School of Basic Sciences
Bachelor of Science Honours in Mathematics
Summer Term Examination – July - August 2024

Duration : 180 Minutes
Max Marks : 100

Sem IV - C1UC401B - Computational Mathematics

General Instructions
Answer to the specific question asked
Draw neat, labelled diagrams wherever necessary
Approved data hand books are allowed subject to verification by the Invigilator

1) Write the integral of $x^2 e^{-4x}$.   K1 (3)

2) Define if else loop and print even or odd integers from given data set.   K2 (4)

3) Define   K2 (6)

     1. Eigenvalues and Eigenvectors command in SageMath.
     2. Inner Product Space command in SageMath

4) Find the general solution of the following first order ODE: dy /dt − y = e^(2t).   K3 (6)

5) Create Sage code that will calculate the number of primes less than 2015.   K3 (6)

6) By using for loop, find a list of all the numbers between 1 and 1000 that are multiples of 3 and 5.   K3 (9)

7) Find the singular value decomposition of a matrix A=[1 -4;3 4].   K3 (9)

8) Write sagemath code by using Taylor series method to determine value of y corresponding to x=2, given that $\frac{dy}{dx} = x + 2y$ and $y(1) = 1$.   K4 (8)

9) Write a sagemath code to calculate the root of a equation $f(x) = 0$ by iterative method.   K4 (12)

10) Calculatethe largest Eigen value and corresponding Eigen vector of the matrix $\begin{bmatrix} 5 & 4 \\ 2 & 2 \end{bmatrix}$ by the power methods.   K5 (10)

11) Write a sagemath code to calculate f(5) by Newton's divided difference interpolation formula for given data set for the given set of points (9, 2), (3, 10), (1,15).   K5 (15)

OR

Write a sagemath code to calculate f(5) by Lagrange interpolation formula for given data set for the given set of points (9, 2), (3, 10)

K5 (15)

12) Use Gram-Schmidt to determine orthonormal basis of the basis {(1, 1, 0),(1, 0, 1),(0, 1, 1)}.

K6 (12)

OR

Apply the Gram-Schmidt orthogonalization process estimate an orthogonal basis from a basis
{(2; -1; 3; 1); (3; 3; 4; 0); (1;-2; 0;-1); (4; 5; 5;-1)}.

K6 (12)