



COMSATS University Islamabad
Department of Computer Science
Midterm Exam Fall 2022

Program : BS-AI & DS
Teacher: Dr. M.Yousaf
Subject: Differential Equations (MTH 242)

13
Total Marks: 25
Time Allowed: 1 hr & 30 min
Date 15-11-2022

Attempt all questions

Q. 1

- (i) Which one of the functions is a solution of the given differential equation $y'' = -y$.
(a) $y = -x$ (b) $y = \sin x$ (c) $y = \frac{1}{2}x^2$ (d) None of these
- (ii) For what value(s) of k $y = x^k$ is a solution of the differential equation $x^2y'' - 2y = 0$.
(a) 1, -2. (b) -1, -2. (c) -1, 2. (d) None of these
- (iii) If the roots of an auxiliary equation of a differential equation are 3, 3, -2, then solution is
(a) $Ae^{-2x} + Be^{3x} + Ce^{3x}$. (c) $Ae^{-2x} + 2Be^{3x}$.
(b) $Ae^{-2x} + Be^{3x} + Cxe^{3x}$. (d) None of these
- (iv) If in a non-homogeneous differential equation $g(x) = x\sin 2x$ then y_p is assumed as (with no duplication term)
(a) $y_p = (Ax + B)\sin 2x$. (b) $y_p = (Ax + B)\sin 2x + (Cx + D)\cos 2x$.
(c) $y_p = Axx\sin 2x + Bxx\cos 2x$. (d) None of these
- (v) The given Bernoulli's differential equation $\frac{dy}{dx} + \frac{1}{x}y = xy^2$ by substituting $w = \frac{1}{y}$ reduces to linear equation
(a) $\frac{dw}{dx} + \frac{1}{x}w = -x$ (b) $\frac{dw}{dx} + \frac{1}{x}w = x$ (c) $\frac{dw}{dx} - \frac{1}{x}w = -x$ (d) None of these
- Q. 2 Solve the initial value problem
 $xy^2dy = (y^3 - x^3)dx, y(1) = 2$ 4
- Q. 3 Use the method of variation of parameters to solve the differential
 $y'' + y = \sin x$. 3
- Q. 4 Solve the given differential equation by finding an appropriate integrating factor
 $(2y^2 + 3x)dx + (2xy)dy = 0$. 5
- Q. 5 The radioactive isotope of lead, Pb-209, decays at a rate proportional to the amount present at time t and has a half-life of 3.3 hours. If 1 gram of this isotope is present initially, how long will it take for 90% of the lead to decay?