



MACHAKOS UNIVERSITY

University Examinations 2021/2022 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

THIRD YEAR SECOND SEMESTER EXAMINATION FOR

DIPLOMA IN BUILDING AND CIVIL ENGINEERING

DIPLOMA IN MECHANICAL ENGINEERING

DIPLOMA IN AUTOMOTIVE ENGINEERING

ECU 0301 MATHEMATICS VIII

DATE: 15/12/2021

TIME: 8:30 – 10:30 AM

INSTRUCTION:

Answer Question One and Any Other Two Questions

QUESTION ONE (30 MARKS)

- a) State giving example the Dirichlet conditions (6 marks)
- b) Derive the Fourier series expansion representation (6 marks)
- c) Determine the half-range sine series of the function

$$f(t) = \begin{cases} -1 & -2 \leq t \leq 0 \\ 1 & 0 \leq t \leq 2 \\ f(T+4) \end{cases} \quad (8 \text{ marks})$$

- d) Obtain the half -range cosine series for the function

$$f(x) = \begin{cases} -6 & -\pi \leq x \leq 0 \\ 6 & 0 \leq x \leq \pi \\ f(x+2\pi) \end{cases} \quad (10 \text{ marks})$$

QUESTION TWO (20 MARKS)

A function $f(x)$ is defined by

$$f(x) = \begin{cases} 2x - x^2 & 0 < x < 3 \\ f(x+3) \end{cases}$$

- a) Sketch the function over two periods (5 marks)
- b) Obtain the Fourier series for the function (15 marks)

QUESTION THREE (20 MARKS)

- a) Determine the Fourier series expansion of a rectified sine wave

$$f(t) = |\sin t| \quad (10 \text{ marks})$$

- b) Determine the Fourier series function of period 2π is defined by

$$f(t) = \begin{cases} \frac{1}{3}t & 0 \leq t \leq \frac{1}{3}\pi \\ \frac{1}{3}(\pi - t) & \frac{1}{3}\pi \leq t \leq \pi \\ f(t + 2\pi) \end{cases}$$

stating to what value the series converges at $t = \frac{\pi}{3}$ (10 marks)

QUESTION FOUR (20 MARKS)

- a) A function $f(x)$ is defined by

$$f(x) = \begin{cases} 2 - x & 0 < x < 4 \\ x - 6 & 4 < x < 8 \\ f(x+8) \end{cases}$$

- i) Sketch the function in the range $-4 < x < 8$ (4 marks)
- ii) Obtain the Fourier Series for the function (10 marks)
- b) Expand a function $f(x) = x_1$ $0 < x < 3$ in the half-range sine series (6 marks)

QUESTION FIVE (20 MARKS)

Given $f(t) = \begin{cases} 4 - t & 0 \leq t \leq 4 \\ f(t+4) \end{cases}$

obtain the half-range cosine series