MAC(member attack complex)
 - g) Distinguish between affinity and avidity.
 - h) All immunogens are antigens but the reverse is not true. Justify.
2. a) Mention four different types of culture medium.
b) Name two techniques of isolating microorganisms in culture.
c) Mention two characteristics of microorganisms.
d) State two methods of controlling microorganisms.
e) Make a brief note on any one biochemical method of identifying bacteria.
3. a) Define Sterilization. Mention one chemical and one physical method of sterilization.
b) What is shigellosis?
c) How can you classify bacteria based on staining properties? Enumerate the differences between their cell wall structures.
4. a) Mention the pathogenicity and symptoms of the disease caused by *Vibrio cholera*.
b) Differentiate between the *Anopheles*, *Culex* and *Aedes* spp.
c) Mention the control measures of mosquitoes.
5. a) Define primary and secondary host with examples.
b) What do you understand by extra-intestinal amoebiasis? What is amoebuli?
c) What is the mode of infection of *Entamoeba* sp. and *Wuchereria* sp.?
d) What is haemozoid pigment?
6. a) Explain the two complement pathways associated with the adaptive and innate immunity.
b) Write the relation of TCR with MHC.
7. a) Explain the structure of monomeric immunoglobulin with diagram.
b) Define adjuvant.
c) What is epitope?

Part III

1. Short Questions

- a) Explain commensalism.
- b) What do you mean by obligatory parasite and facultative parasite?
- c) What is encystation process?
- d) What is elephantiasis?
- e) What is protooncogene?
- f) Why is p53 called the “guardian of the genome”?
- g) What is the function of lac Z and lac Y gene products?
- h) What is altruism?
- i) What is parental investment?

- j) What are instinctive & learning behavior?
 - k) Mention the advantage and disadvantage of arithmetic mean.
 - l) What do you mean by the term "panmictic"?
 - m) Define sustainable development?
 - n) What do you mean by photochemical smog?
2. a) Classify immunoglobulin and name the most abundant immunoglobulin in human system.
 b) With proper illustrations describe briefly the structure of an immunoglobulin.
 c) What type of products would you expect with the following partial heterozygotes of *E. Coli* for lac operon in presence or absence of lactose and why?

	Genotype	Uninduced		induced	
A.	$i^s p^+ o^c z^- y^+$ $i^+ p^+ o^+ z^+ y^-$	β -gal(z)	β -per(y)	β -gal(z)	β -per(y)
B.	$i^- p^+ o^c z^+ y^-$ $i^+ p^+ o^+ z^- y^+$				

- 3. a) What are restriction endonucleases? Why are they so important in recombinant DNA technology? What is pUC19?
 b) Distinguish between an IS and a transposon. What is MPF?
 c) What do you mean by the positive and negative control of lac operon?
- 4. Comment on the conservation of natural resources. Write in brief the strategies of Golden Freedom in Wilderness.
- 5. Describe the concept of Plate tectonics in relation to the major events under geological records. Illustrate the strategies of *in-situ* conservation.
- 6. Define biodiversity. Explain the types of biodiversity with special reference to α , β , γ diversity. How Biodiversity is related to human welfare?
- 7. a) What is FAP? Give example.
 b) Why are the male fishes mostly paternal?
 c) Why does the bee-eater son rear its siblings without breeding.
- 8. a) Name the scientist who deciphered the dance language in bees.
 b) What are round dance & waggle dance?
 c) What is supernormal stimuli? Give example.
 d) State Hamilton's Rule.
- 9. Give a short account on the biology and nature of damage caused by a paddy pest. How can this pest be controlled? Write the example of a common stored grain pest, a common insect pest and a common vegetable pest. Describe briefly the control measure of a common vegetable pest.

- 10. What is kala-azar? What is the cause and effect of it? describe the morphology, life cycle and pathogenicity of it.
- 11. Calculate the mean, median and mode from the following data of marks obtained by B.Sc. students

Marks	10-19	20-29	30-39	40-49	50-59	60-69	70-79
No. of students	5	19	10	13	4	4	2

State mathematically the relation between mean, median and mode.

- 12. a) The data recorded on the frequency of *A. aegypti*, *A. albopictus*, *C. Vishnu* and *A. stephensi* from a bog near Midnapur bus stand is presented below. Find out whether the species of mosquito appear in the ratio 1:1:1:1 applying chi square.

