

Post graduate Exam (Basic Engineering Sciences)
Branch: Engineering Mathematics (Master 600)

Menoufia University
Faculty of Engineering
Shebin El-Kom
Academic Year: 2017-2018
Department: Basic Eng. Sci.



Subject: Ordinary Differential
Equations (1)
Code : BES 609
Time Allowed: 3 hours
Date: 30 / 5 / 2018
Total Marks: 100 Marks

Answer all the following questions:

Q.1 (A) Find the general solution of the following differential equation :-

$$\frac{x dx + y dy}{x dy - y dx} = \sqrt{\frac{a^2 - x^2 - y^2}{x^2 + y^2}}$$

(B) Solve the following differential equation by homogeneous method:-
 $z(x^2 - yz - z^2) dx + xz(x + z) dy + x(z^2 - xy - x^2) dz = 0$

(C) Solve the following differential equation by parametric method:-
 $x dx + y dy + (x^2 + y^2 + z^2 + 1)z dz = 0$

[Q.1 (25 mark)]

Q.2 (A) Solve the following simultaneous differential equations:-

1) $\frac{dx}{yz} = \frac{dy}{xz} = \frac{dz}{xy}$

2) $\frac{x dx}{y^3 z} = \frac{dy}{x^2 z} = \frac{dz}{y^3}$

(B) Solve the following simultaneous total differential equations:-

$$yz dx + xz dy + xy dz = 0 \quad \text{and} \quad (xz + xy - yz) dx + x^2 dy + x^2 dz = 0$$

(C) Solve the following differential equations:-

1) $y''' + y'' = x$

2) $(y'')^2 - 2xy''y''' + (y''')^2(x^2 - 1) = 1$

[Q.2 (25 mark)]

Q.3 (A) Solve the following differential equations by method of variation of parameters:-

1) $y'' + y = x^2 e^x$

2) $y'' - 2y' + y = \frac{1}{x} e^x$

3) $y''' + y' = \tan x$

(B) Solve the following initial value problem by Laplace transform method :-

$$y'' - 2y' + 5y = 8 \sin t - 4 \cos t$$

with initial conditions at $t = 0$,

$$y(0) = 1, \text{ and } y'(0) = 3$$

(C) Find the total solution of the following system of differential equations by Laplace transform method :-

$$\frac{d^2 y}{dt^2} - y = 3x \quad \text{and} \quad \frac{d^2 x}{dt^2} - 4y = -4 e^t$$

with initial conditions at $t = 0$,

$$y(0) = 2, y'(0) = 3, x(0) = 1, \text{ and } x'(0) = 2$$

[Q.3 (25 mark)]

Q.4 (A) Solve the following differential equations in power series using Frobenius method:-

$$(1 - x^2) y'' - 2xy' + 2y = 0$$

(B) Solve the following differential equations in power series using Frobenius method when x has very large value:-

$$2x^3 y'' + x^2 y' + y = 0$$

(C) Find the general solution of the following system of differential equations:

$$Dx + Dy = 2 \sinh t$$

$$Dy + Dz = e^t$$

$$Dx + Dz = 2e^t + e^{-t}$$

$$\text{where } D = \frac{d}{dt}$$

[Q.3 (25 mark)]

With my best wishes

Dr. Mohamady Bassioni