CHUKA   **UNIVERSITY**

UNIVERSITY EXAMINATIONS

RESIT/SPECIAL EXAMINATION

EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF

MATH 442: TIME SERIES ANALYSIS

STREAMS: **TIME: 2 HOURS**

DAY/DATE: TUESDAY 10/08/2021   **11.30 A.M – 1.30 P.M.**

INSTRUCTIONS

- *ANSWER ALL THE QUESTIONS.*

Question One (30 marks)

a) Find the Yule Walker equations of the AR (3) process $X_t = \emptyset_1 X_{t-1} + \emptyset_2 X_{t-2} + \emptyset_3 X_{t-3} + e_t$ (5 marks)

b) Consider the AR (2) process given by $X_t = \frac{4}{5} X_{t-1} - \frac{15}{100} X_{t-2} + e_t$. Show that X_t is stationary and find its autocorrelation function.   (5 marks)

c) Determine whether the process $X_t = 0.6X_{t-1} - 0.5X_{t-2} + e_t - 0.4e_{t-1} + 0.2e_{t-2}$ is stationary and invertible   (5 marks)

d) Fit local polynomial of degree 3 to seven consecutive data point of weight W=1/21[-2, 3, 6, 7, 6, 3,-2]   (5 marks)

e) Given the following observation of a time series X_t for n=10.

t	1	2	3	4	5	6	7	8	9	10
x_t	47	64	23	71	38	64	55	41	59	48

Find

i.   Sample auto-covariance [r(1)] and sample autocorrelation [rho(1)] (5 marks)

ii.   Sample auto-covariance [r(2)] and sample autocorrelation [rho(2)] (5 marks)

Question Two (20 marks)

The data below give the average quarterly prices of a commodity for four(4) years

YEAR	I	II	III	IV
2011	50.4	40.8	47.0	49.2
2012	38.4	33.6	53.2	69.5
2013	67.2	53.2	60.7	42.6
2014	55.1	56.0	61.6	65.3

Calculate the seasonal indices using multiplicative model   (10 marks)

b) Find the spectral density function of the process

$$X_t + X_{t-1} + X_{t-2} = e_t$$ (5 marks)

c) Find the Yule Walker equations of the AR(3) process $X_t = \emptyset_1 X_{t-1} + \emptyset_2 X_{t-2} + \emptyset_3 X_{t-3} + e_t$

(5 marks)

Question Three (20 marks)

a) Consider the AR (2) process given by $X_t = \frac{4}{5}X_{t-1} - \frac{15}{100}X_{t-2} + e_t$. Show that X_t is stationary and find its autocorrelation function.   (10 marks)

b) Determine whether the process $X_t = 0.6X_{t-1} - 0.5X_{t-2} + e_t - 0.4e_{t-1} + 0.2e_{t-2}$ is stationary and invertible.

(10 marks)