3 Yr. Degree/4 Yr. Honours 3rd Semester Examination, 2024 (CCFUP)

Subject : Chemistry

Course: CHEM3051 (SEC)

Time: 2 Hours **Full Marks: 40**

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

1. Answer *any five* questions: 2×5=10

(a) Plot $y = x^2 . e^{-x^2}$ in the range 0 to ∞.

(b) Convert $(100)_2$ $(10101)_2$ to decimal. 1+1

(c) Error in measurement of diameter of a sphere is 1%. Calculate the percentage error in determining the volume.

(d) Write a program to calculate factorial of an integer.

(e) Show that the function $2x^2 - 3x + 1$ is decreasing at $x = 0$ and increasing at $x = 1$.

(f) Give Fortran statement:

$Z = |X^2 - Y^2| + 6e^{XY}$

(g) Mention two limitations of solver in excel.

(h) Plot '$t_{½}$' vs. 'C' for a first order reaction.

2. Answer *any two* questions from the following: 5×2=10

(a) Write a FORTRAN program for printing all Fibonacci numbers up to 100.

(b) Compute a root of the equation $x^2 - 5x + 6 = 0$ using Newton-Raphson method. [Take $X_0 = 5$]

(c) Use the method of least squares to find a formula of the type $Y = mX + C$ which fits the following data.

X	1·0	2·0	3·0	4·0	5·0	6·0
Y	2·0	3·9	5·9	8·2	10·1	12·0

(d) Write a program for arranging numbers in descending orders. What does '= LINEST (array1, array2, False, True)' signify? 3+2

3. Answer *any two* questions from the following: 10×2=20

(a) (i) Calculate the mean, variance and standard deviation of the following data: 1, 3, 5, 7, 9

(ii) Sketch the curve $Y = X^2 - 2X$ with proper Labelling using dataset. 5+5

(b) (i) Derive the expression for the slope and intercept of a straight line assuming there is no error in the determination of 'X'.

(ii) Find the output of following program:

```
K = 3
DO 22J = 5, 10, 2
K = K + J
IF (K.G T. 8) GO TO 33
22 CONTINUE
33K = 4*K
```

(iii) If $a^2 + b^2 = 7ab$, show that $\log\left\{\frac{1}{3}(a+b)\right\} = \frac{1}{2}(\log a + \log b)$. 5+3+2

(c) (i) Write a Fortran Program to compute the product of two matrices of order 3×3.

(ii) $F(x) = x^2 - 2x - 3$ is defined on the set of real numbers. Show that $F(1 + a) = F(1 - a)$ for any real value of a.

(iii) Convert $(108)_{10}$, $(55)_{10}$ to binary. 5+3+2

(d) (i) Use Trapezoidal Rule to calculate the value of $\int_1^5 (x^2+1)\, dx$ taking $h = 1$.

(ii) Write a Fortran Program to compute the roots of quadratic equation $ax^2 + bx + c = 0$.

(iii) Evaluate the Integral $\int_0^e \left\{\frac{1}{\log x} - \frac{1}{(\log x)^2}\right\} dx$. 4+4+2
