M.Sc. 3rd Semester Examination, 2018

HUMAN PHYSIOLOGY

PAPER – PHY-303

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

(Special Paper : *Microbiology and Immunology*)

UNIT – 27

1. (*a*) What are xenobiotic compounds ? Name some why are they considered recalictrant in nature ?

   (*b*) State one mechanism of microbial degradation of xenobiotics.

(*c*) What is cometabolism in relation to biodegradation of xenobiotics ? (1 + 2) + 1 + 1

Or

(*a*) What is bioleaching ?

(*b*) Mention the major properties of microbes able in bioleaching.

(*c*) Describe the first level of bacterial attachment on mineral surface. 1 + 2 + 2

2. (*a*) What is normal microbial flora of human host ? What are different categories of normal flora ? Name two resident flora of human.

(*b*) Differentiate commensalism and mutualism. What are endogenous diseases ? (1 + 1 + 1) + (1 + 1)

Or

(*a*) Briefly discuss on the tissue specificity of normal flora.

(*b*) What is cross-feeding between microbes

(*c*) Give one example of bacterial synergism

(*d*) What is metagenome ? 2 + 1 + 1 + 1

3. (*a*) Give a brief description of Calvin-Benson cycle for CO_2 fixation including the recycling of RuBp.

(*b*) Name the factors influence RuBisCo during photosynthesis. 4 + 1

Or

(*a*) What is C4 carbon assimilatory pathway ? Why is it called C4 pathway ?

(*b*) Give description of PEPCK-dependent C4 pathway. (2 + 1) + 2

4. (*a*) Write down the major processes involved in nitrogen cycle.

(*b*) What is symbiotic biological nitrogen fixation ? Give example of symbiotic relationship with leguminous plant and plants other than legumes. (2 + 1) + (1 + 1)

Or

(*a*) Write down the overall reaction for BNF and progressive reduction of dinitrogen in this process.

(*b*) Give a brief description of the enzyme involved in this process. (1 + 1) + 3

UNIT – 28

1. (*a*) What is signalosome complex ?

(*b*) Describe in brief the T-cell receptor signalling and activation with suitable diagram. 1 + 4

Or

Briefly discuss the steps of T-cell maturation from DP thymocytes to CD^{4+} T-cell and CD^{8+} T-cell ? 5

2. Discuss the mechanism of cytosolic pathway of Ag processing and presentation. 5

Or

(*a*) What do you understand by MHC restriction ?

(*b*) How peptide is generated in endocytic vesicle ?

(*c*) How lipid antigen is presented to T-cell ? $2+1\frac{1}{2}+1\frac{1}{2}$

3. (*a*) Define isograft, allograft and xenograft.

(*b*) What do you mean by graft-versus-host reaction ? 3 + 2

Or

(*a*) Briefly discuss the effector stage of Graft rejection.

(*b*) What do you mean by specific immuno-suppressive therapy ? 3 + 2

4. (*a*) What do you mean by Ab diversity ?

(*b*) How the most possible numbers of Ig gene generated ? 1 + 4

Or

(*a*) What do you mean by cascade induction of cytokine ?

(*b*) What are the features of Class-I cytokine receptor ?

(*c*) Briefly discuss about the signalling pathway of IFNγR (IFNγ Receptor). 1 + 1 + 3

(Special Paper : *Biochemistry, Molecular Endocrinology and Reproductive Physiology*)

UNIT – 27

1. (*a*) Discuss the role of lipids and proteins in asymmetry mentioning its biological significance.

(*b*) State the lipid moving in membrane bilayer with its regulating factors. $\left(2+\frac{1}{2}\right)+\left(2+\frac{1}{2}\right)$

Or

(*a*) Elaborate the morphological and biochemical changes occurred in apoptosis.

(*b*) Discuss the extinsic pathway of apoptosis with diagram. $\left(1\frac{1}{2}+1\frac{1}{2}\right)+2$

2. (*a*) State the glycoside formation reaction mentioning its biological importance.

(*b*) Describe the molecular mechanism of regulation of glycogen metabolism. (1 + 1) + 3

Or

(*a*) Describe 'cyclic photophosphorylation' with diagram.

(*b*) Discuss the C_3 carbon fixation pathway with its regulation. 2 + (2 + 1)

3. (*a*) Elaborate the catalytic mechanism of serine protease.

(*b*) Give the examples of some biologically important serine proteases. $3\frac{1}{2}+1\frac{1}{2}$

Or

(*a*) Discuss the catalytic reactions of catalase and glutathione peroxidase in our body.

(*b*) State the clinical applications of antioxidant enzymes. $\left(1\frac{1}{2}+1\frac{1}{2}\right)+2$

4. (*a*) Discuss the process of invasion and metastasis by cancer cells.

(*b*) What is 'Ras Protein Signaling' ? $2\frac{1}{2}+2\frac{1}{2}$

Or

(*a*) State the types and differentiation of stem cells.

