

Enrolment No. [ ]

S<sub>3</sub>(UBE03B02)BE

B.Tech 3<sup>rd</sup> Semester Mid Term Examination, 2018  
Biochemistry  
Paper Code: UBE03B02

Full Marks: 50

Time: 2 hours

The figures in the margin indicate full marks for the questions  
Candidates are required to give their answers in their own words as far as practicable

(Group-I & Group-II are compulsory)

Group-I

2.5 X 4=10

I. Answer the following question.

1. The first step of the urea cycle is the formation of carbamoyl phosphate. Answer following

- Name the cellular compartment where the above reaction occurs?
- What are the two building blocks of carbamoyl phosphate?
- Which enzyme catalyzes formation of carbamoyl phosphate?
- Name the allosteric activator of the enzyme that catalyzes formation of carbamoyl phosphate?
- This reaction is reversible----True or False?

2. An unspecified protein contains a 15-residue long  $\alpha$ -helix with the following sequence:

WEANIKQRLSTYEYKQ

- How many full turns are in this  $\alpha$ -helix?
  - What is the length of the helix (in Angströms) in the direction of the helix axis?
  - How many hydrogen bonds between the backbone atoms are in this helix? Explain your reasoning.
3. What does the Ramachandran plot represent? What are the parameters shown on the Ramachandran plot and what do they characterize?
4. Briefly describe the reason for the above disorder?

- a) Alkaptonuria    b) Hyperammonemia

II. Answer the following questions. (1 marks each)

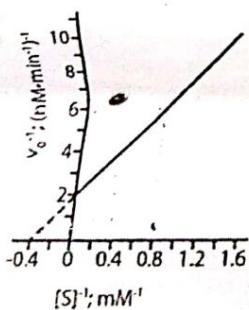
5 X 1=5

- Which is a common characteristic of both an  $\alpha$ -helix and a  $\beta$ -pleated sheet?
- Which is a difference between an  $\alpha$ -helix and a  $\beta$ -pleated sheet?
- What is oxidative deamination? Give an example.
- How is carbamoyl phosphate synthetase I regulated?
- How does arginine affect the activity of carbamoyl phosphate synthetase I?

III. Answer the following questions.

2.5 X 2=5

- If 0.1 M glucose 1-phosphate is incubated with phosphoglucomutase, the glucose 1-phosphate is transformed to glucose 6-phosphate. At equilibrium, the concentration of glucose 1-phosphate is  $4.5 \times 10^{-3}$  M and that of glucose 6-phosphate is  $8.6 \times 10^{-2}$  M. Calculate  $K_{eq}$  and  $\Delta G^\circ$  for this reaction (i.e., in the direction of glucose 6-phosphate formation). T = 298 K, R = 8.315 J/mol/K.
- Consider you are working with an unknown enzyme and measuring kinetics parameters. Using the data shown in the graph, calculate the  $V_{max}$  and  $K_M$  for this enzyme



IV Mark the correct answer only- (0.5 marks each):

