NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

FACULTY OF COMMERCE, HUMAN SCIENCES AND EDUCATION

DEPARTMENT OF ECONOMICS, ACCOUNTING AND FINANCE

QUALIFICATION : BACHELOR OF ECONOMICS HONOURS	
QUALIFICATION CODE: 08BECH	**LEVEL:** 8
COURSE CODE: AEM810S	**COURSE NAME:** APPLIED ECONOMETRICS
SESSION: MAY / JUNE 2025	**PAPER:** 1
DURATION: **3** HOURS	**MARKS:** 100

FIRST OPPORTUNITY EXAMINATION QUESTION PAPER	
EXAMINER	Dr. Valdemar J. Undji (NUST)
MODERATOR:	Ms. Ndesheetelwa N. Shitenga (NUST)

INSTRUCTIONS
1. Read the questions carefully and answer ALL questions 2. Unless specified, all final answers must be round to 2 decimal places 3. Use 5% Significance level 4. Appendixes are attached 5. The use of a calculator is allowed

THIS QUESTION PAPER CONSISTS OF _6_ PAGES (Including this front page)

QUESTION 1 **[25 marks]**

a) Consider the following non-linear model: $y = e^{(ax+bx^2+u)}$.
Transform the above model into a linear model which can be estimated by means of an ordinary least square (OLS). (4)

b) Interpret the coefficients of the transformed model you specified in (a). (4)

c) Explain the following components of a time series and provide a relevant example for each:
i) Trend (3)

ii) Cyclical (3)

iii) Seasonal (3)

iv) Irregular (3)

d) Consider the following autoregressive process of order one, AR(1): $y_t = \rho y_{t-1} + u_t$, where u_t is a white-noise process. State the condition under which:

i) y_t is a stationary time series. (2)

ii) y_t is a non-stationary time series. (3)

QUESTION 2 **[25]**

2.1 Consider the following production model: $GDP_t = \beta_0 + \beta_1 EMP_t + \beta_2 GCF_t + u_t$, where $E(u^2) = \sigma^2 GCF_t^2$. The dependent variable GDP is the level of economic growth. The independent variables EMP and GCF denote employment and gross capital formation, respectively.

a) What obvious violation of the CLRM is depicted by the expected value of the squared residual? Justify your answer. (3)

b) State the appropriate approach for rectifying the issue identified in (a) and show how you would go about rectify the problem. (7)

c) Outline the consequences for the OLS estimates if the issue identified in (a) is ignored. (3)

2.2 Consider the following regression model: $y_t = \alpha_0 + \beta\left(\frac{1}{x_i}\right) + \varepsilon_i \quad \forall \; y, x \neq 0$

a) What sort of functional form is the model? (2)

b) It is possible to estimate the model by means of an ordinary least square (OLS) estimation? Justify your answer. (4)

c) What is the behaviour of y as x tends to approach infinity? (3)

d) Provide an example where such a model may be applicable. (3)

QUESTION 3 [25]

3.1 Specify the Equations of an AR(p), MA(q), and ARMA(p, q). (6)

3.2 Economists work with various types of datasets, including cross-sectional data, time series data, panel data, etc... From the listed datasets, clearly state which type is most commonly associated with the problems of heteroscedasticity and autocorrelation respectively. (4)

3.3 Differentiate between heteroscedasticity and autocorrelation in regression analysis and identify the appropriate diagnostic tests for each. (5)

3.4 Given the pairwise Granger causality test results:

Pairwise Granger Causality Tests
Date: 04/11/25 Time: 14:32
Sample: 2000Q1 2022Q4
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
IMP does not Granger Cause ECG	90	2.14333	0.1236
ECG does not Granger Cause IMP		0.17443	0.8402
M2 does not Granger Cause ECG	90	2.50646	0.0876
ECG does not Granger Cause M2		0.05026	0.9510
M2 does not Granger Cause IMP	90	1.90695	0.1548
IMP does not Granger Cause M2		2.30333	0.1061

Formulate the Granger causality model for assessing the direction of causality between M2 and ECG. Clearly state the null and alternative hypotheses for both directions and conclude whether any Granger causality exists between these two variables. (Note: Use $\alpha = 10\%$). (10)

QUESTION 4 **[25]**

Refer to Appendix 1, which displays the output of the model examining the relationship between exports of goods and services and economic growth, specified as follows:

$$LGDP_t = \beta_0 + \beta_1 LEXPO_t + \beta_2 GEXP_t + \beta_3 ER_t + u_t \quad \text{.....(i)}$$

Where, $LGDP$ = Log of Gross Domestic Product; $LEXPO$ = Log of Export, $GEXP$= Government expenditure, ER =Exchange rate in US$.

Use Appendix 1 to answer the questions that follow.

a) Interpret the coefficients β_1 and β_2. (5)

b) Explain what the Variance Inflation Factor (VIF) is and its use. (5)

c) Is the model's functional form correctly specified? Justify. (5)

d) Are the residuals of the estimated regression normally distributed? Justify. (5)

e) Does the model suffer from first order serial correlation? Justify. (5)

Appendix 1

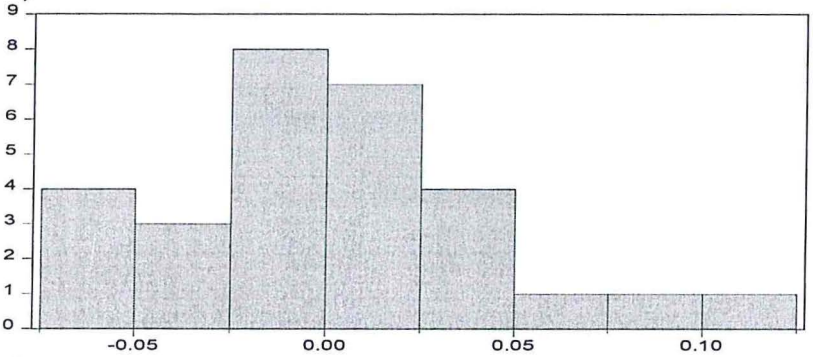
a)

Dependent Variable: LGDP
Method: Least Squares
Date: 05/06/24 Time: 11:28
Sample: 1990 2018
Included observations: 29

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.957662	0.600450	8.256579	0.0000
LEXPO	0.533283	0.062523	8.529420	0.0000
GEXP	3.23E-05	4.02E-06	8.043155	0.0000
ER	0.005866	0.005814	1.008935	0.3227

R-squared	0.985198	Mean dependent var	11.07743
Adjusted R-squared	0.983422	S.D. dependent var	0.354452
S.E. of regression	0.045638	Akaike info criterion	-3.208731
Sum squared resid	0.052070	Schwarz criterion	-3.020138
Log likelihood	50.52659	Hannan-Quinn criter.	-3.149666
F-statistic	554.6668	Durbin-Watson stat	0.973117
Prob(F-statistic)	0.000000		

b)



Series: Residuals
Sample 1990 2018
Observations 29

Mean	-3.77e-15
Median	-0.003339
Maximum	0.111260
Minimum	-0.067406
Std. Dev.	0.043123
Skewness	0.607352
Kurtosis	3.258591
Jarque-Bera	1.863703
Probability	0.393824

c)

Ramsey RESET Test
Equation: UNTITLED
Specification: LGDP C LEXPO GEXP ER
Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	0.049587	24	0.9609
F-statistic	0.002459	(1, 24)	0.9609
Likelihood ratio	0.002971	1	0.9565

d)

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	2.608118	Prob. F(2,23)	0.0953
Obs*R-squared	5.361128	Prob. Chi-Square(2)	0.0685