

**2023**

**M.Sc.**

**4th Semester Examination**

**HUMAN PHYSIOLOGY**

**PAPER : PHY-403A/C/E**

**( Microbiology and Immunology )**

*Full Marks : 40*

*Time : 2 hours*

*The figures in the right-hand margin indicate marks.*

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

*Illustrate the answers wherever necessary.*

**( 403A.1 )**

**( Marks : 20 )**

**SECTION—I**

**( MICROBIAL GENETICS : ADVANCED STUDIES )**

Answer from **all** the Groups as directed.

**GROUP—A**

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

2×2=4

1. What are non-coding RNAs? Mention their functions in cell. 1+1=2

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2. What are transposable elements? 2
3. What is Hfr? 2
4. Differentiate between euchromatin and heterochromatin. 2

### GROUP—B

Answer *any two* questions from the following :

4×2=8

5. Explain the steps involved in initiation of transcription in eukaryotes. 4
6. Draw the structure of a typical T4 bacteriophage. What is a virion? 3+1=4
7. Mention the function of telomerase during eukaryotic replication. What is satellite DNA? 3+1=4
8. What are the possible ways in which a lac operon operates? 4

### GROUP—C

Answer *any one* question from the following :

8×1=8

9. Briefly explain the process of transformation with example. Discuss the importance of post-transcriptional modifications in eukaryotes. 5+3=8
10. Describe the lytic cycle of viral reproduction. Draw the Cloverleaf model of a t-RNA molecule. 4+4=8

( 3 )  
( 403A.2 )

( Marks : 20 )

**SECTION—II**

**( CLINICAL IMMUNOLOGY )**

Answer from **all** the Groups as directed.

**GROUP—A**

Answer *any two* questions from the following :

2×2=4

1. What do you mean by immunotolerance? 2
2. What are oncogenes? 2
3. Explain delayed-type hypersensitivity with example. 1+1=2
4. What is AIDS? 2

**GROUP—B**

Answer *any two* questions from the following :

4×2=8

5. What causes mast cells to degranulate during type-I hypersensitivity? What is ADCC? 3+1=4

( 4 )

6. Differentiate between SEM and TEM.  $2+2=4$
7. Briefly explain direct and competitive ELISA. Write their applications.  $3+1=4$
8. Discuss the direct mechanism of graft rejection.  $4$

### GROUP—C

Answer *any one* question from the following :

$8 \times 1 = 8$

9. Describe the complete mechanism of inflammation. What are CAMs? Give example.  $5+3=8$
10. Discuss the clinical manifestations of one organ-specific and one systemic autoimmune disease. Classify vaccines with example.  $4+4=8$

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( 403C.1 )

( Marks : 20 )

**SECTION—I**

**( BIOCHEMISTRY, MOLECULAR  
ENDOCRINOLOGY & REPRODUCTIVE  
PHYSIOLOGY )**

Answer from **all** the Groups as directed.

**GROUP—A**

Answer *any two* questions from the following :

2×2=4

1. Describe the advantages and disadvantages of C-banding process. 2+2=4
2. What is detoxification of xenobiotics? 2
3. What is quantum dot? 2
4. State the clinical importance of non-functional plasma enzymes. 2

**GROUP—B**

Answer *any two* questions from the following :

4×2=8

5. Describe the chemical and electrical properties of nanomaterials.

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6. Describe the initiation process of eukaryotic replication.
7. Describe the cytokines of innate immunity stating their principal cell sources and biological effects.
8. Write a note on Quantum Confinement.

### GROUP—C

Answer *any one* question from the following :

8×1=8

9. Mention the advantages and disadvantages of enzyme immobilization. Discuss the different cross-linking methods of enzyme immobilization. 4+4=8
10. (a) State the difference between cytokines and growth factors.
- (b) What are different types of interferons and their biological functions?
- (c) Write notes on Type-I and Type-II cytokine receptors. 2+3+3=8

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( 403C.2 )

( Marks : 20 )

**SECTION—II**

Answer from **all** the Groups as directed.

