



# 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)