2024

SKILL ENHANCEMENT COURSE (SEC)

Paper SEC0301403

Full Marks - 30 Time - 1.5 hrs

The figures in the margin indicate full marks for the questions

1. Answer the following 1x5=5
   i. Calculate π to 100 decimal places
   ii. What are the 3 constants in Mathematics?
   iii. What is the command to find the square root of a number.
   iv. Write the command to list the prime numbers from 1 to 100
   v. Write the following in matrix form
   {(1, 2, 3), (4, 5, 6), (7, 8, 9)}

2. Answer any five 2x5=10
   i. How would you calculate the sum of first 50 natural numbers using Mathematica?
   ii. Write the format in Mathematica to plot a 2-dimensional graph $y=f(x), x\epsilon[x_1, x_2]$
   iii. Write in Mathematica the function
   $$f(x) = \sin^2 x + e^x|x| + \sqrt{x} + \frac{x^2}{2\pi}$$
   iv. What is the purpose of show command in Mathematica?
   v. Write the command to clear a set of variable ϑ_1, ϑ_2, ϑ_3 in Mathematica.
   vi. Why do all Mathematica command names begin with capital letters?

vii. Define a function $f(x) = x^{3x} + \sin x$. Write programs in Mathematica to differentiate and integrate $f(x)$

viii. Mention the plot commend in Mathematica to plot three lines y=4x+1, y=-x+4, y=9x-8 for $0 \leq x \leq 2$

ix. Mention two build-in functions with meanings in Mathematica.

x. Write the command to generate the list {2, 1, 6, 5, 9} and sort it in ascending order.

3. Answer any three 5x3=15

i. Let $(a_{ij})_{3x3}$ be a matrix. Write the commands in Mathematica to extract the diagonal elements from the matrix and obtain the adjoint of A. Hence write the commands to find the inverse of A, without using the Mathematica command 'inverse [A]'.

ii. What is Gaussian elimination? Use Mathematica command to find the reduced row echlon form of the matrix

$$\begin{pmatrix} 1 & 1 & 4 & 25 \\ 2 & 1 & 0 & 7 \\ -3 & 0 & 1 & -1 \end{pmatrix}$$

iii. Write a program using Newton's method to find the square root of 81.

iv. Write Mathematica code to solve the non homogeneous system of linear equations mx=b

where m= $\begin{pmatrix} 1 & 5 & -4 & 1 \\ 3 & 4 & -1 & 2 \\ 3 & 2 & 1 & 5 \\ 0 & -6 & 7 & 1 \end{pmatrix}$

$x = \begin{pmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{pmatrix}$ $b = \begin{pmatrix} 1 \\ 2 \\ 3 \\ 4 \end{pmatrix}$

v. Using Mathematica, plot a 3 dimensional graph of the surfaces

$f(x) = x^2 + y^2$

$g(x) = -x^2 + y^2$

in the range $-2 \leq x, y \leq 2$

vi. Using Mathematica generate a list of first 10 odd positive integers and then find the sum of their squares.

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