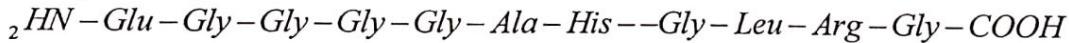
10 X 0.5=5

1. All of the below mentioned amino acids can participate in hydrogen bonding except one  
 (A) Serine      (B) Cysteine      (C) Threonine      (D) Valine
2. All of the following amino acids are both glucogenic as well as ketogenic except  
 (A) Isoleucine    (B) Leucine      (C) Tyrosine      (D) Phenylalanine
3. Which of the characteristics below apply to amino acid Glycine?  
 (A) Optically inactive,    (B) Hydrophilic, basic and charged,    (C) Hydrophobic,  
 (D) Hydrophilic, acidic and charged
4. Which one of the following amino acids may be considered a hydrophobic amino acid at physiological pH of 7.4?  
 (A) Isoleucine,      (B) Arginine,      (C) Aspartic acid,      (D) Threonine
5. Which of the following amino acids is most compatible with an alpha-helical structure?  
 (A) Tryptophan,      (B) Alanine,      (C) Leucine,      (D) Proline
6. In amino acid catabolism, the first reaction for many amino acids is a(n):  
 (A) decarboxylation requiring thiamine pyrophosphate (TPP).  
 (B) hydroxylation requiring NADPH and O<sub>2</sub>.  
 (C) oxidative deamination requiring NAD<sup>+</sup>.  
 (D) reduction requiring pyridoxal phosphate (PLP).  
 (E) transamination requiring pyridoxal phosphate (PLP).
7. Which structural feature is shared by both uracil and thymine?  
 (A) Both contain two keto groups.      (B) Both contain one methyl group.  
 (C) Both contain a five-membered ring.      (D) Both contain three nitrogen atoms.
8. In de novo pyrimidine biosynthesis, which is an IMMEDIATE Precursor in the reaction in which a cytosine nucleotide is produced?  
 (A) UTP      (B) UDP      (C) UMP      (D) orotidine 5'-phosphate
9. In mitochondria, the formation of carbamoyl phosphate requires splitting which of the following number of ATPs?  
 (A) 0,      (B) 1      (C) 2      (D) 3
10. The two nitrogen atoms in urea arise from:  
 (A) ammonia and glutamine,      (B) ammonia and aspartate      (C) glutamine and aspartate  
 (D) glutamine and glutamate      (E) glutamate and alanine

### Group-II (Any two)

12.5X2=25

1. A peptide having the sequence as follow



- i. Draw the fully protonated form of this peptide.      2
- ii. What is the overall charge of this peptide at pH 4 and 8?      8
- iii. Calculate the Isoelectric Point (pI) of this peptide?      2.5

Name of Amino Acid	pK <sub>1</sub>	pK <sub>2</sub>	pK <sub>R</sub>
Glu	2.2	9.7	4.3
Gly	2.4	9.8	-
Ala	2.3	9.7	-
His	1.8	9.2	6
Leu	2.4	9.6	-
Arg	1.8	9	12.5

84P30R06Y0



2. A company has developed three enzymes that degrade highly toxic compounds to non-toxic compounds. Your task is to degrade the greatest amount of the toxic compound in the shortest amount of time. The kinetic properties of the two enzymes are shown below:

Enzyme	$K_m$	$V_{max}$
1	2.5 mM	100 mM/sec
2	5 mM	250 mM/sec
3	10 mM	500 mM/sec

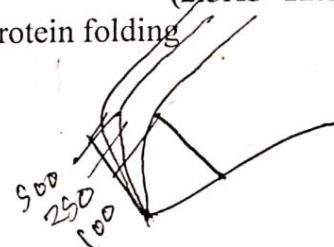
✓ 100  
✓ 50  
✓ 500

- I. At low concentrations of substrate, which enzyme would be better to use based on the information given above? (i.e which enzyme binds the substrate better? Why is this enzyme better to use?) 2.5
- II. At saturating concentration of substrate, which enzyme would be the better to use? 4
- III. Draw the Michaelis-Menten curve for three enzymes and mark on graph paper for  $K_m$  and  $V_{max}$  6

3. Short note on

- (a) Turnover number, (b) Inhibitors on enzyme kinetics (c)  $\alpha$ -helix, (d) Protein folding  
(e) Protein denaturation. (f) Vitamins A, D and C

$$(2.5 \times 5 = 12.5)$$



Helpful information:

