Menofia University
Faculty of Engineering Shebien El-kom
Basic Engineering Science Dep.
Post Graduate Examination, 2019-2020
Date of Exam : 09 / 08 / 2020

Subject: Introduction to Ordinary Differential Equations
Code: BES 506
Time Allowed : 3hrs
Total Marks: 100 Marks

Answer all the following questions الامتحان في صفحتان

Question 1 [10 Marks A 5 Marks and B 5 Marks]

(A) Find the particular solution of the first order first degree ordinary differential equation.

$$\frac{dy}{dx} = y^2 + 1, \qquad y(1) = 0$$

(B) Find the general solution of the first order first degree ordinary differential equation.

$$\frac{dy}{dx} = \frac{x^2 - 2y^2}{2xy}$$

Question 2 [10 Marks A 5 Marks and B 5 Marks]

(A) Find the general solution of the first order first degree ordinary differential equation.

$$(4x^3y - 15x^2 - y)\,dx + (x^4 + 3y^2 - x)\,dy = 0$$

(B) Explain all cases of the integrating factor to reduce the first order first degree ordinary differential equation to an exact equation. Solve this equation as an example

$$(y + xy^2)dx - x\,dy = 0$$

Question 3 [10 Marks A 5 Marks and B 5 Marks]

(A) Find the general solution of the first order first degree ordinary differential equation

$$(x-2)\frac{dy}{dx} + y = x^2 - 4$$

(B) Find the general solution of the first order first degree ordinary differential equation.

$$\frac{dy}{dx} + \left(\frac{2}{x}\right)y = x^2y^3$$

Question 4 [35 Marks (1) 8 Marks , (2) 9 Marks, (3) 9 Marks and (4) 9 Marks]

Find the total solution of the following non-homogeneous second order ordinary differential equation by undetermined coefficients method.

(1) $\frac{d^2y}{dx^2} + 5\frac{dy}{dx} + 6y = x^2$ (2) $\frac{d^2y}{dx^2} + 9y = e^{2x} + \sin(3x)$

(3) $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = \cos(x) + 10e^{-x}$ (4) $\frac{d^2y}{dx^2} - 9y = xe^x + sin(2x)$

Question 5 [15 Marks A 8 Marks and B 7 Marks]

Find the total solution of the following non-homogenous differential equation by the Laplace transform method.

(1) $y'' - y = e^{2t}, y(0) = 0, and\ y'(0) = 1$

(2) $\frac{dx}{dt} + 4x = \cos(t), x(0) = 0$

Question 6 [20 Marks A 10 Marks and B 10 Marks]

(A) Find the solution of the non-homogeneous system of ordinary differential equations.

$$\frac{dx}{dt} = 6x + y + 6t \quad and \quad \frac{dy}{dt} = 4x + 3y - 10t + 4$$

(B) Solve the second order differential equation in series form by recurrence relation method.

$$y'' - 4y = 0$$

With my best wishes Dr. Mohamady Bassioni