PG/IIIS/PHY/303(A_1,A_2,B_1,B_2, C_1,C_2,D_1,D_2)/24

M.Sc. 3rd Semester Examination, 2024

PHYSIOLOGY

(*Human Physiology*)

PAPER – PHY-303(A_1,A_2,B_1,B_2,C_1,C_2,D_1,D_2)

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

PAPER : PHY-303A.1

GROUP – A

Answer any **two** questions from the following : $2 \times 2 = 4$

1. Name the different groups of compounds known as recalcitrant xenobiotic compounds. 2

2. What is leghemoglobin ? 2

3. Why is it difficult for microbes to colonise at the lower respiratory tract of humans ? 2

4. Name two properties of minerals that influence the microbial mineral mobilization. 2

GROUP – B

Answer any **two** questions from the following : $4 \times 2 = 8$

5. Write a note on denitrification. 4

6. Discuss biomagnification in the context of xenobiotic compounds. 4

7. Give a brief description of the rate-limiting enzyme of the Calvin cycle. Differentiate between oxygenic and anoxygenic photosynthesis. 3 + 1

8. In normal microbial flora how do tissue specificity in the host get preference for their persistence ? 4

GROUP – C

Answer any **one** question from the following : $8 \times 1 = 8$

9. What is bioleaching ? What is its importance ? How do microorganisms participate in the process of bioleaching ? Name one microbe studied in bioleaching of ore. 2 + 1 + 4 + 1

10. Discuss the mode of action of enzyme nitrogenase along with its structural features. What is *nif* ? (4 + 3) + 1

PAPER : PHY-303A.2

GROUP – A

Answer any **two** questions from the following : $2 \times 2 = 4$

11. Write a short note on 'Caspases'. 2

12. What is the role of thymus in T-cell development ? 2

13. Write down the role of RAG proteins in antibody diversity. 2

14. Write down the role of IL4 and IL5. 1 + 1

GROUP – B

Answer any **two** questions from the following : $4 \times 2 = 8$

15. Write a short note on CD4+ Helper T cell. 4

16. Give an overview of antigen processing and presentation by macrophages. 4

17. How does complement activation contribute to the body's defence against pathogens ? 4

18. Draw a suitable labelled diagram of IgG molecule. 4

GROUP – C

Answer any **one** question from the following : $8 \times 1 = 8$

19. Write down the structures and functions of MHC-I and MHC-II molecules. How does MHC molecule act as histocompatibility complex ? $(3 + 3) + 2$

20. Describe the role of p53 in apoptosis. Discuss how exogenous antigens trigger immune responses ? What is meant by 'Tumor Necrosis Factor Receptor superfamily' ? $3 + 3 + 2$

[Internal Assessment – 10 Marks]

PAPER : PHY-303B.1

GROUP – A

Answer any **two** questions from the following : $2 \times 2 = 4$

1. What is FRAP ? 2

2. What is campylobacteriosis ? 2

3. What is unlimited proteolysis ? 2

4. What are cancer stem cells (CSCs) ? 2

GROUP – B

Answer any **two** questions from the following : $4 \times 2 = 8$

5. State briefly the contributions of protein and lipid in maintaining the heterogeneity of cell membrane. 2 + 2

6. Describe briefly the mechanism of mitrochondria-mediated pathway of apoptosis. What is apoptosome ? 3 + 1

7. Mention the use and importance of Single Nucleotide Polymorphism (SNP) ? What is Tandem Repeat Polymorphism ? 2 + 2

8. What is PrPc ? How protein misfolding causes neurodegenerative disease ? 1 + 3

GROUP – C

Answer any **one** question from the following : $8 \times 1 = 8$

9. What are cyclins and cyclin-dependent kinases (CDKs) ? State the Mitogen-dependent and independent phases of the cell cycle. Mention the role of ubiquitin-protein ligase-SCF and APC/C in the control of the cell cycle. $2 + 3 + 3$

10. Mention the name of trypsin family of serine protases. State critically the mechanism of serine proteases. Illustrate the role of cytoskeleton in cell motility. $1\frac{1}{2} + 3\frac{1}{2} + 3$

PAPER : PHY-303B.2

GROUP – A

Answer any **two** questions from the following : $2 \times 2 = 4$

11. Distinguish between autocrine and paracrine signaling mechanisms. 2

12. What is sandwitch ELISA ? 2

13. Write two applications of confocal microscopy. 2

14. What is glycogen storage disease ? 2

GROUP – B

Answer any **two** questions from the following : $4 \times 2 = 8$

15. Write brief notes on G Protein Coupling and Ligand Binding of GPCRs. 2 + 2

16. Describe the process of spermatogenesis with special reference to maturation of spermatids. 4

17. Discuss critically the genetic control of test is development mentioning the role of different transcription factors. 4

18. Write the mechanism of action of on carbohydrate metabolism. 4

GROUP – C

Answer any **one** question from the following : $8 \times 1 = 8$

19. State the principle and assay procedure of Radio Immuno Assay (RIA). Mention its advantages and disadvantages. 2 + 4 + 2

20. Describe the intrinsic apoptotic mechanism during male germ cell development. Discuss the steps of in-vitro fertilization (IVF) and its complications. 3 + (3+2)

[Internal Assessment – 10 Marks]