(*b*) What is adult stem cell ? How can it be cultured ? (1 + 1) + (1 + 2)

UNIT – 28

1. (*a*) What are the different classes of cell surface receptors ?

(*b*) Write a brief note on 'G-protein coupling'.

(*c*) What do you mean by 'G-protein coupled receptor desensitization' ? 1 + 2 + 2

Or

(*a*) State the principle of ELISA.

(*b*) Write down the procedures of sandwich ELISA.

(*c*) Mention the application of ELISA assay. 1 + 3 + 1

2. Discuss the interlinked role of prolactin, glucocorticoids and immune system in response to stress. 5

Or

State with suitable diagram the intrinsic pathway of male germ cell apoptosis. 5

3. (*a*) What is genetic sex ?

(*b*) Discuss the role of different transcription factors in male gonad development. 1 + 4

Or

(*a*) Describe the process of spermatocytogenesis with diagram.

(*b*) Elaborate the different phases of spermatid differentiation and maturation. $2\frac{1}{2}+2\frac{1}{2}$

4. How ovulation, pregnancy and menopause are influenced by oxidative stress ? $2+1\frac{1}{2}+1\frac{1}{2}$

Or

Describe the role of GnRH and hcG on IVF. $2\frac{1}{2}+2\frac{1}{2}$

(Special Paper : *Biophysics and Electrophysiology with structural biology*)

UNIT – 27

1. (*a*) What is the significance of Newton's equation in biological systems ?

(*b*) What is Pauli's exclusion principle ?

(*c*) Define the quantum numbers and their significance. 2 + 1 + 2

Or

(*a*) Define the difference between electron affinity and electronegativity.

(*b*) Draw the Lewis dot structure of methane and acetone.

(*c*) What do you understand by chirality of molecule ? 2 + 2 + 1

2. (*a*) Living system is an open, steady system under non-equilibrium. – Explain the statement.

(*b*) Cite a relation between Enthalpy (ΔH), Entropy (ΔS) and absolute temperature (T) and free energy (ΔG) of a system.

(*c*) What is a adiabatic system ? 2 + 2 + 1

Or

(*a*) Explain rates of reaction with a suitable example.

(*b*) How Van't Hoffs equation related with osmotic pressure ?

(*c*) State the principle of reverse osmosis with an example. 2 + 1 + 2

3. (*a*) What is SDS ? Why it is used for electrophoresis of protein ?

(*b*) What is the function of a carrier ampholite in iso-electric focussing ?

(*c*) Write the application of TEM. 2 + 1 + 2

Or

(*a*) Discuss briefly about the different types of probes used during electron microscopy.

(*b*) Define the terms magnification and resolving power of a microscope.

(*c*) Discuss briefly about the working principle of 2D-gel electrophoresis and its application. 2 + 1 + 2

4. (*a*) How a protein structure determines cellular functions.

(*b*) What do you understand by protein folding ?

(*c*) "Folding of proteins invivo is promoted by chaperones" – Explain it. 2 + 1 + 2

Or

(*a*) What is electrode potential ?

(*b*) Describe the working principle of ion-specific electrodes.

(*c*) What is the distinction between the chemical equivalent and electrochemical equivalent of an element ? 1 + 2 + 2

UNIT – 28

1. (*a*) Describe the three level of performance of work by ATP at cellular level.

(*b*) What do you mean by oxidative phosphorylation ?

(*c*) With a suitable diagram describe the membrane structure of complex-I, involve in ATP production. 2 + 1 + 2

Or

(*a*) "Water is a polar molecule" – Explain.

(*b*) Describe the structure of water molecule in relation to its properties.

(*c*) Describe the role of water as a solvent with an example. 2 + 2 + 1

2. (*a*) Describe the evolution of membrane theory.

(*b*) Write down the structural architecture of membrane phospholipid with a suitable diagram. 2 + 3

Or

(*a*) Describe Gouy-Chapman model of electric double layer of membrane.

(*b*) What do you understand by membrane impedance and capacitance ?

(*c*) What is a liposome ? Mention its applications in biology. 2 + 1 + 2

3. (*a*) Describe the structure of gap junction.

(*b*) What is the functional difference between tight junctions and desmosomes ?

(*c*) Cite some examples of cell surface adhesion molecules. 2 + 2 + 1

Or

(*a*) Discuss the role of lectins as cell recognition molecules.

(*b*) Describe the events associated with cell cycle.

(*c*) Miotosis results in producing two cells which are Similar to each other. What would happen if cytokinesis does not occur during mitosis. 2 + 2 + 1

4. (*a*) What are the differences between an enzyme and a protein ?

(*b*) "Enzyme act as biological catalysts" – Explain.

(*c*) State the biochemical nature and activity of active site of an enzyme. 1 + 1 + 3

Or

(*a*) Discuss briefly about the importance of Arhenious equation.

(*b*) What do you are meant by enzyme activity and feed back inhibition ?

(*c*) Define order and molecularity of a chemical reaction. 2 + 2 + 1