



# MACHAKOS UNIVERSITY

University Examinations 2020/2021 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

FIRST YEAR SPECIAL /SUPPLEMENTARY EXAMINATION FOR

BACHELOR OF SCIENCE IN STATISTICS AND PROGRAMMING

BACHELOR OF SCIENCE IN ACTUARIAL SCIENCE

SST 100 – INTRODUCTION TO BUSINESS AND SOCIAL STATISTICS

DATE: 29/3/2021

TIME: 11.00-1.00 PM

## INSTRUCTIONS

### Instructions to the Candidate:

1. Answer Question 1 and any other **two** questions;
2. You must have a Scientific calculator for this paper.
3. Solution to each question must start on a new page.

### QUESTION ONE (30 MARKS) (COMPULSORY)

- (a) (i) Outline *four* areas of application of index numbers in economics. (4 marks)
- (ii) Outline *four* examples of time series as applied in social data. (2 marks)
- (iii) State *four* socio-economic indicators for improvement in standard of living in a country. (4 marks)
- (b) Explain *three* possible ways in which a *time series graph* would be a useful tool to the management of an organisation in performing its function of monitoring and control. (6 marks)
- (c) The data presented in the table below shows the wage in Ksh '000' for employees of a certain parastatal over a six year period.

| Year                 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|----------------------|------|------|------|------|------|------|
| Wage                 | 28   | 32   | 33   | 35   | 37   | 40   |
| Consumer Price Index | 102  | 103  | 105  | 108  | 114  | 117  |

- Compute the real monthly wage index for each year for the employees. (8 marks)
- (d) The data in Table 4 shows the basic commodities used in households, their retail prices and the respective standard quantities (weights) over a five year period, 2006 and 2011.

| Commodity | Standard quantity | Price in Ksh   |                |
|-----------|-------------------|----------------|----------------|
|           |                   | 2010           | 2015           |
|           | W                 | P <sub>0</sub> | P <sub>n</sub> |
| Bread     | 600               | 35             | 65             |
| Sugar     | 2,000             | 80             | 375            |
| Milk      | 500               | 18             | 45             |
| Flour     | 1,000             | 45             | 115            |

Calculate the following:

- (i) A weighted average of price relatives.
- (ii) A weighted aggregate price index. (6 marks)

### QUESTION TWO (20 MARKS)

- (a) Define the term *time series* as used in statistics. (2 marks)
- (b) Differentiate between additive model and multiplicative model with respect to their suitability in data sets. (4 marks)
- (c) Describe the *four* components of a time series as applied in statistics. (14 marks)

### QUESTION THREE (20 MARKS)

- (a) Outline *four* possible sources of official social statistical data. (8 marks)
- (b) Differentiate between the terms *fixed base* and *chain base* relatives as used in index numbers. (4 marks)
- (c) Table 5 shows the price charged by an electrical shop for four categories of electric cables and their corresponding standard length in metres for the years 2007 and 2012.

| Cable Type    | 2007            |            | 2012            |            |
|---------------|-----------------|------------|-----------------|------------|
|               | Price per metre | Std length | Price per metre | Std length |
| Type X 1.5 mm | 30              | 30         | 80              | 50         |
| Type Y 1.5 mm | 35              | 40         | 95              | 75         |
| Type X 2.5 mm | 50              | 30         | 120             | 30         |
| Type X 2.5 mm | 54              | 40         | 140             | 75         |

Calculate the following taking the year 2007 as the base:

- (i) Laspeyre's price index;
- (ii) Paasche's price index. (12 marks)

**QUESTION FOUR (20 MARKS)**

The consumption of electric power in megawatt hours according to a power distribution company during a period of three consecutive years is as the table below.

| Year | Power in megawatt hours |           |           |           |
|------|-------------------------|-----------|-----------|-----------|
|      | Quarter 1               | Quarter 2 | Quarter 3 | Quarter 4 |
| 2009 | 30                      | 60        | 78        | 40        |
| 2010 | 37                      | 64        | 85        | 44        |
| 2011 | 40                      | 70        | 94        | 49        |

- a) Determine the *least squares trend* for the consumption of electricity. (8 marks)
- b) Using the *additive* model, determine the seasonal variation values for consumption of electricity. (8 marks)
- c) Forecast the quarterly consumption of electricity for the year 2012. (4 marks)

**QUESTION FIVE (20 MARKS)**

A matatu sacco has the data for its daily revenue in Kenya shillings for a period of three consecutive weeks as shown in Table 1.

| Week / Day | Revenue in Ksh '000' |         |           |          |        |
|------------|----------------------|---------|-----------|----------|--------|
|            | Monday               | Tuesday | Wednesday | Thursday | Friday |
| Week 1     | 10                   | 22      | 32        | 24       | 12     |
| Week 2     | 14                   | 28      | 39        | 30       | 15     |
| Week 3     | 19                   | 35      | 47        | 37       | 21     |

- a) Determine the moving average trend for the time series data. (8 marks)
- b) Using the multiplicative model, determine the seasonal variation values for the time series data. (8 marks)
- c) Forecast the daily sales for the matatu sacco for week 4. (4 marks)