

M.Sc. 3rd Semester Examination, 2023

PHYSIOLOGY

(*Human Physiology*)

PAPER – PHY-303(A1,A2,B1,B2,C1,C2,D1,D2)

Full Marks : 50

Time : 2 hours

Answer **all** questions

The figures in the right hand margin indicate marks

*Candidates are required to give their answers in
their own words as far as practicable*

Spl. Paper : *Microbiology and Immunology*

PAPER – PHY-303.A1

[Marks : 20]

A . Answer any *two* questions of the following :

1. What is PCR cycle in photosynthesis? ^{2 × 2}

2. Mention two reasons for xenobiotic compounds to be recalcitrant in nature. 1 + 1
3. What is the importance of nitrogen fixing cyanobacteria in BNF ? 2
4. What is sporadic outbreak diseases ? 2

B. Answer any *two* questions of the following : 4 × 2

5. What are xenobiotic compounds ? Why are they considered as environmental pollutants ? 1 + 3
6. What is the significance of nitrogen cycle on earth ? Mention the major processes involved in this cycle along with microbial candidates participating in each process. 1 + 3
7. What is infection ? What are the major features of bacterial infections ? What is colonization ? 1 + 1 + 2
8. What is meant by biohydrometallurgy ?

What is organic acidolysis in metal bioleaching procedure ? Mention two important microbial parameters that influence leaching environment. 1 + 2 + 1

C. Answer any *one* question of the following : 8 × 1

9. Write notes on :

(i) Bioremediation

(ii) Biological Nitrogen Fixation reaction. 4 + 4

10. What is meant by indigenous microbiota ? What is its importance ? Write a brief note on opportunistic infections. What are endogenous diseases ? 3 + 1 + 3 + 1

PAPER – PHY-303.A2

A . Answer any *two* questions of the following : 2 × 2

1. What do you mean by redundancy and pleiotropy properties of cytokines ? Give example. 1 + 1

2. Discuss the structure and function of class-I MHC molecule. 1 + 1
3. How does apoptosis differ from necrosis ? 2
4. What are meant by positive and negative selection ? 1 + 1

B. Answer any *two* questions of the following :

- 4×2
5. Briefly explain the endocytic pathway of antigen processing and presentation.
 6. Explain the process of T-cell and B-cell co-operation.
 7. Draw and discuss the receptor and co-receptor molecules present on the T-helper and T-cytotoxic cell surface with their function.
 8. How does VDJ recombination take place for heavy chain of the immunoglobulin molecule ?

C. Answer any *one* question of the following : 8×1

9. (i) What are caspases ?

(ii) Briefly explain the mitochondrion-dependent apoptosis pathway. $2 + 6$

10. (i) Describe the direct pathway of graft rejection.

(ii) What is T-cell anergy ? $6 + 2$

[Internal Assessment – 10 Marks]

**Spl. Paper : *Biochemistry, Molecular
Endocrinology and Reproductive
Physiology***

PAPER – PHY-303.B1

[Marks : 20]

A . Answer any *two* questions of the following : 2×2

1. What is glycocalyx ? 2

2. Mention the different checkpoints of cell cycle. 2
3. What is unlimited proteolysis ? 2
4. What are the clinical symptoms of Gaucher disease ? 2

B. Answer any two questions of the following : 4 × 2

5. Describe the biochemical changes in apoptosis. What is apoptosome ? How do you prevent food borne diseases ? $1 + 1\frac{1}{2} + 1\frac{1}{2}$
6. What is Biological Nitrogen Fixation ? Write a brief note enzymology of nitrogen fixation. 1 + 3
7. State critically the catalytic mechanism of serine proteases. 4
8. How does p53 regulate cell cycle and apoptosis ? 4

C. Answer any *one* question of the following :

8 × 1

9. Elaborate your idea on membrane proteins. Distinguish between FRAP and FLIP ?

4 + 4

10. What is START in budding yeasts ?
What are Complexes of cyclins and CDKs.

2 + 2 + 4

PAPER — PHY-303.B2

A . Answer any *two* questions of the following :

2 × 2

1. What are paracrine signaling ?

2. What are the phases of spermiogenesis ?

3. What is Von Gierke disease ?

4. What is bipotential gonad during gestation ?

- B. Answer any *two* questions of the following: 4 × 2
5. Mention the receptor types and subtypes of GPCR and state the interaction of α_s with adenylate cyclase with a suitable diagram. 1 + 3
6. What is the role of increased PRL secretion in immunomodulation in response to stress? 4
7. Discuss critically the genetic control of ovarian determination mentioning the role of different transcription factors. 4
8. Write down the effect of oxidative stress in age-related fertility decline and menopause in female. 4

- C. Answer any *one* question of the following : 8 × 1
9. State the principle and assay procedure of Sandwich ELISA. Mention the advantages and disadvantages of ELISA technique. 2 + 3 + 3
10. Describe the cytokine activated JAK/STAT signaling path way. How insulin-secretion is regulated in our body ? 5 + 3

[Internal Assessment – 10 Marks]

Spl. Paper : *Biophysics and Electrophysiology with structural biology*

PAPER – PHY-303.C1

[Marks : 20]

