

M.Sc. 3rd Semester Examination, 2019

**HUMAN PHYSIOLOGY**

PAPER – PHY-303

*Full Marks : 40*

*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*

*Illustrate the answers wherever necessary*

[Special Paper : *Microbiology and Immunology*]

UNIT—PHY-303A.1

[ *Marks : 20* ]

1. Answer any *two* questions from the following :  $2 \times 2$

- (a) Mention two defects observed in 'germ free' animals. 1 + 1

( *Turn Over* )

- (b) What is 'staph-protected' infection ? 2
- (c) Why xenobiotic compounds are considered as pollutants ? 2
- (d) Name the nitrogen-fixing free living cyanobacteria and facultative anaerobe. 1 + 1

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

4 × 2

- (a) What is nitrification ? Write down the reaction sequence in nitrification along with bacteria involved in this process. 4
- (b) What is C3 cycle ? Why is it called so ? Name the rate limiting enzyme for this cycle. 1 + 2 + 1
- (c) Define indigenous microbiota with example. Mention two beneficial effects of normal flora of human. 2 + (1 + 1)
- (d) Why xenobiotic compounds are not generally biodegradable ? What is co-metabolism ? Name the different groups of recalcitrant xenobiotic compounds. 1 + 1 + 2

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

(a) (i) What is infection ? Differentiate 'viral' and 'bacterial' infection patterns.

(ii) What is invasiveness by pathogens ? Mention the different modes of invasiveness adopted by the pathogens.

$$1 + (1\frac{1}{2} + 1\frac{1}{2})(2 + 2)$$

(b) (i) What is biomining ?

(ii) Mention the basic mechanisms for metal mobilization by microorganisms.

(iii) State the characteristics of most studied bacteria in bioleaching.

(iv) Name one fungus and one archaean involved in bioleaching.  $2 + 2 + 2 + 2$

UNIT—PHY-303A.2

[ Marks : 20 ]

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

(a) What are lymphokines ? 2

- (b) What is death receptor ? 2
- (c) What is T cell anergy ? 2
- (d) What types of fragments will you get if you digest an IgG with papain and pepsin ? 1 + 1

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

- (a) Discuss in brief the role of TH cells in activation of B-cells and macrophages. 2 + 2
- (b) Write briefly on characteristics and function of five classes of antibody molecules. 4
- (c) Define apoptosis. Give a brief outline of the intrinsic pathway of apoptosis. 1 + 3
- (d) Describe briefly the molecular nature and function of CD<sub>4</sub>. 2 + 2

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

- (a) (i) What is MHC ? What is its importance ?
- (ii) Give a brief description of the functions of different classes of MHC.  $(2 + 2) + 4$

- (b) (i) What are cytokines? How cytokine production is triggered?
- (ii) Mention the cytokine-dependent immune responses generated.
- (iii) What are interferons? (2 + 1) + 3 + 2

[Special Paper : *Biochemistry, Molecular Endocrinology and Reproductive Physiology*]

UNIT—PHY-303C.1

[ Marks : 20 ]

1. Answer any *two* questions from the following : 2 × 2
- (a) Mention the structural domains of transmembrane proteins.
- (b) Differentiate necrosis from apoptosis.
- (c) Write down the types of accessory pigments of photosynthesis.
- (d) Define the pluripotent stem cells.

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

(a) What are CDKs ? How CDKs are regulated ? 1 + 3

(b) State the intrinsic pathways of apoptosis with special reference to caspases. 4

(c) Discuss the basic characteristics of cancer cells. What are cancer-causing genes ?  $2\frac{1}{2} + 1\frac{1}{2}$

(d) Distinguish between Photosystem I and II of photosynthesis. 4

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

(a) What are 'Lateral' and 'Transverse' movement of cell membrane ? Discuss FRAP and FLIP process for tracking of lateral movement. Why membrane fluidity is important ?

$$\left(1\frac{1}{2} + 1\frac{1}{2}\right) + \left(1\frac{1}{2} + 1\frac{1}{2}\right) + 2$$

(b) Mention the name of some important cysteine and aspartate proteases. Describe their basic catalytic mechanisms. What do you know about zymogen activation ?

$$(1 + 1) + (2 + 2) + 2$$

UNIT – PHY-303C.2

[ Marks : 20 ]

