



MACHAKOS UNIVERSITY

University Examinations 2019/2020 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

SPECIAL /SUPPLEMENTARY EXAMINATION FOR

DIPLOMA IN ELECTRICAL AND ELECTRONICS ENGINEERING

DIPLOMA IN MECHANICAL ENGINEERING

DIPLOMA IN CIVIL ENGINEERING

ECU 0301: ENGINEERING MATHS VII

DATE: 21/01/2021

TIME: 2.00-4.00 PM

INSTRUCTIONS TO CANDIDATES

Answer question one and any other two questions

QUESTION ONE (30 MARKS)

Solve the following differential equations

- a) $x \frac{dy}{dx} = 3 - 2x^2$ (3 marks)
- b) $2 \frac{dr}{d\theta} + \sin 2\theta = 0$ (5 marks)
- c) $y \frac{dy}{dx} = 3 - y^2$ (5 marks)
- d) $(x + 2) \frac{dy}{dx} = 3 - \frac{2y}{x}$ (5 marks)
- e) $\frac{dy}{dx} + x = y$ given $x = 0$ when $y = 2$ (7 marks)
- f) $\frac{d^2y}{dx^2} + 6 \frac{dy}{dx} + 13y = 0$ (10 marks)

QUESTION TWO (20 MARKS)

- a) Obtain the particular solution of the differential equation
 $x \frac{dy}{dx} = y + x^3 - 2x$ given that $x = 1$ when $y = 3$ (5 marks)
- b) Solve the differential equations

- i) $\frac{dy}{dx} + x^{-1}y = x^{-1}y^2$ (5 marks)
- ii) $\frac{d^2y}{dx^2} + 14\frac{dy}{dx} + 49y = 4e^{5x}$ (10 marks)

QUESTION THREE (20 MARKS)

- a) Solve the following Bernoulli differential equation

$$\frac{dy}{dx} + x^{-1}y = x^{-1}y^2 \quad (6 \text{ marks})$$

- b) Solve the linear differential equation

$$x^2 \frac{dy}{dx} + 2xy - x + 1 = 0 \quad (4 \text{ marks})$$

- c) Use the method of undetermined coefficient to solve the differential equation

$$\frac{d^2y}{dx^2} + 14\frac{dy}{dx} + 49y = 4e^{5x} \quad (10 \text{ marks})$$

QUESTION FOUR (20 MARKS)

- a) Solve the equation

$$\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 3y = x^2 - 1 \quad (8 \text{ marks})$$

- b) $\frac{d^2y}{dx^2} + 6\frac{dy}{dx} + 10y = 2\sin 4x$ (7 marks)

- c) $2(x+1)\frac{dy}{dx}(1-2x)y = x^2\sqrt{1-x}$ (5 marks)

QUESTION FIVE (20 MARKS)

- a) $(x+2)\frac{dy}{dx} = 3 - \frac{2y}{x}$ (6 marks)

- b) $x^3\frac{dy}{dx} - x^2y = y^4\cos x$ (4 marks)

- c) $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 4y = 4x + 3\cos 2x$ (10 marks)