MACHAKOS UNIVERSITY

University Examinations for 2024/2025 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES
DEPARTMENT OF MATHEMATICS, STATISTICS AND ACTUARIAL SCIENCES

FIRST YEAR FIRST SEMESTER EXAMINATION FOR DEGREE IN BACHELOR OF SCIENCE IN ACTUARIAL SCIENCE

SST 100: INTRODUCTION TO BUSINESS AND SOCIAL STATISTICS

DATE: 23RD JANUARY, 2025 **TIME: 8.30 AM – 10.30 AM**

INSTRUCTIONS:
Answer question ***ONE (Compulsory)*** *and* ***any other TWO*** *questions*

QUESTION ONE *(COMPULSORY)* (30 MARKS)

a) "Index Numbers are devices for measuring changes in the magnitude of a group of related variables". Discuss this statement and point out the important uses of index numbers. (5 marks)

b) Describe each of the following:
   i. Base period (1 mark)
   ii. Price relatives (1 mark)
   iii. Residual (1 mark)
   iv. Trend (1 mark)

c) "Laspeyre's index has an upward bias and the Paasche's index downward bias". Explain this statement. (2 marks)

d) Discuss the various tests of adequacy of index numbers. (4 marks)

e) Briefly explain each of the following:
   i. Base-shifting (1 mark)
   ii. Splicing (1 mark)
   iii. Deflating (1 mark)

f) List the three types of price Index numbers. (3 marks)

g) Reconstruct the following indices using 1985 as base: (4 marks)

Year	1982	1983	1984	1985	1986	1987
Index	100	120	190	200	212	250

h) Briefly describe the moving average and least squares methods of measuring trend in time-series. (2 marks)

i) Describe any three importance's of statistics in business. (3 marks)

QUESTION TWO (20 MARKS)

a) Given are the following price-quantity data, with price quoted in $ per kg and production in quantity.

	1980		1985	
Item	Price	Production	Price	Production
Fish	15	500	20	600
Mutton	18	590	23	640
Chicken	22	450	24	500

Find:

i) Laspeyre's Price Index for 1985, using 1980 as the base (2 marks)

ii) Laspeyre's Quantity Index for 1985, using 1980 as the base (2 marks)

iii) Paasche's Price Index for 1985, using 1980 as the base (2 marks)

iv) Paasche's Quantity Index for 1985, using 1980 as the base (2 marks)

v) Fisher's Price index (2 marks)

vi) Fisher's Quantity index (2 marks)

b) Explain clearly the different components into which a time series may be analyzed. (4 marks)

c) Explain what you understand by time series. Why is time-series considered to be an effective tool of forecasting? (4 marks)

QUESTION THREE (20 MARKS)

a) The sales of a company for the years 1990 to 1996 are given below:

Year	1990	1991	1992	1993	1994	1995	1996
Sales	32	47	65	88	132	190	275

Find trend values by using the equation $Y_c = ab^x$ and estimate the value for 1997. (10 marks)

b) Given are the following price-quantity data, with price quoted in $ per kg and production in quantity.

	1980		1985	
Item	Price	Production	Price	Production
Fish	15	500	20	600
Mutton	18	590	23	640
Chicken	22	450	24	500

Compute:

i. Index of Average of Price Relatives (base year 1980); using mean, median and geometric mean. (5 marks)

ii. Index of Average of Quantity Relatives (base year 1980); using mean, median and geometric mean. (5 marks)

QUESTION FOUR (20 MARKS)

a) Define Statistics. Explain its types, and importance to trade, commerce and business. (6 marks)

b) A company that specializes in the production of petrol filters has recorded the following production (in 1000 units) over the last 7 years.

Year	1994	1995	1996	1997	1998	1999	2000
Production	42	49	62	75	92	122	158

i. Develop a second-degree estimating equation that best describes these data. (12 marks)

ii. Estimate the production in 2004. (2 marks)

QUESTION FIVE (20 MARKS)

a) A company that manufactures steel observed the production of steel (in metric tonnes) represented by the time-series:

Year	1990	1991	1992	1993	1994	1995	1996
Production in steel	60	72	75	65	80	85	95

i. Find the linear equation that describes the trend in the production of steel by the company. (8 marks)

ii. Estimate the production of steel in 1997. (2 marks)

b) Fit a trend line to the following data by using the freehand method. (4 marks)

Year	1991	1992	1993	1994	1995	1996	1997	1998
Sales turnover	80	90	92	83	94	99	92	104

c) List any three limitations of freehand method. (3 marks)

d) Using three-yearly moving averages, determine the trend and short-term-error. (3 marks)

Year	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Production ('000')	21	22	23	25	24	22	25	26	27	26