VIT

Vellore Institute of Technology

Winter Semester 2018-19

Continuous Assessment Test – I

Programme Name: B. Tech.

Course Name & Code: Applications of Differential and Difference Equations - MAT2002

Slot: D2

Class Number(s): VL2018195000443, 444,445,448,450,455,457,459,462,465,467,468,5969,5980

Exam Duration: 90 minutes

Maximum Marks: 50

Answer All the Questions (5 × 10 = 50)

S. No.	Question	Course Outcome (CO)
1.	Find the half-range sine series of $f(x) = \pi - x$ in $0 < x < \pi$ and using Parseval's identity prove that the sum of the series $\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \cdots = \frac{\pi^2}{6}$.	[2]
2.	Sketch the graph of the periodic function $f(x+4) = f(x)$, where $f(x) = \begin{cases} x, if\ 0 < x < 2 \\ 0, if\ 2 < x < 4 \end{cases}$ and obtain its Fourier series.	[2]
3.	Use Cayley – Hamilton theorem to show that the matrix $A = \begin{bmatrix} 1 & 0 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$ satisfies $A^n = A^{n-2} + A^2 - I$ for any $n \geq 3$. Hence find A^{50}.	[1]
4.	Reduce the quadratic form $Q = x^2 + 2y^2 + z^2 - 2xy + 2yz$ to a canonical form using an orthogonal transformation, and specify its rank, index, signature and nature.	[1]
5(a)	Find up to the first harmonic in the Fourier series of $y = f(x)$ defined in the following table x: 0, 1, 2, 3, 4 y: 1, 1.2, 1.4, 1.3, 1 (5 marks)	[2]
5(b)	Is the matrix $\begin{bmatrix} 2 & 1 & 0 \\ 0 & 2 & 1 \\ 0 & 0 & 2 \end{bmatrix}$ diagonalisable? Justify your answer. (5 marks)	[1]