MACHAKOS UNIVERSITY

University Examinations 2018/2019

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS, STATISTICS AND ACTUARIAL SCENCE

THIRD YEARSPECIAL/SUPPLEMENTARY EXAMINATION FOR

BACHELOR OF SCIENCE IN MATHEMATICS AND COMPUTER SCIENCE
BACHELOR OF SCIENCE IN STATISTICS AND PROGRAMMING
BACHELOR OF SCIENCE IN MATHEMATICS
BACHELOR OF ECONOMICS AND STATISTICS
BACHELOR OF EDUCATION
BACHELOR OF ARTS

SMA335: ODE I

DATE: 27/9/2019 **TIME: 8:30 – 10:30 AM**

Instructions to the Candidate:

Attempt question ***one (compulsory***) and any other ***two questions***.

Question 1(30mks)

a) Consider the differential equation $\sqrt{3+\left(\frac{dy}{dx}\right)^2} = 2x$

i.) State the order of the differential equation (2 marks)

ii.) State the degree of the differential equation (2 marks)

b) Consider the differential equation $\left(x^3 + y^3\right)dx - 3xy^2 dy = 0$

i) Show that it is homogeneous (3 marks)

ii) Use the substitution $y = vx$ to transform the equation into an equation containing v *and* x *only* (2 marks)

c) The scientific law states that the acceleration of a particle during upward motion under gravity is $-g$. write down this law as a differential equation (3 marks)

d) Solve the differential equation $\frac{dy}{dx} = \frac{x-y+3}{2x-2y+5}$, given that it is non-homogeneous.(4 marks)

e) Solve the Bernoulli's equation $\frac{dy}{dx} + y = xy^3$ (4 marks)

f) Determine the particular integral for the equation $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = e^{2x}$ (5 marks)

g) Solve the linear equation $\frac{d^4y}{dx^4} + 2\frac{d^3y}{dx^3} + \frac{d^2y}{dx^2} = \sin 3x$ (5 marks)

Question 2(20mks)

a.) Solve the differential equation $\frac{d^3y}{dx^3} - \frac{d^2y}{dx^2} - \frac{dy}{dx} = e^{3x}$ (6 marks)

b.) Solve the differential equation $x\frac{d^2y}{dx^2} - \frac{dy}{dx} + 4x^3y = x^5$ (7 marks)

c.) Solve the differential equation $(D-4)y = e^{3x}x^2$ (7 marks)

Question 3(20mks)

a) Show that $\frac{xy}{x^2+y^2}$ is a homogeneous function in x *and* y *only* (5 marks)

b) Solve the differential equation $(3x+2y-5)dx + (2x+3y-5)dy = 0$ (8 marks)

c) Solve the equation $(D-1)(D+3)(D-5)y = \cosh x$ (7 marks)

Question 4(20mks)

Consider the differential equation $(4x+3y^2)dx + 2xdy = 0$

a) Show that this equation is not exact (4 marks)

b) Calculate an integrating factor of the form x^n where n is a positive integer (3 marks)

c) Using the integrating factor in (b) above solve the differential equation (13 marks)

Question 5(20mks)

a.) Determine the differential equation whose solution is $y = A\cos 8x + B\sin 8x$ (4 marks)

b.) Solve the differential equation $\frac{dy}{dx} = \sin x$ (3 marks)

c.) Solve $\frac{dy}{dx} + y\cot x = \cos ecx$ (5 marks)

d.) Solve $(2D^2 + 2D + 3)y = x^2$ (8 marks)