namibia university
OF SCIENCE AND TECHNOLOGY

FACULTY OF HEALTH, NATURAL RESOURCES AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

QUALIFICATION: Bachelor of Science in Applied Mathematics and Statistics	
QUALIFICATION CODE: 07BSAM	**LEVEL: 7**
COURSE CODE: AEM702S	**COURSE NAME:** Applied Econometric Modelling
SESSION: January, 2023.	**PAPER:** THEORY
DURATION: 3 HOURS	**MARKS:** 100

SECOND OPPORTUNITY/SUPPLEMENTARY EXAMINATION QUESTION PAPER	
EXAMINER	Prof. Rakesh Kumar
MODERATOR:	Prof. Peter Njuho

INSTRUCTIONS
1. Answer ALL the questions in the booklet provided.
2. Show clearly all the steps used in the calculations.
3. All written work must be done in blue or black ink and sketches must be done in pencil.

PERMISSIBLE MATERIALS

1. Non-programmable calculator without a cover.
2. Statistical tables will be provided when needed.

THIS QUESTION PAPER CONSISTS OF 3 PAGES (Including this front page)

Question 1. [Total Marks: 20]

Given the following information on dependent variable Y and two independent variables X_2 and X_3:

Number of observations, n=15.

$\bar{Y} = 1942.33, \overline{X_2} = 2126.33, \overline{X_3} = 8.0, \sum(Y_i - \bar{Y})^2 = 830121.33,$

$\sum(X_{2i} - \overline{X_2})^2 = 1103111.33, \sum(X_{3i} - \overline{X_3})^2 = 280$

$$\acute{X}X = \begin{bmatrix} 15 & 31895 & 120 \\ 31895 & 68922.513 & 272144 \\ 120 & 272144 & 1240 \end{bmatrix}$$

$$\acute{X}y = \begin{bmatrix} 29135 \\ 62905821 \\ 247934 \end{bmatrix}$$

$$(\acute{X}X)^{-1} = \begin{bmatrix} 37.2324 & -0.0225 & 1.3367 \\ -0.0225 & 0.00001 & -0.0008 \\ 1.3367 & -0.0008 & 0.0540 \end{bmatrix}$$

$$\acute{y}y = 57,420$$

Residual Sum of Squares (RSS), $\sum \hat{u_i}^2 = \acute{y}y - \hat{\beta}\,\acute{X}y = 1976.8557$
Explained Sum of Squares (ESS)= 828144.4778
Total Sum of Squares (TSS) = 830121.333
Answer the following questions:

   (a) Find $\hat{\beta}$.   (6 marks)
   (b) Fit the regression model of Y on X_2 and X_3.   (4 marks)
   (c) Find R^2.   (4marks)
   (d) Develop ANOVA table and test the hypothesis $H_0: \beta_2 = \beta_3 = 0$.   (6 marks)

Question 2. [Total Marks: 20]

(a) Prove that in a classical linear regression model, OLS estimators have minimum variance.
                                                                     (10 marks)

(b) How can the problem of heteroskedasticity be removed by the method of generalized least squares?   (10 marks)

Question 3. [Total Marks: 20]

(a) Discuss the estimation of parameters of a regression model in presence of perfect multicollinearity.   (10 marks)

(b) Using matrix approach, prove that in a multiple regression model, the OLS estimators are unbiased.

                                                         (10 marks)

Question 4. [Total Marks: 20]
(a) List the assumptions of classical linear regression model. (6 marks)
(b) What is identification problem? (4 marks)
(b) Discuss the Koyck's approach to distributed lag models. (10 marks)

Question 5. [Total Marks: 20]
An investigator is interested in knowing whether the monthly family expenditure is related to the monthly family income. A sample of 10 families is selected at random, the detail is given below.

Family consumption expenditure (USD): Y	70	65	90	95	110	115	120	140	155	150
Family income (USD): X	80	100	120	140	160	180	200	220	240	260

(a)Find the regression equation of monthly family consumption expenditure on the monthly family income. Predict the monthly family expenditure for monthly family income of USD 300.
(15 marks)
(b)What is the estimated change in the average monthly family expenditure with one unit change in the monthly family income? (2 marks)
(c) How much variation in the monthly family consumption expenditure is explained by the monthly family income. (3 marks)

-------------------------------------END OF QUESTION PAPER……………………………………………………………….