TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF APPLIED AND HEALTH SCIENCES

DEPARTMENT OF MATHEMATICS AND PHYSICS

UNIVERSITY EXAMINATION FOR:

BACHELOR OF SCIENCE IN STATISTICS AND COMPUTER SCIENCE

AMA 4409: APPLIED TIME SERIES ANALYSIS PAPER 11

SPECIAL/ SUPPLIMENTARY EXAMINATIONS

SERIES: SEPTEMBER

TIME: 2 HOURS

DATE: SEP 2018

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of FIVE questions. Attempt QUESTION ONE and any other TWO.

Do not write on the question paper.

QUESTION ONE (30 MARKS)

a) (i) Briefly explain what an autocorrelation coefficient is. (2marks)

b) Suppose $\{e_t\}$ is some discrete random process with mean μ and variance δ^2. Show that $\{X_t\}$ is a random walk (i.e if $X_t = X_{t-1} + e_t$). (7marks)

c) Which components of the time series is mainly applicable in the following cases?

i) Fire in a factory

(ii) Decrease in employment in a sugar factory during the off season

iii) fall in death rate due to advances in science.

Explain your answers without referring to any other time series (6marks)

d) Determine whether the following process represented by $X_t = e_t + 0.7e_{t-1} - 0.2e_{t-2}$ is invertible. (6 marks)

e) Why is it important to study seasonal patterns in time series (6marks

d) Briefly explain the following terminologies used in time series.
   (i) Continuous time series
   (ii) discrete time series
   (iii) Stochastic time series (3marks)

QUESTION TWO (20 MARKS)

a) Given below are the figures of sales (in 000 sh.) of a certain shop :

Year	2002	2003	2004	2005	2006	2007	2008
Sales	125	128	133	135	140	141	143

(i) Fit a straight line by the method of least squares and show the trend values. Is there an increase or decrease in sales? (13 marks)
(ii) Eliminate the trend. (3 marks)
(iii) Estimate the sales for 2010, and 2012 (4 marks)

QUESTION THREE (20MARKS)

a) State the areas of application of time series analysis (5marks)
b) Discuss the components of time series. (15 marks)

QUESTION FOUR (20 MARKS

a) Specify fully the model for an MA (1) process, and derive the mean, variance and autocorrelation function (ACF) of an MA(1) process in terms of the parameters of your model. (9marks)

b) Below are quarterly sales data at a beer production company recorded over a four-year period. Determine the centered moving averages and the ratio to moving average. (11marks)

Year	Data
1992 Q1	443.00
1992 Q2	410.00
1992 Q3	420.00
1992 Q4	532.00
1993 Q1	433.00
1993 Q2	421.00
1993 Q3	410.00
1993 Q4	512.00
1994 Q1	449.00
1994 Q2	381.00
1994 Q3	423.00
1994 Q4	531.00
1995 Q1	426.00
1995 Q2	408.00
1995 Q3	416.00
1995 Q4	520.00

QUESTION FIVE (20 MARKS)

a) Explain what an AR model is. (2marks)

b) Explain how moving averages can be used to extract the seasonal and trend components from a time series. (8marks)

c) Calculate the seasonal indices using the simple averages method for the following data indicating the average quarterly prices of a commodity for 4 years. State the demerit of this method. (10 marks)

year	Q1	Q2	Q3	Q4
1967	40.3	44.8	46.0	48.0
1968	50.1	53.1	45.3	59.5
1969	47.2	50.1	52.1	56.2
1970	55.4	59.0	61.6	65.3