VIT

Vellore Institute of Technology

DEPARTMENT OF MATHEMATICS
SCHOOL OF ADVANCED SCIENCES
Fall Semester - 2019 ~ 2020

Continuous Assessment Test –II, Oct – 2018

Course Code : **MAT2002** Slot: **F1+TF1**
Course Name : **Applications of differential and difference equations** Date: **01.10.2019**
Duration : **90 Minutes** Max. Marks: **50**

Answer all **[5 x 10 = 50]**

1. Solve by method of variation of parameters

$x^2y'' - 2xy' - 4y = \frac{10}{x}$ with the conditions $y(1) = 3; y'(1) = -15$.

2. Solve by laplace transform

$x''(t) + 2x'(t) + 3x(t) = \begin{cases} e^{-t} & 0 \le t \le 1 \\ 0 & elsewhere \end{cases}$ with $x(0) = 1, x'(0) = -1$.

3. The differential equation $L\frac{d^2Q}{dt^2} + R\frac{dQ}{dt} + \frac{1}{C}Q(t) = V(t)$ that represents a series circuit consists of a resistor with $R = 20\,ohm$ and inductor with $L = 1\,H$, a capacitor with $C = 0.002\,F$ and a $12\,V$ battery. If the initial charge and current are both zero. Find the charge and current at time t.

4. Solve the system of differential equation for the currents $i_1(t)$ and $i_2(t)$ in some electrical network is given by

$$\frac{d}{dt}\begin{bmatrix} i_1(t) \\ i_2(t) \end{bmatrix} = \begin{bmatrix} -\frac{R_1+R_2}{L_2} & \frac{R_2}{L_2} \\ \frac{R_2}{L_2} & -\frac{R_2}{L_2} \end{bmatrix}\begin{bmatrix} i_1(t) \\ i_2(t) \end{bmatrix} + \begin{bmatrix} \frac{E}{L_2} \\ 0 \end{bmatrix}$$ with $R_1 = 8\,ohm, R_2 = 3\,ohm,$

$L_1 = 1\,h,\ E = 100\sin(t), i_1(0) = 0, i_2(0) = 0.$

5. Find the series solution for the differential equation $y'' + \cos(x)\,y = 0$ about the ordinary point $x_0 = 0$. $\left(\text{use } \cos(x) = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \cdots\right)$.

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