



MACHAKOS UNIVERSITY

University Examinations for 2020/2021

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

THIRD YEAR FIRST SEMESTER EXAMINATION FOR

DIPLOMA IN BUILDING AND CIVIL ENGINEERING

DIPLOMA IN ELECTRICAL ENGINEERING

DIPLOMA IN MECHANICAL ENGINEERING

DIPLOMA IN AUTOMOTIVE ENGINEERING

ECU 0300: MATHEMATICS VII

DATE: 13/8/2021

TIME: 8.30-10.30 AM

INSTRUCTION: Answer Question *ONE* which is compulsory and any other *TWO* Questions

QUESTION ONE (COMPULSORY) (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

$$x \frac{dy}{dx} = y + x^3 - 2x \text{ given that } x = 1 \text{ when } y = 3 \quad (5 \text{ marks})$$

- 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)

Solve the equations

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

Obtain the general solutions of the following differentials

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)