

KATHMANDU UNIVERSITY  
End Semester Examination [C]  
January, 2019

Marks scored:

Level : B. Tech.  
Year : II

Course : BIOT 209  
Semester: II

Exam Roll No. :

Time: 30 mins.

F. M. : 20

Registration No.:

Date JAN 01 2019

SECTION "A"

[10 Q. × 1 = 10 marks]

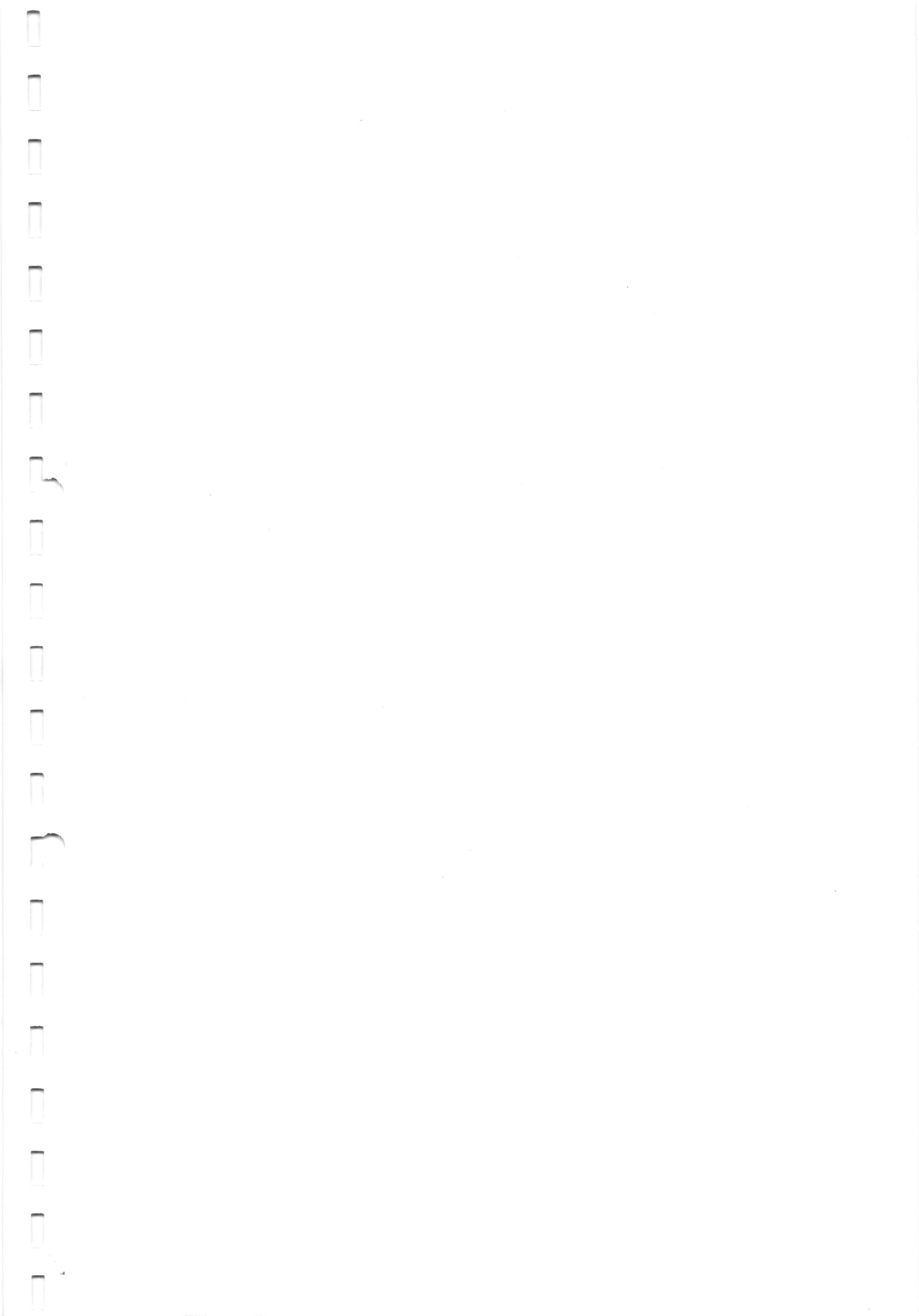
Choose and tick the most appropriate answer.

