2024
VIRTUAL INSTRUMENTATION

Full Marks: 100

Time: Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1. Draw and explain the operation of the following converters: (i) Dual slope type ADC and (ii) Weighted resistor type 4-bit DAC. — 10 x 2 = 20

2. a) What is Virtual Instrumentation? What are the advantages of Virtual Instrumentation? — 6
   b) Draw and explain the Virtual Instrumentation Model and Virtual Instrumentation architecture. — 8
   c) Mention the advantages and disadvantages of LabVIEW. — 6

3. a) Write a VI program to convert (i) degree to radian and (ii) Fahrenheit to Kelvin — 6
   b) A first-order response of a system is described by the equation $y(t) = 1.25(1-e^{-0.8t})$. Write a VI program to obtain the values of $y(t)$ for t = 12 minutes and t = 20 minutes. — 6
   c) What is Sub-VI? Write a VI program to perform the operation of full adder using Sub-VI. — 8

4. a) Explain, with an appropriate example, the operations of FOR Loop. — 7
   b) Write a VI program to obtain the factorial of n using FOR loop. — 6
   c) Write a VI program to obtain the sum and average for 5 numbers using WHILE loop. — 7

5. a) Explain, with the schematic diagram, the operation of Shift Register (SR) and Stack Shift Register (SSR). Give one example for each. Why initializations are needed in SR and SSR? — 10
   b) Write a VI program to obtain the sum of the series 2+ 4 + 6 + 8 + 10 + ----+ n terms using SR. — 5
   c) Describe, with the schematic diagram, the operation of Array Subset Function. (ASF). Why it is needed? — 5

6. a) Explain, with suitable example, the operations of flat and stacked sequence structures. — 6
   b) Explain, how inverse of a matrix can be obtained in LabVIEW.
   Write a VI program to obtain the inverse of a matrix A = $\begin{bmatrix} 2 & 0 \\ 1 & 5 \end{bmatrix}$. — 4+4
   c) Write a VI program to simulate a proportional- derivative (PD) controller. — 6

7. a) Explain, with an appropriate example, the operations of Formula nodes. Mention its merits. — 8
   b) Built a VI to compute the following equations using formula nodes:
   (i) $y_1(x) = x^3 - 6x^2 + 15$ and (ii) $y_2(x, y) = 1.2x - 2.5y - 2$ — 6
   c) What do you mean by the terms: Cluster – bundle, unbundle, bundle by name and unbundle by name? Give one example for each. — 6

8. Write a short note on the following: — 4X5=20
   a) Sample and Hold circuit
   b) Feedback node and its application
   c) MyRIO and CRIO
   d) 2D array using two nested FOR loops