NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

FACULTY OF COMMERCE, HUMAN SCIENCES AND EDUCATION

DEPARTMENT OF ECONOMICS ACCOUNTING AND FINANCE

QUALIFICATION:	**BACHELOR OF ECONOMICS HONOURS DEGREE**		
QUALIFICATION CODE:	08HECO	**LEVEL:**	8
COURSE CODE:	AEM810S	**COURSE NAME:**	APPLIED ECONOMETRICS
SESSION:		**PAPER:**	THEORY
DURATION:	3 HOURS	**MARKS:**	100

FIRST OPPORTUNITY QUESTION PAPER	
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MODERATOR:	Dr. Reinhold Kamati

INSTRUCTIONS
1. Answer ALL the questions. 2. Write clearly and neatly. 3. Number the answers clearly.

PERMISSIBLE MATERIALS

1. Ruler
2. Calculator

THIS QUESTION PAPER CONSISTS OF 4 PAGES

QUESTION 1 [25 MARKS]

a) What is the difference between time-series and cross-sectional data? [5]

b) Explain the purpose of the following diagnostic tests, and also state their hypotheses and decision rules

i. Normality [3]

ii. Autocorrelation [3]

iii. Heteroscedasticity [3]

iv. Ramsey RESET [3]

v. CUSUM [3]

c) Given the following unrestricted OLS regression equation

$Y_t = B_0 + B_1X_{1t} + B_2X_{2t} + B_3X_{3t} + B_4X_{4t} + B_5X_{5t} + e_t$

i. State the hypothesis and decision rule used to test whether X_2, X_3 and X_4 are redundant variables. [4]

ii. If the variables in question c) i. are redundant, how would the adjusted coefficient of determination be affected? [1]

QUESTION 2 [25 MARKS]

a) What properties of time series data would make Ordinary Least Squares (OLS) results spurious? [2]

b) State the four characteristics of the spurious OLS regression equation. [4]

c) Why should one conduct the unit-roots tests? [4]

d) State the Augmented Dickey-Fuller (ADF) and Phillips Peron equations used to test for unit roots. [10]

e) Fully interpret the unit root test results for the Exports (EXP) variable in Tables 1-4 below. [5]

Table 1

Null Hypothesis: EXP has a unit root				
Exogenous: Constant				
Lag Length: 1 (Automatic - based on SIC, maxlag=7)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-1.277610	0.6261
Test critical values:	1% level		-3.679322	
	5% level		-2.967767	
	10% level		-2.622989	
*MacKinnon (1996) one-sided p-values.				

Table 2

Null Hypothesis: EXP has a unit root				
Exogenous: Constant, Linear Trend				
Lag Length: 1 (Automatic - based on SIC, maxlag=7)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-1.271960	0.8750
Test critical values:	1% level		-4.309824	

	5% level		-3.574244	
	10% level		-3.221728	
*MacKinnon (1996) one-sided p-values.				

Table 3

Null Hypothesis: D(EXP) has a unit root				
Exogenous: Constant				
Lag Length: 2 (Automatic – based on SIC, maxlag=7)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-3.903703	0.0062
Test critical values:	1% level		-3.699871	
	5% level		-2.976263	
	10% level		-2.627420	
*MacKinnon (1996) one-sided p-values.				

Table 4

Null Hypothesis: D(EXP) has a unit root				
Exogenous: Constant, Linear Trend				
Lag Length: 2 (Automatic – based on SIC, maxlag=7)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-4.340872	0.0100
Test critical values:	1% level		-4.339330	
	5% level		-3.587527	
	10% level		-3.229230	
*MacKinnon (1996) one-sided p-values.				

QUESTION 3 [25 MARKS]

a) Under what circumstances do you use the ARDL econometrics method?

b) Given Gross Domestic Product (GDP), Capital (K) and Labour (L) variables, where GDP is the dependent variable, and K and L are independent variables, answer the following questions:

i. Write the ARDL equation for the three variables. [3]

ii. How do you test for cointegration using the above equation in b) i.? State the hypothesis and decision rule. [2]

iii. If cointegration is confirmed, state the ARDL-ECM for these three variables. [8]

iv. Write down the short-run and long-run parameters in the ARDL-ECM equation. [2]

v. Interpret the ARDL-ECM results in Table 5 below. [5]

Table 5

ARDL Error Correction Regression
Dependent Variable: D(LNGDP)
Selected Model: ARDL(3, 2, 1)
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNGDP(-1))	0.272387	0.041986	6.487582	0.0000
D(LNGDP(-2))	0.111162	0.019216	5.784960	0.0000
D(LNPCE)	0.418140	0.026011	16.07579	0.0000
D(LNPCE(-1))	0.455314	0.061821	7.364981	0.0000
D(LNPDI)	0.136933	0.005837	23.45855	0.0000
ECT(-1)	-0.868385	0.060270	-14.40829	0.0000
R-squared	0.992970	Mean dependent var		0.029535
Adjusted R-squared	0.991297	S.D. dependent var		0.021068
S.E. of regression	0.001965	Akaike info criterion		-9.433025
Sum squared residual	8.11E-05	Schwarz criterion		-9.145061
Log-likelihood	133.3458	Hannan-Quinn criterion.		-9.347398
Durbin-Watson stat	1.712794			

QUESTION 4 [25 MARKS]

(a) Suppose you want to test for the Dynamic Granger causality between GDP (Y) and money supply (M), whose model is given as follows:

$$\Delta Y_t = \lambda_0 + \sum_{i=1}^{n} \lambda_{1i}\Delta Y_{t-i} + \sum_{i=1}^{n} \lambda_{2i}\Delta M_{t-1} + \lambda_3 \epsilon_{1t-1} + \mu_{1t} \qquad (1)$$

$$\Delta M_t = \varphi_0 + \sum_{i=1}^{n} \varphi_{1i}\Delta Y_{t-i} + \sum_{i=1}^{n} \varphi_{2i}\Delta M_{t-1} + \varphi_3 \epsilon_{2t-1} + \mu_{2t} \qquad (2)$$

i. What name is given to this model? [5]

ii. Using the appropriate hypothesis, succinctly explain the four **conditions** of causality for equations (1) and (2). [12]

iii. Assume that the results in the table below are obtained from estimating the equations [1] and [2].

iv. Interpret these Granger results below fully. [8]

Dependent variables	**Independent variables F-value (prob.)**		**LR causality t-value (prob)**
	ΔLNY	**ΔLNM**	
ΔLNY	$\beta_{11} = \beta_{12} = \beta_{13} = 0$ (0.08234)	$\beta_{21} = \beta_{22} = \beta_{23} = 0$ (0.34201)	-2.8443 (0.0000)
ΔLNM	$\varphi_{11} = \varphi_{12} = \varphi_{13} = 0$ (0.03534)	$\varphi_{21} = \varphi_{22} = \varphi_{23} = 0$ (0.00156)	-3.4567 (0.0000)

Note: *, ** and *** denote statistical significance at 10%, 5%, and 1% levels, respectively