<i>A. aegypti</i>	:160
<i>A. albopictus</i>	:142
<i>C. Vishnu</i>	:136
<i>A. stephensi</i>	:114

Critical χ^2 values : $\chi^2_{0.05(2)} = 5.99$; $\chi^2_{0.05(3)} = 7.82$; $\chi^2_{0.05(4)} = 9.49$

b) Observe the following hypothetical populations and state which populations are in H.W.F.

Population	Genotype		
	DD	Dd	dd
1	250	500	250
2	0.33	0.33	0.33

Part III

1. Short Questions

- What is Assemblage protection?
- What are the full forms of BRP and MAB
- Define wild life.
- What is negative frequency dependent selection? State with example.
- How neutral mutation causes evolution of traits?
- What is positive selection? What is its relation with adaptation?
- What do you mean by homeostasis?
- What is tetanus?
- What is Q10?
- What is saponification number?
- What is a deoxyribose sugar? Give example.
- What is a motif?
- What is reservoir host? Give an example of a parasite that may occur in reservoir host.
- What is elephantiasis? Why is it called so?
- How can be the following parasites clinically detected: *Ascaris* sp., *Wuchereria* sp., *Plasmodium* sp.
- What is sense strand?
- What is ribozyme?
- State the function of telomerase.

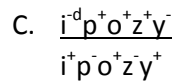
Group A

- What do you mean by Biosphere reserve? What is the recent technique of maintaining this reserve?
 - What are the objectives of Project Tiger? Why maximum tigers are available in Sunderban area?
- Briefly describe the strategy of *in-situ* conservation.
 - Comment on the levels of conservation by WWF.
- What is Kala-azar? State the life cycle of the causative organism of the disease. Mention the pathogenicity and clinical features of the disease.

Group B

- Is lactose the actual inducer of Lac operon. What do you mean by positive and negative control in Lac operon.
 - What are check points? Why are they called so?

Genotype	Uninduced		induced	
A. $i^s p^+ o^c z^+ y^-$	β -gal(z)	β -per(y)	β -gal(z)	β -per(y)
$i^+ p^+ o^+ z^- y^+$				
B. $i^+ p^+ o^c z^- y^+$				
$i^d p^+ o^+ z^+ y^-$				



6. a) State one important function of the following
 i) SSB ii) dnaC iii) Ligase iv) RNase H v) ori C
 b) What do you mean by abortive initiation.
 c) Distinguish between:
 i. RNA polymerase core enzyme and RNA polymerase holoenzyme.
 ii. Open promoter and closed promoter
 iii. Primosome and Replisome
 iv. Eukaryotic and prokaryotic initiation of translation
7. a) What do you mean by natural selection? Is it only the survival of the fittest?
 b) Why nonrandom mating and drift cause alterations in Hardy-Weinberg equilibrium?
 c) Describe the roles of inversion and duplication in creating variation for evolution.
8. a) Mention the main difference between classical and operant conditioning.
 b) What do you mean by Fixed Action Pattern? Explain with example.
 c) Write the definitions of following (any two)
 i. Circadian rhythm ii. Free running period iii. Mullerian mimicry

Group C

9. a) Define neurotransmitter.
 b) What is refractory period?
 c) What is hyperpolarization?
 d) Describe the role of calcium in skeletal muscle contraction.
10. a) State the significance of oxygen dissociation curve.
 b) State the visual pathway by using a flow chart.
 c) Describe how an electrical impulse is generated in the rod cells of retina.
11. a) Differentiate between fibrous and globular protein.
 b) Describe the α -helical structure of protein.
 c) What are pyranose and furanose ring structures?
 d) What do you mean by essential amino acids?
12. a) Differentiate between saturated and unsaturated fatty acids.
 b) What are homoglycans and hetroglycans? Give examples.
 c) Explain peptide linkage with a diagram.
 d) 'Sucrose is a non-reducing disaccharide'. Justify.

Part III
Paper V(Group A)

1. Short Questions

- a) What are the differences between *ex-situ* and *in-situ* conservation?
 - b) What are the aims of conservation?
 - c) What do you understand by wild life?
 - d) What is Agenda 21?
 - e) What is decibel?
 - f) Define wetland.
 - g) Name the biodiversity hotspots in India.
2. a) State briefly the features of autotrophic and heterotrophic successions.
b) Distinguish between density dependent and density independent factors.
c) what do you understand by Megadiversity countries and Biodiversity Hot Spots?
3. a) Give a brief account of the causes and consequences of global warming. What is photochemical smog?
b) Explain biomagnifications with data.
4. a) Explain briefly how J-shaped growth curve differs from S-shaped one. Add a note on cohort.
b) Name the factor that largely determines carrying capacity of a population. What is a K-selected population?
5. Write explanatory notes on the following (any two)
- a) Wildlife of Sundarbans
 - b) Concept of climax.

