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UNIVERSITY OF LAGOS, FACULTY OF ENGINEERING
FIRST SEMESTER MID-SEMESTER TEST (2018/2019 SESSION)
SSG 219: ORDINARY DIFFERENTIAL EQUATIONS I Time: 1 hrs 30 Minutes

1. Solve the following equations

(a) Using the integrating factor, solve $(x^2 - 1)\frac{dy}{dx} + 2xy = x$

(b) A body at a temperature of 50^0F is placed outdoors where the temperature is 100^0F. if after 5 minutes the temperature of the body is 60^0F, find

(i) How long it will take the body to reach a temperature of 75^0F and

(ii) The temperature of the body after 20 minutes.

2. Solve the following equations

(a) $q'''' + q'' - 2q = 0$

(b) A $\frac{1}{2}kg$ mass is attached to a spring having a spring constant of $8N/m$. The mass is started in motion by displacing it $10cm$ above its equilibrium position with an initial velocity of $2m/sec$ in the upward direction. Find the subsequent motion, if the force due to air resistance is $4\dot{x}N$.

3. Find the general solution to the following differential equations by necessary method of

(a) $y''' + y' = \sec x$

(b) $y'' - y' - 2y = 4x^2, \quad y(0) = 1, \; y'(0) = 4$

4. Solve the following questions

(a) Find the recurrence formular for the differential equation below. Hence find it's general solution $y'' + (x - 1)y' + (2x - 3)y = 0$

(b) Solve the linear differential equation $x^3y''' - 2x^2y'' - 2xy' + 8y = 0$

University of Lagos
Faculty of Engineering
Second Semester Final Examination (2017/2018 Session)
GEG 219: DIFFERENTIAL EQUATIONS I Time: 2 hrs

Instructions: ***Answer five (5) Questions Only***

Question 1

a. Using the integrating factor, solve the following sets of first order linear differential equations
   (i) $xy' + 2y = 3x + 2$
b. A certain radioactive material is known to decay at a rate proportional to the amount present. If initially there is 50 milligrams of the material present and after two hours it is observed that the material has lost 10% of its original mass, find
   (i) An expression for the mass of the material remaining at any time t
   (ii) The mass of the material after four hours and
   (iii) The time at which the material has decayed to half of its initial mass *(12 marks)*

Question 2

Solve the following linear differential equations

(a) $y'''' - 9y'' + 20y = 0$

(b) A $10kg$ mass is attached to a spring stretching it by $0.7m$ from its natural length. The mass is started in motion from equilibrium position with an initial velocity of $1m/sec$ in the upward direction. Find the subsequent motion, if the force due to air resistance is $-90\dot{x}N$. (Take $g = 9.8m/s^2$) *(12 marks)*

Question 3

Find the general solution to the following differential equations by method of **undetermined coefficients**

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

(b) $y'' - 2y' + y = 3e^{2x}$ *(12 marks)*

Question 4

Solve the following linear differential equations by **variation of parameters**

(a) $y'' - 4y' + 3y = \frac{e^x}{1+e^x}$

(b) $y'''' = 5x$ *(12 marks)*

Question 5

Find the recurrence formular for the **Power Series** solution of the differential equations below. Hence find their general solution.

(a) $y'' - (x-2)y' + 2y = 0$

(b) $(x^2 - 1)y'' + xy' - y = 0$ *(12 marks)*

Question 6

Solve the following **Cauchy-Euler** equations

(a) $x^2y'' + xy' + y = 0, \quad y(1) = 1, \quad y'(1) = 2$

(b) $2x^2y'' + 5xy' + y = x^2 - x$ *(12 marks)*

Question 7

Solve the following first order **nonlinear** differential equations

(a) $y'(y + x^2y) = 2x, \quad y(0) = -2$

(b) $x^2y - x^3y' = y^4 \cos x$

(12 marks)