4. Answer any *two* questions from the following :  $2 \times 2$
- (a) Mention the binding sites of different ligands in GPCR.
  - (b) Write down the applications of ELISA.
  - (c) What is spermiogenesis ?
  - (d) What are the morphological hallmarks of apoptosis in germ cells ?
5. Answer any *two* questions from the following :  $4 \times 2$
- (a) Describe the cyclic AMP mediated signal transduction pathway of GPCR. 4
  - (b) "Increased thyroid hormone secretion during cold stress exerts immunoenhancing effects." – Explain it. 4
  - (c) Discuss the apoptosis via the intrinsic pathway during male germ cell development. 4

(d) How age-related female fertility decline and menopause is related to oxidative stress? What is polycystic ovarian syndrome? 3 + 1

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

(a) Write down the principle of radio-immunoassay. Describe the detail assay procedure mentioning its advantages and disadvantages. 2 + (3 + 1 + 2)

(b) What is bipotential gonad? Describe the genetic control of testis determination. State the Golgi and Cap phase of spermatid differentiation with suitable diagram. 1 + 3 + (2 + 2)

[Special Paper : *Biophysics and Electrophysiology with structural Biology*]

UNIT – PHY-303E.1

[ Marks : 20 ]



1. Answer any *two* questions from the following :  $2 \times 2$

- (a) Define the terms electronegativity and electron affinity. What are the characteristics of van der Waal's forces ? 1 + 1
- (b) Why is the N-C single bond in peptide bonds have a partial double bond character ? 2
- (c) What do you understand by reaction rate ? Calculate the reaction rate of any chemical reaction. 1 + 1
- (d) Calculate the work done during splitting of bigger drop. 2

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

- (a) Define electrophoretic mobility. Mention the factors that affect electrophoretic mobility (EPM). Why are ammonium persulfate (APS) and TEMED used in SDS-PAGE ? 1 + 1 + 2
- (b) State Fick's law of diffusion. Calculate the nature of flux (J) during diffusion. What is revised Fick's law ? 1 + 2 + 1

(c) State the relation in between work done and surface energy density. Classify surface tension at different interfaces.  $2 + 2$

(d) Define half-cell potential and reduction potential. Write the applications of ion-selective electrodes.  $1 + 1 + 2$

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

(a) Write the physical properties of electron beams of SEM. State the basic components of SEM with a suitable diagram. How does the image form through this microscope.  $3 + 2 + 3$

(b) What do you understand by bond enthalpy ? Write the principle of a Carnot heat engine. What do you understand by thermodynamic efficiency of Carnot heat engine ? At a power plant, superheated steam at  $560^{\circ}\text{C}$  is used to drive a turbine for electricity generation. The steam is discharged to a cooling tower at  $38^{\circ}\text{C}$ . Calculate the efficiency of this process.  $2 + 3 + 1 + 2$

UNIT— PHY-303E.2

[ Marks : 20 ]

4. Answer any *two* questions from the following :  $2 \times 2$
- (a) Define Zeta, stern and total electro-chemical potential of membrane. 2
- (b) Briefly state the role of complex-III in electron transport chain. 2
- (c) Write the differences between intrinsic and extrinsic membrane protein with an example. 2
- (d) Classify liposomes on the basis of their size and number of bilayers. 1 + 1
5. Answer any *two* questions from the following :  $4 \times 2$
- (a) With a suitable picture describe the space filling models of membrane lipid. Write the nature of phospholipid structure of cell membrane. (1 + 1) + 2

- (b) What are the differences between spot desmosomes and belt desmosomes. What happens when a hydrophobic molecule are exposed to water ? 2 + 2
- (c) Briefly discuss the nature of solute transport across the cell membrane. 4
- (d) What is G<sub>0</sub> (Quiescent phase) of cell cycle ? Describe in brief the events taking place during the interphase. 1 + 3

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

- (a) Shortly describe about the liposomal drug delivery system. Describe the mechanism of liposome formation. Briefly explain the effects of cations on water dynamics. 3 + 3 + 2
- (b) How does the dynamic movement of the membrane occur ? What is caveolins ? What is meant by EC 2.7.1.1 of enzyme ? Write the role of different environmental conditions controlling enzyme velocity during any enzymatic reaction. (2 + 1) + (2 + 3)
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