Group B

1. Short Questions

- a) What is a starter culture? Give example.
 - b) What do you mean by amoebiasis?
 - c) What are the symptoms of cholera?
 - d) Name two enzymes used in ELISA?
 - e) Give the full form of RIA and ELISA.
 - f) What is the causative agent of filariasis?
2. a) State briefly the causative organisms and pathogenecity of Shigellosis.
b) What is pasteurization?
c) State one anti-adult and one anti-larval method of control of mosquito.
3. a) Distinguish between bacillary and amoebic dysentery.
b) Differentiate between *Anopheles* spp., *Aedes* spp. And *Culex* spp.
c) Describe briefly the process of formation of yoghurt or cheese.
d) State two control measures of Shigellosis.
4. a) What are the common types of malaria that occur in human? Describe the human cycle of any malarial parasite studied by you.
b) What are the common control measures of Leishmaniasis and malarial disease?
5. a) Give an account of obligatory and facultative parasitism.
b) Describe the life-cycle of *Wuchereria bancrofti* using word diagram only. How can the infection of *W. bancrofti* be detected? State the pathogenecity of *Wuchereriasis*.
6. Write notes on encystations and excystation of *Entamoeba* sp. What is its mode of infection? State the clinical features of its infection. Describe the structure of trophozoite and cystic stage of *Entamoeba*.

7. a) Distinguish between affinity and avidity.
- b) State briefly the types and function of different Ig molecules.
- c) Give a diagrammatic representation of a typical Immunoglobulin.
8. a) Explain the two complement pathways associated with the adaptive and innate immunity.
- b) Write the relation of TCR with MHC.

Part III
Paper VI (Group A)

1. Short Questions

- a) What is Pribnow box?
- b) What are check points in cell cycle?
- c) What are palindromic sequences? Give an example.
- d) Define ribozyme with an example.
- e) What is puc19?
- f) What are tumor promoters?
- g) What is the fundamental difference between DNA polymerase and Taq DNA polymerase?
- h) State one difference between a cDNA library and a genomic library.
2. a) What are restriction endonucleases. Why are they so important in recombinant DNA technology?
- b) Distinguish between an IS and a transposon.
- c) What is a retroposon?
3. a) What is MPF and what is its role in cell cycle?

	Genotype	Uninduced		induced	
A.	$i^+p^+o^c z^+y^-$ $i^+p^+o^+z^-y^+$	β -gal(z)	β -per(y)	β -gal(z)	β -per(y)
B.	$i^+p^+o^c z^+y^+$ $i^+p^+o^+z^+y^-$				
C.	$i^-d p^+o^+z^+y^-$ $i^+p^+o^+z^-y^+$				

4. a) Enumerate 4 differences between prokaryotic and eukaryotic translation.
- b) State briefly the charging of tRNA in *E. coli*
- c) What is polysome?
5. a) What do you mean by open promoter and close promoter?
- b) DNA polymerases are only able to synthesize DNA in the presence of both a template strand and a primer strand. What are the functions of the two strands?
- c) How do endonucleases and exonucleases differ?
6. a) Explain with the help of examples, what do you mean by prototroph and auxotroph?
- b) A geneticist studying the pathway of synthesis of phenylalanine in *Neurospora* isolated several mutants that require phenylalanine to grow. She tested whether each mutant would grow when provided additives that believed were in the pathway of phenylalanine synthesis (see table), a plus(+) indicates growth and minus(-) indicated the lack of growth in the 3 mutants tested. What type of products would you expect with the following partial heterozygotes of *E. coli* for lac operon in presence or absence of lactose and why?

	Additive			
	Phenylpyruvate	Prephenate	Chorismate	Phenylalanine
Wild type				
Mutant-1				
Mutant-2				
Mutant-3				

7. a) What is C-value? Why is it regarded as a paradox?
b) What are LINES and SINES?
c) What do you mean by inverted repeats, long terminal repeats and direct repeats?
8. a) Sickle cell anemia is caused by missense mutation – do you support? Give reasons. What is the problem with one gene one enzyme hypothesis?
b) Write about the treatments of thalassemia.

