

**VIT**Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)**School of Advanced Sciences**
Winter Semester 2021-22
Continuous Assessment Test – II

Programme Name & Branch : B. Tech.
Course Code : BMAT203L
Course Name : Linear Algebra & Differential Equations
Slot : C2+TC2+TCC2
Class Number : VL2022230100819 / VL2022230100817
Faculty : T.Yogalakshmi / K.Raghavendar
Exam Duration : 90 minutes **Max Marks: 50**

Answer all the Questions (5 × 10 = 50)

S. No.	Question	Marks
1.	(i) Solve the linear differential equation $\frac{dy}{dt} = -3y + \sin 5t, y(\pi) = 1.$ (6 marks) (ii) Find and classify the equilibrium solutions of $\frac{dy}{dt} = y^2 - 2y - 8.$ (4 marks)	10
2.	A bottle of orange juice is taken out of the refrigerator at 5°C and warms up 8°C in 5 minutes while sitting in a room of temperature 28°C. According to Newton's law of cooling, how warm will the orange juice be if left out for 15 minutes?	10
3.	Compute the Maclaurin series for the function $e^{2x} \sin x$ upto fourth order degree.	10

4.	Evaluate $\int \frac{t}{1-t^2} dt$ as a power series centered at '0' and find its radius and interval of convergences respectively.	10
5.	Modern skyscrapers are built flexibly which tend to sway back and forth to absorb the shocks of the strong gusts of wind or earthquakes. Using Euler's method, illustrate the approximate solution of the system of differential equations that model the swaying motion of the skyscraper to measure of how far the tall building is bent, governed by the damped harmonic oscillator equation $\frac{d^2y}{dt^2} + p \frac{dy}{dt} + qy = 0$, where the constants $p = 0.3$ and $q = 0.5$ are chosen to reflect the characteristics of the particular building being studied, having the initial conditions $y(0) = 0.1$, $y'(0) = 0.1$, $0 \leq t \leq 1$ and $\Delta t = 0.2$ respectively	10