**SUBJECT CODE : MT/PE/MM15**

**M. Sc. DEGREE EXAMINATION, NOVEMBER 2009**
**BIOINFORMATICS**
**FIRST SEMESTER**

COURSE    : **ELECTIVES**
PAPER      : **MATHEMATICAL METHODS**
TIME       : **3 HOURS**                  **MAX. MARKS : 100**

### ANSWER ANY SIX QUESTIONS ONLY

1.    a) Given that $A = \{0,1,3,5\}$, $B = \{1,2,4,7\}$, $C = \{1,2,3,5,8\}$. Prove that
      $(A \cap B) \cap C = A \cap (B \cap C)$.

     b) Given that $f(x) = x + 3$, $g(x) = 2x + 7$ and $h(x) = x^2$ check whether
      $(f \circ g) \circ h = f \circ (g \circ h)$.

     c) Find the $40^{th}$ term of an arithmetic progression whose $9^{th}$ term is 465 and $20^{th}$
      term is 388.

                                                   (2+10+5)

2.    a) Find the sum to $n$ terms of the series $0.7 + 0.77 + 0.777 + ...$

     b) Find the sum to infinity the series $1 + \dfrac{1+2}{2!} + \dfrac{1+2+2^2}{3!} + \dfrac{1+2+2^2+2^3}{4!} + ...\infty$

                                                 (7+10)

3.    a) Find $x, y, z$ and $w$ if $3\begin{bmatrix} x & y \\ z & w \end{bmatrix} = \begin{bmatrix} x & 6 \\ -1 & 2w \end{bmatrix} + \begin{bmatrix} 4 & x+y \\ z+w & 3 \end{bmatrix}$

     b) Show that the matrix $A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$ satisfies the equation

      $A^3 - 6A^2 + 9A - 4I = 0$ and hence find $A^{-1}$ .

                                                 (7+10)

4.    a) Find the differential coefficient of $\dfrac{(a-x)^2(b-x)^3}{(c-2x)^3}$ .

     b) If $y = x^{x^{x^{.^{.^{.\infty}}}}}$ find $\dfrac{dy}{dx}$ .

                                                 (7+10)

                                                           **..2**

5.    a) If $x = a(\theta - \sin\theta)$ and $y = a(1 - \cos\theta)$ find $\dfrac{dy}{dx}$.

      b) If $x = \sin\theta$, $y = \cos p\theta$ prove that $(1 - x^2)y_2 - xy_1 + p^2 y = 0$.

      c) Find the maxima and minima of the function $2x^3 - 3x^2 - 36x + 10$.

                                                      (5+7+5)

6.    a) If $u = \tan^{-1}\left(\dfrac{x^3 + y^3}{x - y}\right)$ prove that $x\dfrac{\partial u}{\partial x} + y\dfrac{\partial u}{\partial y} = \sin 2u$.

      b) Find the equation of the tangent to the curve $y = \dfrac{6x}{x^2 - 1}$ at the point (2,4).

                                                      (10+7)

7.    a) Evaluate $\displaystyle\int \dfrac{x^{24}}{x^{10} + 1}\,dx$

      b) Evaluate $\displaystyle\int \dfrac{2x + 3}{x^2 + x + 1}\,dx$

      c) Evaluate $\displaystyle\int \dfrac{3x + 1}{(x-1)^2(x+3)}\,dx$

                                                      (7+5+5)

8.    a) Show that $x^2 = \dfrac{\pi^2}{3} + 4\displaystyle\sum_{n=1}^{\infty}\dfrac{(-1)^n \cos nx}{n^2}$ in the interval $(-\pi \le x \le \pi)$.

      b) Express $f(x) = \dfrac{1}{2}(\pi - x)$ as a Fourier series with period $2\pi$ to be valid in the interval 0 to $2\pi$.

                                                      (9+8)

9.    a) Solve $\dfrac{dy}{dx} + y\cos x = \dfrac{1}{2}\sin 2x$.

      b) Solve $(D^2 + 5D + 6)y = e^x$.

                                                        (8+9)

10.    a) How many seven-letter words can be formed using the letters of the word "Benzene"?

      b) Find the number of combinations of the four objects $a, b, c, d$ taken 3 at a time.

      c) Compute $\dbinom{10}{7}$.

                                                      (6+6+5)

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