Group B

1. Short Questions

- a) What is iodine number of fats?
 - b) State the steps of formation of phosphoenol pyruvate from pyruvate.
 - c) What is a multienzyme complex?
 - d) What is the significance of K_m ?
 - e) How many moles of ATP will be formed from complete oxidation of glucose under aerobic condition?
 - f) Give example of a physiological process utilizing the principle of Donnan membrane equilibrium.
 - g) What do you mean by gated channels?
 - h) What is action potential?
2. a) State the role of calcium in the regulation of muscle contraction.
b) Explain why propagation of nerve impulse is faster in myelinated than in unmyelinated nerve fibres.
c) What are R and T states of hemoglobin?
3. a) Describe the mechanism of phototransduction.
b) How are the hair cells of Organ of Corti stimulated?
c) State with a flow chart how does auditory impulse travel from cochlea to auditory cortex.
4. a) What is β -oxidation? How many molecules of acetyl CoA will be produced from the β -oxidation of a C_{19} fatty acid?
b) What happens when $[S] \gg K_m$, $[S] = K_m$ and $[S] \ll K_m$?
c) What is peptide bond?
d) Explain EC number.
5. a) Explain the roles of glycogen branching and debranching enzymes in glycogen synthesis and catabolism.
b) Define the term ammunotelic. Give example.
c) What is the significance of glucose phosphorylation?
d) Give examples each of an anion and a cation exchanger.
6. a) Name the source of N and C in the urea cycle. Briefly describe this cycle.
b) What is the basic difference between transamination and deamination?
c) Describe the role of pyridoxal phosphate in transamination.
d) What are allosteric enzymes?

7. a) Differentiate between (any two)
 - i. Native and SDS PAGE
 - ii. α -helix and β -pleated sheet
 - iii. Competitive and non-competitive enzyme inhibition.
- b) What is the significance of prosthetic groups in enzymes?
- c) What is a chiral centre? State the possible number of stereoisomers of an aldose and ketose sugar each containing 5 carbon atoms.
- d) Comment on pyruvate dehydrogenase complex.
8. a) Write notes on any two
 - i) JG apparatus
 - ii) Oxygen dissociation curve
 - iii) Synaptic transmission
 - iv) Structure and function of voltage-gated sodium channel.

Part III
Paper VII(Group B)

1. Short Questions
 - a) What do you understand by the term 'throwing' in the context of sericulture?
 - b) What is bee space in perspective of apiculture?
 - c) Define stifling.
 - d) What is pest?
 - e) Write notes on contact insecticide.
 - f) Write the scientific names of one vegetable pest and one common stored grain pest.
 - g) What is systemic insecticide?
2. Give an example of jute stem weevil. How does this pest cause damage to their host plant? What is jute? Describe the life-cycle of the pest. Suggest an integrated schedule for controlling jute pest.
3. What are the common grains that can be infested by stored grain pest? State its i) infective stage, ii) time of damage and iii) nature of damage to the grains. Describe the life-cycle and control measures of the pest.
4. a) What is apiculture? Describe the members of bee colony.
b) What is silk? Describe the life history of *B. mori*. Comment on silk gland.
5. a) Write short notes on the application of biotechnology and its prospect in sericulture.
b) What are the defects of indigenous methods? Comment on honey and bee wax.
6. a) What is pest management? What is agroecosystem? Briefly comment on mechanical mode of pest management.
b) What is IPM? Briefly illustrate the critical issues of IPM.
7. a) What do you understand by the term dairy management? Comment on tools of management.
b) Briefly describe the types of calf housing. What is weaning and what are the advantages?
8. a) What is poultry? How many types of breed are found? Comment on Indian breed.
b) Write a short note on diseases and preventive measures.

Group A

1. Short questions

- a) What do you understand by the term Geological time scale?
 - b) What is zoogeography?
 - c) What is protobiogenesis?
 - d) Define coacervate.
 - e) Define α -taxonomy and β -taxonomy.
 - f) What is punctuated equilibrium?
 - g) What is the difference between Mullerian and Batesian mimicry?
2. a) What do you mean by Hamilton's inequality? How this can explain altruistic behavior?
b) Discuss whether Hamilton's inequality can explain cooperation between nonrelatives.
3. a) Comment on the distribution of animal in time and space.
b) What are barriers? How many types of barriers are there? Comment on the filter bridge barrier in connection with discontinuous distribution.
4. a) Mention the disadvantages of the most accepted species concept.
b) Differentiate between sibling species and subspecies with appropriate examples.
c) In what way micro-taxonomy differ from macro-taxonomy?
5. Write about the methods by which worker bees communicate with their hive mates about the source of pollen. How can they communicate physiologically? Mention how natural selection shapes this phenomenon in bees.