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: November: 2022	PAPER: THEORY
DURATION: 3 HOURS	MARKS: 100

FIRST OPPORTUNITY 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.

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

Question 1. [Total Marks: 20]
(a) Discuss the method of indirect least squares. (10 marks)
(b) In a two variable linear regression model, show that the variance of least square estimator $\widehat{\beta_2}$ is $\frac{\sigma^2}{\sum x_i^2}$. (10 marks)

Question 2. [Total Marks: 20]
(a) Prove that the residuals $\widehat{u_i}$ in the regression model $Y_i = \widehat{\beta_0} + \widehat{\beta_1} X_i + \widehat{u_i}$ are uncorrelated with the predicted Y_i? (10 marks)
(b) Discuss the method of generalized least squares in handling the problem of heteroscedasticity. (10 marks)

Question 3. [Total Marks: 20]
A real estate company (DLF) is interested to determine the relationship between the selling price of a flat and its size. A sample of 10 flats is selected at random, the detail is given below.

Flat Selling Price (1000s NAD): **Y**	245	312	279	308	199	219	405	324	319	255
Size of flat (square feet): **X**	1400	1600	1700	1875	1100	1550	2350	2450	1425	1700

(a) Find the regression equation of flat selling price on the size of flat. Predict the price for a flat with 2000 square feet area. (12 marks)
(b) What is the estimated change in the average value of flat selling price because of one unit change in size of the flat? (3 marks)
(c) Determine how much variation in flat prices is explained by variation in the size of the flat. (5 marks)

Question 4. [Total Marks: 20]
(a) Discuss the Koyck's approach to distributed lag models. (10 marks)
(b Discuss the estimation of parameters of a regression model in presence of perfect multicollinearity. (10 marks)

Question 5. [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), $\sum \widehat{u_i}^2 = \acute{y}y - \widehat{\beta}\,\acute{X}y = 1976.8557$

Explained Sum of Squares (ESS) = 828144.4778

Total Sum of Squares (TSS) = 830121.333

Answer the following questions:

    (a) Find $\widehat{\beta}$.   (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)

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