# MACHAKOS UNIVERSITY

**University Examinations 2018/2019**

**SCHOOL OF PURE AND APPLIED SCIENCES**

**DEPARTMENT OF MATHEMATICS, STATISTICS AND ACTUARIAL SCIENCE**

**SPECIAL/SUPPLEMENTARY EXAMINATION FOR**

**DIPLOMA IN ELECTRICAL ENGINEERING**

**DIPLOMA IN MECHANICAL ENGINEERING**

**DIPLOMA IN CIVIL ENGINEERING**

**ECU0302: MATHEMATICS VIII**

**DATE 23/7/2019** **TIME: 8:30 – 10:30 AM**

**INSTRUCTIONS**

**Answer Question ONE and any other TWO questions**

**QUESTION ONE 30 MARKS)**

a) State at least three conditions that must be satisfied for a function to have a fourier series (2 marks)

b) A function $f(x)$ is defined by the

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

i) Sketch the function over the interval $-4 \le x \le 8$ (4 marks)

ii) find the corresponding fourier series (8 marks)

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

$f(x) = \{x^2$ for $0 \le x \le 5$ (8 marks)

d) Derive the fourier series co-efficeints $a_0$ $a_n$ $and$ $b_n$ period $2\pi$ (8 marks)

**QUESTION TWO (20 MARKS)**

Determine the fourier series for the function $f(t)$ defined by

$$f(t) = \begin{cases} 0 & -2 \le t \le 0 \\ 3t & 0 \le t \le 4 \\ & f(t+6) \end{cases}$$

Calculate also its percentage third harmonic.

**QUESTION THREE (20 MARKS)**

A periodic function is defined by

$$f(x) = \begin{cases} 1 - \frac{x}{\pi} & -\pi \le x \le 0 \\ 1 + \frac{x}{\pi} & 0 \le x \le \pi \\ & f(x + 2\pi) \end{cases}$$

i) Sketch the graph for three periods (3 marks)
ii) Determine the fourier series for the function (13 marks)
iii) Using the substitution $x = \pi$ in the fourier series obtained show that

$\frac{\pi^2}{8} = \sum_{n-1}^{\infty} \frac{1}{(2n-1)^2}$ (4 marks)

**QUESTION FOUR 20 MARKS)**

a) A periodic function is $f)t)$ defined within the period $0 \le t \le 2\pi$

by $f(t) = \begin{cases} t & 0 \le t \le \frac{\pi}{2} \\ \frac{\pi}{2} & \frac{\pi}{2} \le t \le \pi \\ \pi - \frac{t}{2} & \pi \le t \le 2\pi \end{cases}$

sketch the function over the interval $-2\pi \le t \le 3\pi$ and obtain the fourier series expansion for the function. (10 marks)

b) Obtain the half-range sine series for the function

$$f(x) = \begin{cases} -1 & -\pi \leq x \leq 0 \\ 1 & 0 \leq x \leq \pi \\ & f(x + 2\pi) \end{cases}$$ (10 marks)