



MURANG'A UNIVERSITY OF TECHNOLOGY

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF APPLIED SCIENCES

UNIVERSITY ORDINARY EXAMINATION

2017/2018 ACADEMIC YEAR

**FOURTH YEAR FIRST SEMESTER EXAMINATION FOR THE DEGREE OF
BACHELOR OF SCIENCE IN MATHEMATICS & COMPUTER SCIENCE/
THIRD YEAR FIRST SEMESTER EXAMINATION FOR THE DEGREE OF
BACHELOR OF SCIENCE IN STATISTICS & PROGRAMMING**

AMS 318/SMA 2431– TIME SERIES ANALYSIS

DURATION: 2 HOURS

DATE: 6TH DECEMBER, 2017

TIME: 9.00 – 11.00 A.M.

Instructions to Candidates:

1. Answer **Question 1** and **Any Other Two** questions.
2. Mobile phones are not allowed in the examination room.
3. You are not allowed to write on this examination question paper.

SECTION ONE - COMPULSORY

QUESTION ONE

- (a) Define stationary time series (2 marks)
- (b) Outline and briefly explain four major reasons to record and analyse time series data (4 marks)
- (c) Determine whether the following process is invertible $x_t = e_t - 1.3e_{t-1} + 0.4e_{t-2}$ (4 marks)
- (d) i) Use the data given below to fit a trend line using the method of semi-average.

Year	88	89	90	91	92	93	94	95	96	97	98	99
Sales (KSh)	52	79	76	66	69	94	87	79	104	97	92	105

- ii) State two advantages of semi-average method (6 marks)
- (e) State and explain briefly any three examples of time series data (6 marks)
- (f) Briefly explain the following terms as used in time series analysis
- i) A linear filter
- ii) A differencing filter (4 marks)
- (g) A covariance generating function of a moving average process is given by:
 $y_t = e_t + e_{t-1} + e_{t-2} + e_{t-3}$ Compute the autocorrelation function (4 marks)

SECTION TWO – ANSWER ANY TWO

QUESTION TWO

- (a) Derive the best moving average for fitting locally a polynomial of degree three to seven consecutive data points (10 marks)
- (b) Outline any two forecasting procedures (2 marks)
- (c) Explain the steps involved in Box-Jenkins procedure of analyzing time series data (8 marks)

QUESTION THREE

- (a) Calculate the seasonal variations for the following data using the ratio to trend method

Year	Q1	Q2	Q3	Q4
2010	30	40	36	34
2011	34	52	50	44
2012	40	58	54	48

2013	54	76	68	62
2014	80	92	86	82

(12 marks)

- (b) Discuss the four components of a time series giving an example in each case (8 marks)

QUESTION FOUR

- (a) Consider an autoregressive process given by $x_t = \frac{7}{20}x_{t-1} + \frac{3}{20}x_{t-2} + e_t$. Show that x_t is stationary hence find its autocorrelation function (12 marks)

- (b) Assuming a four year cycle, calculate the trend by method of moving average from the following data in relation to production of tea in Limurur. Determine the fluctuations.

Year (20..)	01	02	03	04	05	06	07	08	09	10	11	12
Production	52	79	66	69	94	87	89	104	97	92	101	76

(6 marks)

- (c) Differentiate between an autoregressive process and a moving average (2 marks)

QUESTION FIVE

- (a) The covariance generating function of MA(3) process is given by

$$y_t = e_t - \frac{1}{4}e_{t-1} + \frac{1}{5}e_{t-2} + \frac{1}{4}e_{t-3}$$

Determine the autocovariance hence the autocorrelation function (10 marks)

- (b) Outline two limitations of a moving average method in measuring the trend (2 marks)

- (c) The data below shows the figures of production (in thousand tones) in a tea factory

Year	2004	2007	2008	2009	2010	2011	2014
Production	68	87	93	86	90	99	90

- i) Fit a straight line by the method of least squares and tabulate the trend values (6 marks)
- ii) Estimate the production in 2006 and 2015 (2 marks)