KABARAK UNIVERSITY

EXAMINATIONS

2008/2009 ACADEMIC YEAR

FOR THE DEGREE OF BACHELOR OF SCIENCE IN ECONOMICS AND MATHEMATICS

COURSE CODE: **MATH 416**

COURSE TITLE: **TIME SERIES**

STREAM: **Y4S1**

DAY: **WEDNESDAY**

TIME: **2.00 – 4.00 P.M.**

DATE: **18/03/2009**

INSTRUCTIONS:

Attempt **QUESTION ONE** and **ANY OTHER TWO** questions.

PLEASE TURN OVER

Question One (30mks)

(a) The data below shows the sales made by a company from 1997 to 2000.

Year	Quarter 1	Quarter 2	Quarter 3	Quarter 4
1997	50	35	10	28
1998	54	38	12	34
1999	58	41	15	41
2000	62	44	18	46

(i) Obtain a 4 moving average trend. **(3mks)**

(ii) Using an appropriate model, obtain seasonal and random variations. **(4mks)**

(iii) Hence forecast for 2001 quarter 1, quarter 2. **(2mks)**

(b) Calculate the autocovariance and hence the autocorrelation function (ACF) of the data below.

1	2	3	4	5	6	7	8
50	40	32	24	16	13	9	6

Hence plot the correlogram **(6mks)**

(c) Determine whether the following ARMA models are stationary

(i) = − 0.24 +

(ii) = −0.9 − 0.2 +

(iii) = 0.8 $_{-}$ + 0.48 $_{-}$ + **(4mks)**

(d) Determine the invertibility and ACF of the following MA (2) process

(i) = − 0.36 − 0.36

(ii) = 0.6 − 0.5 + **(4mks)**

(e) Obtain the spectral density of an AR(1) process given by

= Ø + **(5mks)**

Question Two (20mks)

(a) (i) State Wold decomposition theorem. **(4mks)**

(ii) Hence derive the Auto regression model AR(1) and AR (2). **(2mks)**

(b) Given ARMA (1, 1) model obtain

(i) the ACF **(4mks)**

(ii) Explain the behavior of the ACF **(2mks)**

(c) Calculate the ACF for = 0.5 + 0.3 +

Hence plot it. **(8mks)**

Question Three (20mks)

(a) Explain the following terms:

(i) invertibility

(ii) weekly stationary

(iii) causality

(iv) correlogram **(8mks)**

(b) Compute the spectral density of the filtered process

= –[+ +] **(6mks)**

(c) Given the series

Year	**Q1**	**Q2**	**Q3**	**Q4**
1	59	25	75	12
2	63	28	79	17
3	70	32	84	22
4	77	36	89	27

(i) plot the time series

(ii) obtain the trend

(iii) forecast for year 5 **(6mks)**

Question Four (20mks)

(a) Briefly explain the factors that make a time series non-stationary. **(8mks)**

(b) The spectral density of a real valued time series { } is defined on [0, π] by

$$( ) = \begin{cases} 100 & \text{if } \pi_{6} - < < {}_{6} + 0.01 \\ 0 & \text{otherwise} \end{cases}$$

And on [− ,0] by ( ) = (−)

(i) Evaluate the ACF of at lag 0 and 1 **(6mks)**

(ii) What is the variance of = − − 12 **(6mks)**

Question Five (20mks)

(a) Determine the discrete fourier transform of the following series

(i) = 0.5 +

(ii) = 0.3 + 0.2 + **(8mks)**

(b) Find the ACF and PACF of the series = 0.5 + 0.2 + **(8mks)**

is the series stationary. **(4mks)**