Name of Amino Acid	One letter code	Name of Amino Acid	One letter code	Name of Amino Acid	One letter code
Alanine	A	Glycine	G	Proline	P
Arginine	R	Histidine	H	Serine	S
Asparagine	N	Isoleucine	I	Threonine	T
Aspartic Acid	D	Leucine	L	Tryptophan	W
Cysteine	C	Lysine	K	Tyrosine	Y
Glutamic Acid	E	Methionine	M	Valine	V
Glutamine	Q	Phenylalanine	F		

$$\begin{aligned}
 & 400 \xrightarrow{\text{kg}} S \div S \times S \\
 & 400 \times 12 \quad S \div S \times 0.5 \\
 & 1000 \xrightarrow{} 400 \\
 & 400 \times 12 \\
 & \quad \swarrow 1000 \\
 & \quad \text{C} \text{O} \text{O} \\
 & \quad \text{C} \text{O} \text{O} \\
 & \quad \text{C} \text{O} \text{O}
 \end{aligned}$$

Full Marks: 50

1. Answer whether the following statements are true or false: [1 x 11 = 11]
- a. Ketchup is an example of shear thickening fluid. T
  - b. In dilatant fluids, for a constant strain rate stress decreases with time. F
  - c. Viscosity of an incompressible fluid changes with time. F
  - d. Streamlines, streaklines and pathlines are identical for a steady flow. T
  - e. For a fluid at rest viscous force is zero. F
  - f. Pressure in a gas decreases linearly with depth. F
  - g. The center of pressure and center of gravity for a horizontal plate immersed in a liquid coincides. F
  - h. For irrotational flow curl of the stream function is zero. T
  - i. The value of stream function changes along a streamline. F
  - j. Stream function and velocity potential functions are orthogonal. T
  - k. Froude number is the ratio of inertia force and surface tension force. T

2. Answer any three questions : [3 x 3 = 9]
- a. An open-ended circular glass tube is inverted on a bath filled with liquid. What difference you expect to observe in the fluid flow in the glass tube if the liquid is (a) water and (b) mercury? Explain the difference.
  - b. Deduce the velocity profile for Couette flow between two parallel plates.
  - c. Describe the geometrical interpretations of stream function.
  - d. Starting from Euler's equation show that for irrotational flow Bernoulli's equation holds for the entire flow field with a constant value irrespective of the streamline direction.

*Answer any three questions from below*

3. The system in Fig. 1 at 20°C. If atmospheric pressure is 101.33 kPa and the pressure at the bottom of the tank is 242 kPa, what is the specific gravity of fluid X? Given, specific gravities of SAE oil, water and mercury at 20°C are 8720, 9790 and 133100 kg/m<sup>3</sup> respectively. [4]
- ✓ Show that the hydrostatic force on a plane surface immersed in a fluid at an arbitrary angle does not depend on the angle of inclination of the plane surface. Determine the location of the center of pressure of the plane. [6]
4. Discuss the working principles of (i) Bourdon tube, (ii) Bellow gage and (iii) McLeod gage, (iv) Pirani gauge. [10]

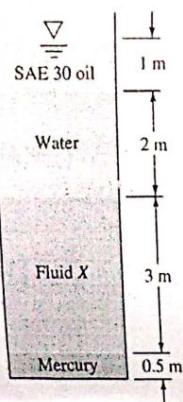


Figure 1

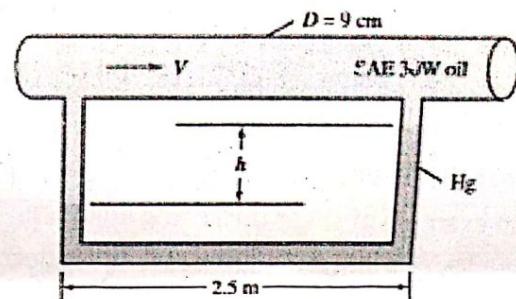


Figure 2

5. A cylindrical beaker with a diameter of 15 cm and a height of 30 cm is filled with 2649.375 ml of water. If the beaker underwent a rotation of 310 rpm and reaches a steady rigid body rotation state, calculate the percentage change in the pressure at the bottom left point of the vessel with respect to the resting state. Given 1 liter=1 decimeter<sup>3</sup>. [5]

