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University Examinations 2020/2021

SUPPLEMENTARY/SPECIAL EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN MATHEMATICS AND COMPUTER,

SUPPLEMENTARY/SPECIAL EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN EDUCATION SCIENCE

SMA 3352: ODE 2

DATE: APRIL 2022

TIME: 2 HOURS

INSTRUCTIONS: *Answer question **one** and any other **two** questions*

QUESTION ONE (30 MARKS)

a) Find the wronsklan of e^t, e^{2t}, e^{-st} (3 marks)

b) Solve the system below using matrix method (7 marks)

$$\frac{dx}{dt} = 3x + 4y$$

$$\frac{dy}{dt} = -2x - 3y$$

c) Show that y=x is a solution of the equation $x^2 y^{II} - 4xy^{I} + 4y = 0$, hence solve the equation

(8 marks)

d) Show that the following equation is non-linear giving reasons

$$5x \frac{d^4 y}{dx4} - 3x \frac{d^3 y}{dx^3} \cdot \frac{dy}{dx} + 2\left(\frac{dy}{dx}\right)^2 + 9y^2 = 0$$
(3 marks)

e) Locate and classify the singular points of the equation $(x^2 - 8x)\dfrac{d^2 y}{dx^2} + (x+2)\dfrac{dy}{dx} + y = 0$

(6 marks)

f) Write down the Legendre differential equation and show its singularity (3 marks)

QUESTION TWO (20 MARKS)

a) Verify that the total differential equation is solvable $3x^2 dx + 3y^2 dy - (x^3 + y^3 + e^{2Z})dz = 0$, if so, solve by taking one of the variables as constant (12 marks)

b) Solve the non-linear differential equation $\dfrac{d^2 y}{dx^2} \sin \dfrac{dy}{dx} = \sin x$ which satisfies the conditions

y(1)=2 and $y^1(1) = 1$ (8 marks)

QUESTION THREE (20 MARKS)

a) Obtain the power senes solution of the equation $\dfrac{dy}{dx} = y$ in ascending powers of x and hence

solve the equation (12 marks)

b) Show that Legendre polynomial of order 1 is x (8 marks)

$P_1(x) = x$

QUESTION FOUR (20 MARKS)

a) Bessel's differential equation is given by $x^2 y^{11} + xy^1 - p^2 y = 0$. Define it's singularity and

the nature of its power series solution (6 marks)

b) Show that x=0 is an ordinary point of the equation $(x^2 - 1)\dfrac{d^2 y}{dx^2} + 3x\dfrac{dy}{dx} + xy = 0$ (3 marks)

c) Find the power series solution of $(x^2 - 1)y^{11} + 3xy^1 + xy = 0$. (11 marks)

QUESTION FIVE (20 MARKS)

Show that the total differential equation is integrable and hence solve

$yz(y+z)dx + zx(z+x)dy + xy(x+y)dz = 0$ (20 marks)