- In case of diffusion process between two compartments with concentrations  $C_1$  and  $C_2$  ( $C_1 > C_2$ ), separated by a membrane with permeability  $P$  that allows diffusion, the particle flux  $J$  is equal to  
[a]  $P(C_1 + C_2)$       [b]  $P(C_1 - C_2)$       [c]  $P(C_2 - C_1)$       [d]  $-P(C_1 + C_2)$
- Langevin has given a more direct treatment of Brownian motion focusing on following one particle as it jiggled around such that the average distance moved by a small spherical particle of radius 'a' in a given time  $t$  can be obtained from the relation  
[a]  $\overline{x^2(t)} = \frac{K_B T}{3 \pi a \eta}$       [b]  $\overline{x^2(t)} = \frac{K_B T}{6 \pi a \eta}$   
[c]  $\overline{x^2(t)} = \frac{K_B T}{3 \pi a \eta} t$       [d]  $\overline{x^2(t)} = \frac{K_B T}{6 \pi a \eta} t$
- Flux of water  $\phi_w$  is related to the hydrostatic pressure  $P$  and osmotic pressure  $\pi$  as  
[a]  $u_w \text{ grad}(P - \pi)$       [b]  $-u_w \text{ grad}(P - \pi)$   
[c]  $u_w c_w \text{ grad}(P - \pi)$       [d]  $-u_w c_w \text{ grad}(P - \pi)$
- Active transport is  
[a] the movement of a particle along its concentration gradient, usually concerned with accumulating high concentrations of molecules, and it uses energy  
[b] the movement of a particle against its concentration gradient, usually concerned with accumulating high concentrations of molecules, and it uses energy  
[c] the movement of a particle along its concentration gradient, usually concerned with accumulating high concentrations of molecules, and it does not use any energy  
[d] the movement of a particle against its concentration gradient, usually concerned with accumulating high concentrations of molecules, and it does not use any energy
- Olfaction and taste both respond to chemical stimulation but they are quite different because  
[a] olfaction requires that the chemical be volatile, and taste requires that the chemical be soluble both in water and mucous secretions  
[b] olfaction requires that the chemical be soluble both in water and mucous secretions, and taste requires that the chemical be volatile  
[c] olfaction requires that the chemical be volatile and soluble in mucous secretions, and taste requires that the chemical be soluble in water  
[d] olfaction requires that the chemical be soluble in water, and taste requires that the chemical be volatile and soluble in mucous secretions
- The radius of second orbit of hydrogen atom is  
[a] 0.106 nm      [b] 0.053 nm      [c] 0.075 nm      [d] 0.212 nm



JAN 01 2019

17. The energy difference between bonding molecular orbital and anti-bonding molecular orbital is called .....
18. The operator  $-i\hbar\nabla$  in quantum mechanics is called ..... operator.
19. The pure vibrational spectra can only be observed in .....
20. The shift of resonance line of a given compound from that of standard reference compound is called ..... of that compound.



KATHMANDU UNIVERSITY  
End Semester Examination [C]  
January, 2019

JAN 01 2019

Level : B. Tech.  
Year : II  
Time : 2 hrs. 30 mins.

Course : BIOT 209  
Semester: II  
F. M. : 55

SECTION "C"

[5 Q. × 4 = 20 marks]

1. Derive Van't Hoff equation  $\pi = RTC_A$ .
2. What do you mean by near death experiences (NDE)? Explain near death experiences with different stages.

OR

Discuss the visual, chemical, somatic and visceral receptors.

3. What are the selection rules for optical spectra? Explain the fine structure of sodium D-line using the selection rule.

OR

Write the time-dependent Schrödinger's equation and obtain the time-independent Schrodinger's equation from that.

4. Calculate the wavelength separation between the two component lines which are observed in the normal Zeeman Effect. The magnetic field used is  $0.4 \text{ Wb/m}^2$ . Given  $e/m = 1.76 \times 10^{11} \text{ C/kg}$  and  $\lambda = 6000 \text{ \AA}$ .

5. What is meant by hybridization? Explain the  $sp^3$ -hybridization with wave functions.

OR

Explain the X-ray diffraction spectrometer with schematic diagram.

SECTION "D"

[5 Q. × 7 = 35 marks]

6. Discuss Brownian motion and random walk. Derive an expression for the average distance moved in a given time.

7. Show that the particle flux  $\phi = -u.c.grad(\mu)$  and use it to show that the water flux  $\phi_w = -u_w grad(P-\pi)$ .

OR

Derive an expression for Guldberg-Waage's law. Discuss resting membrane potential of cells and hence derive Goldman-Hodgkin-Katz equation.

8. Discuss neuronal cable theory and show that the voltage signal falls away exponentially.

OR

Define the terms action potential and synapse. Write down the properties of action potential. Discuss the transport of information in the nervous system.

9. Derive the magnetic dipole moment due to the orbital motion of an electron and show that gyro-magnetic ratio of the electron is  $8.8 \times 10^{10} \text{ C/kg}$

10. Explain the theory of pure rotational spectra of a diatomic molecule.

OR

Explain the theory of NMR deriving the necessary formula and explain its instrumentation with schematic diagram.