- A . Answer any *two* questions from the following : 2 × 2
1. Mention the features of facilitated diffusion. 2

2. What is the difference between 1st order and 2nd order reaction ? 2
3. Explain ion-dipole interaction with suitable examples. 2
4. What is Lewis dot structure ? Give examples. 1 + 1

B. Answer any *two* questions from the following : 4 × 2

5. Explain the relationship between surface tension and change of force with equations. Classify different interface of surface tension. 3 + 1
6. "For Newtonian fluids, shear stress linearly varies with the shear rate" Justify the statement. What is viscous-plastic fluid ? 2 + 2
7. What is molecular orbital theory ? Write the SI unit of Planck's constant. 2 + 2

8. Write the principle of SDS-PAGE. What is the role of β -mercaptoethanol in SDS-PAGE ? 2 + 2

C. Answer any *one* question from the following : 8 \times 1

9. Define zone electrophoresis. Mention the difference between zone electrophoresis and moving boundary electrophoresis. Define electrophoretic mobility. Mention the factors affecting electrophoretic mobility. 2 + 2 + 2 + 2

10. Describe the features of electron generation system of SEM. Which types of methods are adopted for 3D data processing in SEM. Write down the characteristic features of TEM. Which types of electrons are generated when an electron beam strike on a sample ? 3 + 2 + 1 + 2

PAPER – PHY-303.C2

A. Answer any *two* questions from the following :

1. Briefly explain the second law of thermodynamics in the light of bioenergetics. 2×2 2
2. Why heat capacity is an important property of water ? 2
3. Why fluidity of cell membrane is so important ? What is flippase ? 2
4. Mention the general features of the components present in an active site of enzymes. 2

B. Answer any *two* questions from the following :

5. Write briefly about the Helmholtz electrical double layer model. 4×2 4
6. Briefly mention the role of cholesterol in cell membrane. What types of carbohydrates are present in cell membrane surface. 3 + 1

7. Define zeta potential. Mention the factors that affect zeta potential. 2 + 2
8. What is allosteric site of an enzyme? Briefly describe the 'Induced Fit Hypothesis' of enzyme. 1 + 3

C. Answer any *one* question from the following:

9. What is Gibbs Free Energy? How exergonic and endergonic reaction are responsible for progression of bioenergetic reaction? How does ATP perform cellular functions? What is the difference between potential and kinetic energy? 8×1
1 + 3 + 2 + 2
10. What is liposome? Mention the characteristics of large unilamellar vesicles (LUV) and small unilamellar vesicles (SUV). Mention the therapeutic application of liposome. 2 + 4 + 2

[Internal Assessment – 10 Marks]

Spl. Paper : Neurophysiology

PAPER – PHY-303.D1

[Marks : 20]

A . Answer any two questions from the following :

1. What are the kinesin and dynein ? 2 × 2
2
2. Name two developmental disorders based on the incomplete neural tube formation. What do you mean by neurulation ? 1 + 1
3. What is radial sorting ? 2
4. What are meant by autoreceptors and heteroreceptors ? 2

B. Answer any two questions from the following :

5. Briefly describe the spinal cord development. 4 × 2
4

6. Compare the type I and type II synapse. What are the criteria to consider a substance as a neurotransmitter? 2 + 2
7. Which glial cell plays a vital part in neuro-immuno modulation? Which type of cells of CNS form a permeable barrier between CSF and tissue fluid? Briefly describe the development of neural cells and supporting cells from the progenitor cells. 1 + 1 + 2
8. Describe the molecular structure and functions of NMDA receptors. 2 + 2

C. Answer any *one* question from the following :

8 × 1

9. Describe the molecular mechanism of vesicular docking and release at the presynaptic end. What do you know about the post synaptic thickening? What is meant by active zone? 4 + 3 + 1

10. (a) What do you mean by ionotropic and metabotropic receptors ? 4
- (b) Describe the molecular structure of nAChR. Describe the structural changes of nAChR after binding of ligand to it. (4 + 2)

PAPER – PHY-303.D2

- A. Answer any *two* questions from the following : 2 × 2
1. Name the molecules which can inhibit the presynaptic acetylcholine release and the postsynaptic binding of acetylcholine to its receptors. 1 + 1
 2. Define homeobox gene. Which protein is involved in the ventralization of *Drosophila* embryo ? 1 + 1

3. What is the function of nestin ? 2

4. Define cDNA library. What are neurotrophins ? 1 + 1

B. Answer any *two* questions from the following : 4 × 2

5. Define EPP. What is syncytial blastoderm ? What is energids ? 2 + 1 + 1

6. Briefly describe the distribution of serotonergic neurons in the brain. What is radial glial cell ? 3 + 1

7. Compare the action potential of cardiac muscle and skeletal muscle. 4

8. Describe the expression regulation of Hunchback and Caudal protein in *Drosophila melanogaster*. 2 + 2

C. Answer any *one* question from the following :

8 × 1

9. What do you mean by Cross-bridge formation ? Elaborate on the molecular mechanisms of skeletal muscle contraction.

2 + 6

10. Explain the anterior-posterior axis formation in *Drosophila melanogaster* embryo. What do you mean by cellular blastoderm ?

2 + 6

[Internal Assessment – 10 Marks]