Determine the expression for metacentric height of a floating body in terms of the moment of inertia of the waterline footprint, volume of the submerged region and the distance from c.g. to center of buoyancy of the body. [5]

- ✓6. SAE 30W oil at 20°C flows through the 9-cm-diameter pipe as shown in Fig. 2 at an average velocity of 4.3 m/s. (a) Determine the volume flow rate in m<sup>3</sup>/h. (b) Calculate the expected reading  $h$  of the mercury manometer, in cm. Given, density and coefficient of viscosity for oil is 870 kg/m<sup>3</sup> and 0.29 kg/m-s respectively at 20°C. [5]

✓Determine the Bernoulli's equation along a streamline for steady incompressible flow. [5]

7. When fluid in a pipe is accelerated linearly from rest, it begins as laminar flow and then undergoes transition to turbulence at a time  $t_{tr}$  that depends on the pipe diameter  $D$ , fluid acceleration  $a$ , density  $\rho$ , and viscosity  $\mu$ . Arrange this into a dimensionless relation between  $t_{tr}$  and  $D$ . [5]

A two-dimensional incompressible flow field is defined by the velocity components  $u = 2V\left(\frac{x}{L} - \frac{y}{L}\right)$  and  $v = -2V\frac{y}{L}$  where  $V$  and  $L$  are constants. If they exist, find the stream function and velocity potential. [5]

- ✓8. Derive the continuity equation in its differential form from the law of conservation of mass using Reynolds transport theorem. [6]  
Deduce the non-dimensional version of the x-component of the Navier-Stokes equation by taking appropriate non-dimensional variables. [4]

Enrolment No. [ ]

S<sub>3</sub>(UBE03B01)BE

B.Tech 3rd Semester Mid-Term Examination, 2018  
 Chemical & Biochemical Thermodynamics  
 Paper Code: UBE03B01

Time: 2 hours

Full Marks: 50

Part A (Total Marks: 10)

Match each row (from A to J) of the left column with appropriate one from of the right column (numbered 1 to 14) of the following table. You cannot use any element of the right column more than once.

Left		Right	
A	Extensive property	1	Co-existence of two phases <i>C</i>
B	Triple point	2	Entropy <i>S</i>
C	Boiling point	3	Irreversible <i>I</i>
D	Open system	4	A bacterium <i>D</i>
E	Disorder in a system	5	Enthalpy
F	Spontaneous process	6	Co-existence of three phases <i>B</i>
G	Free expansion	7	$\Delta H = Q$
H	Isentropic process	8	Adiabatic reversible
I	Cyclic change of state	9	Heat <i>J</i>
J	Path function	10	Volume <i>A</i>
		11	Pressure
		12	Temperature
		13	$\Delta U = 0$ <i>1</i>
		14	$\Delta U = Q$

Give your answer in the following table format:

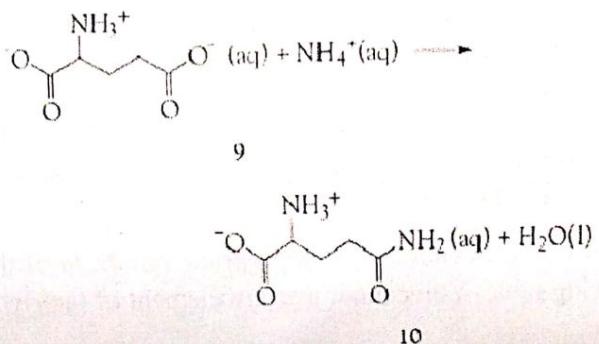
Left	A	B	C	D	E	F	G	H	I	J
Right										

Part B (Total Marks: 40)Question No. 1 is compulsory. Attempt ANY ONE from rest.