**GROUP—A**

Answer *any two* questions from the following :

2×2=4

1. What is secondary hypertension?
2. Mention the microvascular complications of diabetes mellitus.
3. State the atherogenic effects of insulin.
4. What is Leydig cell aging?

**GROUP—B**

Answer *any two* questions from the following :

4×2=8

5. Describe the role of the renin-angiotensin system in the pathogenesis of essential hypertension.

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6. How does aging influence on testosterone synthesis and male sexual functions?
7. State the functions of angiotensin II mediated through the AT1 receptor.
8. Describe briefly the process of production of recombinant insulin.

### GROUP—C

Answer *any one* question from the following :

8×1=8

9. (a) State the correlation between intramuscular triglyceride concentration and insulin resistance.
- (b) Discuss the pathophysiologic features of macrovascular complications seen in diabetes mellitus. 4+4=8
10. (a) Discuss the effect of alcohol on Gamma-Glutamyl Transpeptidase (GGT).
- (b) Discuss critically the growth and endocrine effects of alcohol in our body. 3+5=8



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( 403E.1 )

( Marks : 20 )

**SECTION—I**

**( BIOPHYSICS AND ELECTROPHYSIOLOGY  
WITH STRUCTURAL BIOLOGY )**

Answer from **all** the Groups as directed.

**GROUP—A**

Answer *any two* questions from the following :

2×2=4

1. What is labelled-line coding of taste?
2. Define kinesiology. Classify it. 1+1=2
3. Write the 'water shift theory' in radiation damage. 2
4. Mention the different applications of CRO and AFM. 1+1=2

**GROUP—B**

Answer *any two* questions from the following :

4×2=8

5. Name three methods for pumping a laser. What is four-level laser? Briefly explain its working principle. 2+1+1=4

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6. What do you mean by Limits of Stability (LOS)? How could you calculate mechanical advantages? 2+2=4
7. Write down the principle of Atomic Force Microscopy (AFM). Mention the difference between contact and tapping modes of AFM. 2+2=4
8. With a suitable block diagram, describe the functional unit of CRO. 4

### GROUP—C

Answer *any one* question from the following :

8×1=8

9. How does radiation therapy work for cancer treatment? How could you calculate the atomic number (Z) of any atom? Establish a link between decay energy (Q) and binding energy ( $E_{ij}$ ) for beta ( $\beta$ ) particle release. Write a short note on electron capture. 2+1+2+3=8
10. Explain the construction and working principle of Ruby laser. What is the wavelength of light  $\text{CO}_2$  and Ruby laser? What is Q-switching in a laser? (2+2)+2+2=8

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( 403E.2 )

( Marks : 20 )

**SECTION--II**

Answer from **all** the Groups as directed.

**GROUP—A**

Answer *any two* questions from the following :

2×2=4

1. What is Partition Coefficient?
2. Write two applications of an ultracentrifuge.
3. Briefly state the first law of photochemistry.
4. Why is nuclear medicine so important?

**GROUP—B**

Answer *any two* questions from the following :

4×2=8

5. What are Miller indices? Write the difference between Face Centred Cubic (FCC) and Body Centred Cubic (BCC) structures. 2+2=4
6. What is density gradient centrifugation? Write the factors on which the sedimentation coefficient depends. 2+2=4

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7. Justify Beer Lambert law in relation to photochemistry. State Stark Einstein's law of photochemistry.  $2+2=4$
8. How does the body pH affect the efficacy of magnetic field during body magnetic treatment in different diseases? Mention the biological importance of magnetite present in brain.  $2+2=4$

### GROUP—C

Answer *any one* question from the following :

$8 \times 1 = 8$

9. Write the principle of ion-exchange chromatography. What are the detection systems used in paper chromatography? Mention the factors which affect the efficiency of column chromatography. What is isocratic elution?  $2+2+2+2=8$
10. With a suitable diagram, explain the nature of energy state transformation by Jablonski. What is Stern-Volmer equation? Explain the nature of 2<sup>nd</sup> class lever systems present in human body in relation to biomechanics.  $4+1+3=8$

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