Menofia University Faculty of Engineering Shebien El-kom Basic Engineering Science Dep. Post Graduate Examination, 2015-2016 Date of Exam : 04 / 06 / 2016	Minoufia University	Subject: Introduction to Ordinary Differential Equations Code: BES 506 Time Allowed : 3 hrs Total Marks: 100 Marks

Answer all the following questions الامتحان في صفحتان

Question 1 [**25 Marks**]

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

$$(y^2+2)\frac{dy}{dx} = 5\,y \quad given\ that\ y = 1\ when\ x = \frac{1}{2}.$$

(B) Find the particular solution of the first order first degree ordinary differential equation:

$$7\,x\,(x-y)dy = 2\,(x^2+6\,xy-5\,y^2)\,dx$$
$$given\ that\ x = 1\ when\ y = 0$$

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

$$(x-2)\,\frac{dy}{dx} + \frac{3(x-1)}{(x+1)}y = 0$$

Question 2 [**25 Marks**]

(A) 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

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

(B) Find the general solution of the first order but not of first degree ordinary differential equations:

1- $\left(\frac{dy}{dx}\right)^2 - e^{2x}\frac{dy}{dx} = 0$ 2- $y\left(\frac{dy}{dx}\right)^2 - 2x\frac{dy}{dx} + y = 0$

(C) Find the general solution of the second order first degree ordinary differential equations:

1- $x^2\,\frac{d^2y}{dx^2} + x\,\frac{dy}{dx} = 0$ 2- $y\frac{d^2y}{dx^2} + 1 = \left(\frac{dy}{dx}\right)^2$

Question 3 **[25 Marks]**

(A) Prove that if $y_1 = e^x$, $y_2 = xe^x$, and $y_3 = e^{3x}$are linearly independent functions. Discus completely all the difference between the general solution and particular solution of an ordinary differential equation . Find the homogeneous differential equation which the complement solution is :

$y_c = c_1y_1 + c_2y_2 + c_3y_3 where\ c_1, c_2, and\ c_3\ are\ constants$.

(B) Find the general solution of the non-homogenous system of differential equations:

$$\frac{d^2x}{dt^2} - y = e^{2t} + 5 \qquad \text{and} \qquad \frac{dy}{dt} - x = sin(2t)$$

(C) Find the total solution of the following non-homogenous differential equation by the linear differential operator method

$$\frac{d^4x}{dt^4} - x = cos^2(t)$$

Question 4 **[25 Marks**

(A) Find the total solution of the following non-homogenous differential equation by the undetermined coefficients method.

$$\frac{d^4x}{dt^4} - 16\,x = e^{5t} + sin(2t)$$

(B) Find the total solution of the following non-homogenous differential equation by the undetermined coefficients method.

$$[(D)(D-1)(D-2)]\,x = t^3 + e^{2x}, D = \frac{d}{dt}$$

(C) Show that the power series solution of the differential equation :

$(x+1)\frac{d^2y}{dx^2} + (x-1)\frac{dy}{dx} - 2y = 0$, using the Leibniz-Maclaurin method is given

by : $y = 1 + x^2 + e^x$, given the boundary conditions that at $x = 0, y = \frac{dy}{dx} = 1$.

With my best wishes *Dr. Mohamady Bassioni*