



SCHOOL OF ADVANCED SCIENCES  
CONTINUOUS ASSESSMENT TEST – II  
WINTER SEMESTER 2022-2023

Programme Name & Branch: B. Tech.  
Course Code: BMAT102L  
Course Name: Differential Equations and Transforms  
Class Number(s): Common to all  
Exam Duration: 90 minutes

Maximum Marks: 50

General instruction(s): 1: Answer all the questions

1. Solve the differential equation  $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 3y = e^{-x} \sin x$ ,  $y(0) = 0$  and  $y'(0) = 1$  by method of undetermined coefficients. [10]
2. Use method of variation of parameters to find the general solution of the differential equation  $x^2 \frac{d^2y}{dx^2} - 3x \frac{dy}{dx} + 4y = \log x$ , ( $x > 0$ ). [10]
3. A 16-pound weight ( $w = mg$ , where  $g = 32 \text{ ft/s}$ ) is attached to a 5-foot-long spring ( $k$ -spring constant). At equilibrium the spring measures 8.2 feet. If the weight is pushed up and released from rest at a point 2 feet above the equilibrium position. Let the vibrations with an external constant force  $f(t) = 5$  units are described by the equation  $m \frac{d^2x}{dt^2} + \frac{dx}{dt} + kx = f(t)$ , find the vertical displacement  $x(t)$ , provided the surrounding medium offers a resistance numerically equal to the instantaneous velocity. Also discuss the nature of the vibrating spring. [10]
4. (a) Form the partial differential equation for  $(x - a)^2 + (y - b)^2 + z^2 = r^2$  by eliminating the arbitrary constants  $a$  and  $b$ . [5+5]  
(b) Find the solution of the non-linear partial differential equation  $z^2 = 1 + p^2 + q^2$ , where  $p = \frac{\partial z}{\partial x}$ ,  $q = \frac{\partial z}{\partial y}$ .
5. Find the general solution of the differential equation  $(x^2 - yz)p + (y^2 - zx)q = z^2 - xy$ , where  $p = \frac{\partial z}{\partial x}$ ,  $q = \frac{\partial z}{\partial y}$ . [10]