1(a) Consider exhaling of 0.50 L of air during breathing. Assume that the exhaled air lifts a piston so the change in volume is  $\Delta V = 0.50$  L and the external pressure is 1 atm. Determine the work involved in Joule. [4]

1(b) A microbial fermentation reaction results in the formation of 1.0 mol CO<sub>2</sub>(g) at 25°C and 100 kPa. Determine the work involved in Joule. [4]

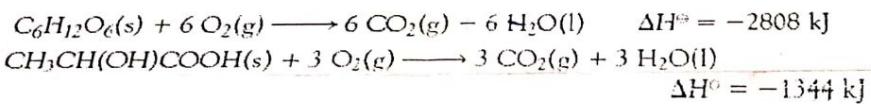
1(c) The enzyme glutamine synthetase mediates the synthesis of the amino acid glutamine (Gln, 10) from the amino acid glutamate (Glu, 9) and ammonium ion. The process is endothermic and requires energy extracted from the oxidation of biological fuels stored in ATP. Estimate the value of the reaction enthalpy at 60°C by using following data table. [4]



$$\Delta_f H^\circ = +21.8 \text{ kJ mol}^{-1} \text{ at } 25^\circ\text{C}$$

Substance	Water (liq)	Ammonium ion (aq)	Gln (aq)	Glu (aq)
Standard constant pressure heat capacity (JK <sup>-1</sup> mol <sup>-1</sup> )	75.3	79.9	187	177

1(d) In biological cells that have a plentiful supply of O<sub>2</sub>, glucose is oxidized completely to CO<sub>2</sub> and H<sub>2</sub>O. Muscle cells may be deprived of O<sub>2</sub> during vigorous exercise and, in that case, one molecule of glucose is converted to two molecules of lactic acid by the process of glycolysis. Given the thermochemical equations for the combustions of glucose and lactic acid:



calculate the standard enthalpy for glycolysis:



1(e) Derive an expression for the reversible isothermal work due to expansion of one mole of a gas from V<sub>1</sub> to V<sub>2</sub> that obeys the equation of state given by P(V-b) = RT, where b is a constant. Assume all volume terms denote molar volume. [4]

2(a) Why do real gases deviate from ideal behaviour? (b) Define compressibility factor and explain its significance. (c) What is Boyle temperature? (d) Deduce an expression for Boyle temperature for a gas following van der Waals gas equation. (e) Explain the theorem of corresponding states (both two-parameter and three-parameter) [3+3+1+8+5]

3. Write a short note on each of the following items:

[5X4=20]

(a) Heat, (b) Work, (c) Kelvin-Planck statement, (d) Carnot's cycle

Full Marks: 50

*The figures in the margin indicate full marks for the questions*

Answer all the questions.

✓ 1. Define Utility. Discuss the assumption of cardinal approach to utility. Explain the law of diminishing marginal utility.  $(1+1+3=5)$

✓ 2. Derive the conditions of consumer's equilibrium under ordinal approach. Justify your answer with the help of indifference curve and income line/ budget line.  $(3+2=5)$

✓ 3. What is law of demand? Using suitable diagrams and examples, explain the difference between change in demand and change in quantity demanded.  $(2+2=4)$

✓ 4. What are the various types of elasticity of demand? Explain.  $(5)$

✓ 5. Based on the following table answer the questions.

Price of good X (₹)	Quantity demanded for good X (Nos.)	Quantity demanded for good Y (Nos.)	Consumers income (₹)
22	20	30	12,000
26	18	28	10,000
30	15	26	9,500
32	14	25	8,000
35	12	20	7,800

a) Determine the cross price elasticity of demand for good Y when the price of X increases from ₹22 to ₹35.

b) Calculate the price elasticity of demand for good X when the price decreases from ₹30 to ₹22.

c) Calculate the income elasticity of both the goods when consumer's income increases from ₹7,800 to ₹12,000.  $(2+2+2=6)$

✓ 6. Give Journal Entries in the books of Sundaram chemicals Ltd. and then post into ledger accounts for Cash, Capital, Purchases and Machinery:  $(5+5=10)$