PAPER : PHY-303C.1

GROUP – A

Answer any **two** questions from the following : $2 \times 2 = 4$

1. What is isoelectric focusing ? 2

2. Why is β-mercaptoethanol used in SDS-PAGE ? 2

3. What do you mean by order of a reaction ? Classify order of reaction. 1 + 1

4. Mention the different interfaces related to surface tension. 2

GROUP – B

Answer any **two** questions from the following : $4 \times 2 = 8$

5. Write down briefly about peptide bond. What is a chiral molecule ? 2 + 2

6. What is dipole–dipole interaction ? Mention the importance of hydrogen bonds in biological systems. 2 + 2

7. What is random walk in the light of diffusion dynamics ? Mathematically express 2nd Fick's law of diffusion. 2 + 2

8. Calculate the work done(W) in a blowing of liquid drop or soap bubble(Condition : The drop has one and the bubble has two free surfaces). Radius of the soap bubble is increased from R to 2R. Calculate the work done(W) in this process in response to surface tension. 2 + 2

GROUP – C

Answer any **one** question from the following : $8 \times 1 = 8$

9. Define electron affinity and electronegativity. Write a note on chemical bonds found in biological systems. Write the Lewis dot structure of H_2O and CCl_4. 2 + 4 + 2

10. "A polypeptide is a polymer of amino acids connected in a specific sequence". Justify the

statement. Critically explain the nature of protein folding. What are chaperons ? Write a short note on Ramachandan Plot. 2+2+1+3

PAPER : PHY-303C.2

GROUP – A

Answer any **two** questions from the following : $2 \times 2 = 4$

11. Briefly explain the redox reaction in relation to ETC. 2

12. Write down the importance of liposome. 2

13. What do you understand by membrane impedance and capacitance ? 1 + 1

14. Write down the third law of thermodynamics in relation to bioenergetics. 2

GROUP – B

Answer any two questions from the following : $4 \times 2 = 8$

15. How could you calculate Gibbs free energy ? Write a relationship between equilibrium and metabolism with a suitable example. 1 + 3

16. What is zeta potential ? Mention the factors that affect zeta potential. 2 + 2

17. Discuss briefly about the postulates of Hodgkin-Huxle 's model ? 4

18. With a schematic diagram briefly describe the features of active site of an enzyme. Classify enzymes according to their composition. 2 + 2

GROUP – C

Answer any one question from the following : $8 \times 1 = 8$

19. Describe the structure and function of gap junction. Mention the physicochemical properties of water with reference to its molecular structure. (2 + 2) + 4

20. Write a short note on 'Chemiosmotic Theory' of Peter Mitchell. With a suitable diagram describe the role of Complex-I for electron transportation during ATP synthesis in mitochondria. Which component of mitochondria is maintaining the proton motive force ? 3 + 4 + 1

[Internal Assessment — 10 Marks]

PAPER : PHY-303D.1

Special Paper : (*Neurophysiology*)

GROUP – A

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

1. What is dendritic apparatus ? 2

2. Which brain region is known as "reptile brain" ? Mention its two major functions. 1 + 1

3. What is perforated synapse ? 2

4. Name one serotonin and one GABA agonist. 1 + 1

GROUP – B

Answer any **two** questions from the following : $4 \times 2 = 8$

5. Which evolutionary factors make the human brain unique ? 4

6. Compare the symmetric and asymmetric synapses. 2 + 2

7. Briefly write about the activation of a metabotropic receptor upon a ligand binding, with suitable diagram(s). Give an example of such ligand, and its antagonist. 2 + 1 + 1

8. Write a brief note on the role of Sema3A and Slit in axonal pathfinding. 2 + 2

GROUP – C

Answer any **one** question from the following : $8 \times 1 = 8$

9. How do the sulcus and gyrus develop in human brain ? Briefly describe the limitations of human intelligence progression based on the brain evolution. 4 + 4

10. Describe the microtubular dynamics during the development of neuronal growth cone. Briefly explain the mechanism how guidance cues direct the spinal cord commissural axon development. 4 + 4

PAPER : PHY-303D.2

Special Paper : (*Neurophysiology*)

GROUP – A

Answer any **two** questions from the following : $2 \times 2 = 4$

11. Define muscle spindle. What is innervation number ? 1 + 1

12. Mention the serotonin and dopamine enriched regions of human brain. 1 + 1

13. What are energids ? 2

14. How does the chromatin to cytoplasm ratio regulate the larvae development of a *Drosophila* fly. 1 + 1

GROUP – B

Answer any **two** questions from the following : $4 \times 2 = 8$

15. Describe the ultrastructural integration of sarcomere to the muscle fiber membrane to become a functional unit of muscle. 4

16. Write a note on the biochemical pathway of GABA synthesis. 4

17. How do the mutations in Krüppel and fushi tarazu alter the *Drosophila* body plan during development ? 2 + 2

18. Write brief note on interneurons. 4

GROUP – C

Answer any **one** question from the following : $8 \times 1 = 8$

19. What is muscle torque ? How does the applied force and muscle length relate ? Describe the role of Ca^{2+} in the development of mEPP in the neuromuscular junction and in the quantal release of neurotransmitter that affect the amplitude of muscle contraction. 1 + 2+(3+2)

20. Explain the dorso-ventral axis formation in *Drosophila melanogaster* larvae. Mention the regulation of *oskar* and *pumilio* in the axis formation of it. 5 + 3

[Internal Assessment – 10 Marks]
