M. SC. BIOINFORMATICS SEM.-I (C.B.C.S.) (2013 COURSE) / ADVANCED DIPLOMA IN BIOINFORMATICS SEM.-I (C.B.C.S.) (2013 COURSE) :WINTER - 2017

SUBJECT : ESSENTIAL BIOMATHEMATICS

Day : **Monday** | Time : **10.00 AM TO11.30 AM**

Date : **06/11/2017** | **W-2017-1010** | Max. Marks : 60

N.B.

1) **Q.1** and **Q.5** are **COMPULSORY.** Out of the remaining, attempt **ANY TWO** from each sections.
2) Answers to both the sections should be written in **SEPARATE** answer book.
3) Figures to the right indicate **FULL** marks.
4) Use of Non-Programmable scientific calculator is allowed.

SECTION – I

Q.1 Answer the following: **(10)**

a) Evaluate $\lim_{x\to 2}\left(\frac{x-2}{x^2+x-6}\right)$

b) Find equation of line through (2,-3) and making an angle of 135^0 with positive direction of x axis.

c) Find $\frac{dy}{dx}$ if $y = x^e + e^x$.

d) Find unit vector along $\bar{a} = 3\hat{i} - 9\hat{j} + \sqrt{10}\,\hat{k}$

e) What is order of reaction for the isomerization reaction $A \xrightarrow{K_1} B$ and $E + S \xrightarrow{K_1} E \cdot S$.

Q.2 Answer any **TWO** of the following: **(10)**

a) A(8,5), B(9, -7), C(-4, 2) and D(2,6) are the vertices of a quadrilateral ABCD. If P,Q, R and S are the midpoint of sides AB, BC, CD and DA respectively. Show that PQRS is a parallelogram using slopes.

b) Evaluate:

i) $\int\left(\sqrt{x}+\frac{1}{\sqrt{x}}\right)^2 dx$ **ii)** $\int\left[(2x-7)^5+(7-2x)^5\right]dx$

c) Solve the following differential equation $(1+y^2)\tan^{-1}x\,dx + 2y(1+x^2)dy = 0$.

Q.3 Answer any **TWO** of the following: **(10)**

a) Verify that A(BC) = (AB) C

$$A=\begin{bmatrix}2 & 4 & 3\\ -1 & 3 & 2\end{bmatrix} \text{ and } B\begin{bmatrix}2 & -2\\ 3 & 3\\ -1 & 1\end{bmatrix} \text{ and } C=\begin{bmatrix}3 & 1\\ 1 & 3\end{bmatrix}.$$

b) Show that the vectors $\bar{a} = 2\hat{i} - 3\hat{j} + \hat{k}$, $\bar{b} = \hat{i} + \hat{j} + 5\hat{k}$, and $\bar{c} = 16\hat{i} + 11\hat{j} + \hat{k}$ are mutually perpendicular.

c) Find the Laplace transforms of the following functions:

i) $f(t) = \cos(t - 2\pi/3)$, $f > 2\pi/3$
$= 0$, $f < 2\pi/3$.

ii) $f(t) = (t-1)^3$, $t > 1$
$= 0$, $t < 1$

Q.4 Answer any **TWO** of the following: **(10)**

a) Application of enzyme kinetics in Biology.

b) Applications of partial differential equation to Biology.

c) Derive Michaelis Menten equation.

P.T.O.

SECTION - II

Q.5 Answer the following: **(10)**

a) Evaluate $\lim_{x\to 0}\left(\frac{3^x-2^x}{\tan x}\right)$.

b) Find acute angle between the lines represented by $x^2+4xy+y^2=0$.

c) Find focal distance of the point P(2, -5) on parabola $2y^2=25x$.

d) Explain the key parameters of the Michaelis Menten equation.
i) Enzyme efficiency **ii)** Vmax.

e) Find Laplace transform of $4e^{2t}+5e^{-3t}$

Q.6 Answer any **TWO** of the following: **(10)**

a) i) Find the value of k if $2x + y = 0$ is one of line represented by $6x^2 + kxy + y^2 = 0$.

ii) Evaluate $\lim_{x\to 0}\frac{12^x-4^x-3^x+1}{x\sin x}$.

b) i) Find equation of circle concentric with the circle $x^2 + y^2 - 2x - 6y - 7 = 0$ and of the circumference 10π units.

ii) Find equation of parabola with focus at (-9,0) and directrix $x = 9$.

c) i) Find the degree and order of the following differential equations

1) $y=3\frac{d^2y}{dx^2}+5\sqrt{1-\left(\frac{dy}{dx}\right)^3}$.

2) $y=x\frac{dy}{dx}+2\left(\frac{dy}{dx}\right)^{-2}$.

3) $dy+\sqrt{1+\frac{d^2y}{dx^2}}dx=0$.

ii) Find $\frac{dy}{dx}$ if $y=e^{\sin 3x}+(\sin 3x)^3$.

Q.7 Answer any **TWO** of the following: **(10)**

a) i) Find $\bar{a}\cdot\bar{b}$ and interpret the result where, $\bar{a}=-3i+j-\hat{k},\ \bar{b}=2\hat{i}+4\hat{j}-2\hat{k}$.

ii) Find $\bar{a}\cdot\bar{b}$ and $\bar{a}\times\bar{b}$ where $\bar{a}=-3\hat{i}+4\hat{j}-5\hat{k}$ and $\bar{b}=4\hat{i}+2\hat{j}-\hat{k}$,

b) i) Solve $(xy^2 - x)dx = (y + x^2y)dy$.

ii) Find inverse of $A=\begin{bmatrix}1 & 3\\ 2 & 7\end{bmatrix}$.

c) Find inverse $\begin{bmatrix}2 & 2 & 1\\ 1 & 0 & 3\\ 1 & -4 & -4\end{bmatrix}$.

Q.8 Answer any **TWO** of the following: **(10)**

a) i) What is significance of $\frac{kr}{kf}$ and $k_{cat}(S^{-1})$?

ii) What is the catalytic efficiency?

b) Prove that the sum of two solution to homogeneous linear differential equation is again solution as is product of solution with any constant.

c) Verify that if $u_1\ u_2\ \ldots\ u_k$ are solution of the common homogeneous linear equation L[u]=0 then linear combination or super position $u = c_1u_1+\ldots..+c_k\ u_k$ is the solution for any choice of the constants $c_1\ldots\ldots\ldots\ c_k$.