- 01/07/2018 Started business with cash Rs.1,00,000
- 03/07/2018 Goods purchased for cash Rs.12,000
- 05/07/2018 Machine Purchased for cheque Rs.18,000
- 08/07/2018 Goods purchased on credit from Mr.G Rs.23,000
- 09/07/2018 Furniture sold for cash Rs. 9,000
- 12/07/2018 Goods sold for cash Rs. 25,000
- 16/07/2018 Wages paid Rs.6,000
- 18/07/2018 Withdrawn cash from business for personal use Rs.2,000

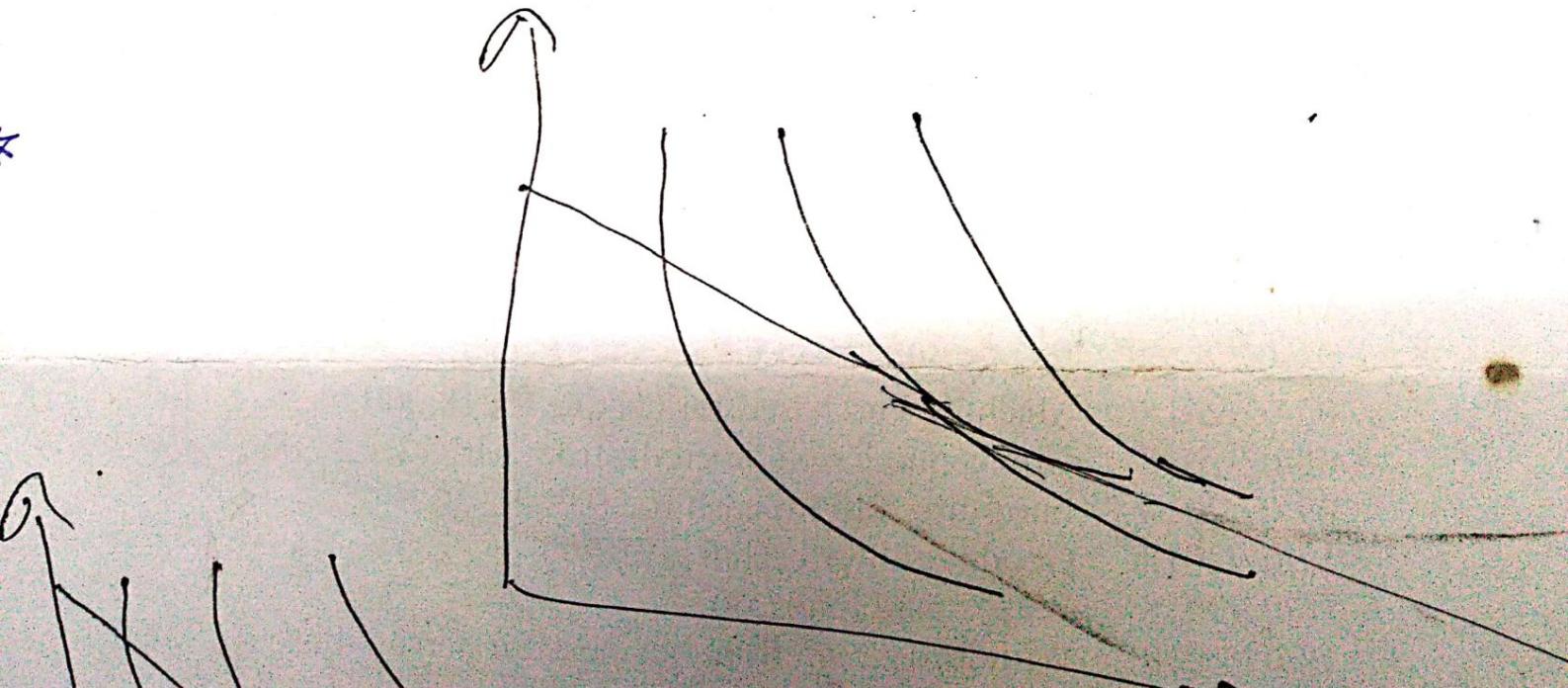
25/07/2018 Rent received Rs.5,000  
30/07/2018 Cash deposited into bank Rs.4,000

- ✓ 7. The following Ledger balances extracted from the books of PB Construction Limited.  
Prepare a Trial Balance as on 31<sup>st</sup> March 2018.
- Opening Stock Rs.1,600, Salary Rs.3,000, Cash in hand Rs. 3,200, Investment Rs. 15,800, Land & Building Rs. 17,000, Bills Payable Rs.15,000, Sundry debtors Rs. 24,600, Bank overdraft Rs. 33,400, Capital Rs. 55,000, Drawings Rs. 2,000, Sales Rs. 1,15,000, Purchases Rs.70,000,Carriage Rs. 2,700, Advertisement Rs. 2,400, Discount received Rs.1,500, Insurance premium Rs. 1,600, Furniture Rs.7,500, Office Rent Rs. 2,000, Bad debt Rs.600, Return inward Rs.5,000,Excise duty Rs.200, interest received Rs. 1,000, Return outward Rs.2,000, General Reserve Rs. 10,000, Depreciation Rs.3,000, Telephone charges Rs. 2,000. (8)
- ✓ 8. Discuss various classifications of account and rules for Debit and Credit with suitable examples. (5)
- ✓ 9. Write short notes on (any one): (i) Double Entry System (ii) Event and Transaction Credit Transaction (iii) (2)

OR

Define cash book. What are the various types of Cash Book? (2)

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Enrolment No. 17UBE063

S<sub>3</sub>(All Branch):ALL

B. TECH 3<sup>rd</sup> SEMESTER MID-TERM EXAMINATION - 2018

Subject Name: Engineering Mathematics - III

Subject code: UCH/CE/PE03C14/UCS/EC/EE/EI03C13/UME03C12

Time: 2 Hours

Full Marks: 50

Symbols used here have their usual meanings

Group A

Answer all the following questions

[5 × 5 = 25]

- ✓ 1. The chances that doctor A will diagnose a disease X correctly is 60%. The chances that a patient will die by his treatment after correct diagnosis is 40% and the chances of death by wrong diagnosis is 70%. A patient of doctor A, who has disease X, died. What is the probability that his disease was diagnosed correctly?

- ✓ 2. The following is the distribution function of a discrete random variable X:

x	-3	-1	0	1	2	3	5	8
F(x)	0.10	0.30	0.45	0.50	0.75	0.90	0.95	1.00

- (i) Find the probability distribution of X, (ii) Find  $P(X \text{ is even})$  (iii)  $P(1 \leq X \leq 8)$ , (iv) Find  $P(X = -3 | X < 0)$ .

- ✓ 3. The kms X in thousands of kms which car owners get with a certain kind of tyre is a random variable having probability density function:

$$f(x) = \begin{cases} \frac{1}{20} e^{-\frac{x}{20}}, & \text{for } x > 0 \\ 0, & \text{for } x \leq 0 \end{cases}$$

Find the probabilities that one of these tyres will last (i) at most 10,000 kms, (ii) anywhere from 16,000 to 24,000 kms (iii) at least 30,000 kms.

- ✓ 4. Define moment generating function. A random variable X is distributed at random between the values 0 and 1 so that its probability density function is:  $f(x) = kx^2(1 - x^3)$ , where  $k$  is a constant. Find the value of  $k$ . Using this value of  $k$ , find its mean and variance.

- ✓ 5. A car is parked among 10 cars in a row, not at either end. On his return the owner finds that exactly 4 of the 10 places are still occupied. What is the probability that both neighboring places are empty?

P.T.O.

### Group B

Answer all the following questions

Marks: 25

- ✓ 1. Find the fourier series of the periodic function  $f$  with period  $2\pi$ , defined as follows:

$$f(x) = \begin{cases} 0, & \text{for } -\pi < x < 0 \\ x, & \text{for } 0 < x < \pi \end{cases}$$

What is the sum of the series at  $x = 0, \pm\pi, 4\pi$ .

[6]

2. Find the Fourier series of  $f(x) = \begin{cases} x, & -1 < x < 0 \\ x+2, & 0 < x < 1 \end{cases}$  and hence evaluate the value of

$$1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \dots$$

[5]

- ✓ 3. Find the half range Sine Series of  $f(x) = \begin{cases} \frac{1}{4} - x, & 0 < x < 1/2 \\ x - \frac{3}{4}, & \frac{1}{2} < x < 1 \end{cases}$

[3]

- ✓ 4. Define linear partial differential equation with suitable example. Form a partial differential equation by the elimination of the arbitrary functions  $\phi$  from  
 $\phi(x+y+z, x^2+y^2-z^2) = 0.$

[4]

- ✓ 5. Solve:  $py + qx = xyz^2(x^2 - y^2).$

[3]

- ✓ 6. Solve:  $(x^2 - y^2 - yz)p + (x^2 - y^2 - zx)q = z(x - y).$

[4]

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Enrolment No. 17UBF003

S<sub>3</sub>(UBE03B03)BE

B.Tech 3<sup>rd</sup> Semester Mid-Term Examination, 2018  
Human Physiology  
Paper Code: UBE03B03

Full Marks: 50

Time: 2 hours

STUDENTS ARE INSTRUCTED TO GIVE ANSWER SEPARATELY OF PART-I AND PART-II IN THE SAME ANSWER SCRIPT.

PART-I  
(TOTAL MARKS: 25)

Attend any five Questions:

1. What is tissue and mention its types present in human body? Write down the developmental process of human body from a zygote. 1+1+3=5
- ✓ What is gland? Write down its divisions and their characters in detail. 1+4=5
- ✓ Write down the characteristics of bone and cartilage. 3+2=5
- ✓ What is the molecular composition of hemoglobin? Does the functionality of hemoglobin as a protein depend on its tertiary or quaternary structure? On average, what is the lifespan of a red blood cell? Where are they destroyed? Where do heme groups go after the destruction of hemoglobin molecules? 1+1+1+1+1 = 5
- ✓ 5. What is anemia? Describe the background reason of Hemolytic Anemia, Nutritional Anemia, Aplastic Anemia ? How can you check that liver is not functioning properly by blood test? 1+(1x3)+1 = 5
6. a) What is the function of platelets? What are the clinical consequences of the condition known as thrombocytopenia?  
b) Multicellular organisms are formed through serial mitosis. Would this formation be possible if each cell produced by mitosis was identical to its parent cells? What do you think about this process? 1+1+3=5

PART II  
(TOTAL MARKS: 25)

Attend all questions in the following:

- ✓ 1. Explain the mechanism of different molecular transport that occurs in the cell. (1x10=10)  
(or)  
List all the endomembranous systems and explain the structure, components and function of any three endomembrane systems of cells. (1+3+3+3=10)
- ✓ 2. Answer the following: (10 marks)
  - a✓ Oxidative Phosphorylation or Electron transport chain with a neat diagram of the complexes involved. (1 x 3=3)
  - b✓ Explain the structure, components involved and functions of nucleus. (1 x 3=3)
  - c✓ Explain packaging, docking and release of secretory vesicles from Golgi Complex using SNARE proteins (1x4=4)
- ✓ 3. Say true or false
  - a. Kinesin is the motor protein that carries secretory vesicle from negative end to positive end of microtubules. (5x1=5)
  - b. Channel proteins in the plasma membrane will have non-stop passages.
  - c. V class proton pumps only protons.
  - d. When water is added to the blood in vessels, RBCs will swell and burst.
  - e. Secondary active transport works consuming energy from ATP.