# ZIMBABWE SCHOOL EXAMINATIONS COUNCIL (ZIMSEC)

# SUBJECT 4041, STATISTICS

**\*Available in the November Examinations only**

**2013 - 2017**

## 1.0    Preamble

This syllabus is a two year course for O-Level candidates. It fosters the developments of intellectual, data collection, management and analytical skills. The approach to be adopted should be learner centred mainly focusing on understanding statistical concepts, problem solving and interpretation of results. The syllabus assumes the knowledge of Zimbabwe junior secondary Mathematics syllabus. It provides a firm foundation for the learner who intends to study statistics and/or related subjects up to and beyond O-Level and for the statistical requirements of a wide range of professions.

**2.0    AIMS**

The syllabus aims are to:

2.1    develop an understanding and application of statistical concepts and skills in the economic and social aspects

2.2    appreciate the beauty and crucial role of statistics in national development

2.3    enable efficient use of electronic devices to solve statistical problems

2.4    develop the ability to use statistical knowledge and skills in other disciplines

2.5    stimulate the exercising of value decisions/judgments based on the scientific approach

2.6    acquire a suitable foundation for further studies and related disciplines

**3.0    ASSESSMENT OBJECTIVES**

By the end of the course, pupils should be able to:

3.1    define statistical terms.

3.2    comprehend statistical concepts and relationships in the economic and social aspects among others.

3.3    interpret, use and present information in written, graphical, diagrammatic and tabular terms.

3.4    deduce and infer through manipulation of statistical expressions.

**SCHEME OF ASSESSMENT**

|  | PAPER 1 | PAPER 2 |
|---|---|---|
| **WEIGHTING** | **50%** | **50%** |
| Structure of paper | Approximately 25 short answer questions | **SECTION A**<br>6 compulsory short questions<br>**SECTION B**<br>4 questions out of 5 |
| **TIME ALLOWED** | **2 ½ hours** | **2 ½ hours** |

## SPECIFICATION GRID

|  | PAPER 1 | PAPER 2 | |
|---|---|---|---|
|  |  | SECTION A (36%) | SECTION B (64%) |
| Recall and comprehension | 24% | 12% | 12% |
| Application and analysis | 58% | 18% | 40% |
| Synthesis and evaluation | 18% | 6% | 12% |
| **Total** | **100%** | **100%** | |

A high standard of accuracy will be expected in calculations and in the drawing of diagrams and graphs. All working must be clearly shown. **The use of an electronic calculator is expected in both papers.**

**METHODOLOGY**

Teachers are encouraged to use learner centred and participatory methods. This is to enable pupils to become active participants in the learning process and the learning of the subject becomes interesting and exciting.

Some of the recommended methodologies: guided discovery, field trips, group discussion, case study, demonstration, project method, experimentation, etc.

**NB.** It is suggested that:

1.  Concepts be developed starting from concrete situations in the (immediate environment) and moving to abstract one.

2.  Principles be based on sound understanding of related concepts and reinforce relevant skills taught in other subjects.

    **Time Allocation: 4 periods of 35-40 minutes per week.**

| TOPIC | OBJECTIVES  Learners should be able to | CONTENT | SUGGESTED LEARNING ACTIVITIES AND NOTES |
|---|---|---|---|
| 1. Introduction to statistics | -define statistical terms | Terms;  • Statistics -descriptive  -inferential  • population, sample • parameter ,Statistic • variable -random -qualitative, quantitative -discrete, continuous • Importance of statistics -area of application -uses | Citing relevant examples |
|  | -explain the importance of statistics in economic and social aspect |  | Discussing the application of statistics in everyday life e.g. at home, school, community, Education, health, insurance, ZIMSTAT, for  Planning, decision making etc. |
| 2. Data | -identify the different types of statistical data   -distinguish different types of statistical data. | • Types of data -primary and secondary -qualitative and quantitative -continuous and discrete | Defining data types.  Distinguishing between   -data and information,  -primary and secondary data,  - quantitative and qualitative, |

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| | | | -continuous and discrete data, |
| | -identify different sources of statistical data | • Sources of data <br> - Primary and secondary | - citing ethno-based examples. |
| | -describe different methods of data collection | • Data collection methods <br> -Census and surveys | Comparing the different sources of data. <br><br> Collecting data using different methods in their locality |
| | -explain the different techniques used in collecting statistical data <br><br> -state advantages and disadvantages of each method and technique | • Data collection techniques such as <br> -questionnaires <br> - observations <br> -interviews etc <br> • Measurement scales <br> -Nominal <br> -ordinal <br> -interval <br> -ratio | Conducting interviews <br><br> Designing and administering questionnaires <br><br> Conducting field trips <br><br><br> Giving advantages and disadvantages of each method and technique of collecting data |
| | -define measurement scales | | Giving examples of each measurement scale |

| 3. Sampling | -compare and contrast different sampling methods | • Sampling methods<br>-Simple random<br><br>-stratified<br><br>-systematic<br><br>-quota<br><br>-clustered | Demonstrating different sampling methods.<br><br>Describing different sampling methods |
| --- | --- | --- | --- |
| | -define bias<br><br>-explain how bias arises and how it can be reduced. | • Bias | Discussing the occurrence of bias and how it can be reduced |
| 4. Estimation of errors | Define terms error, absolute, and relative error<br><br>Carry out the four operations | Types of errors<br><br>• Absolute<br>• Relative<br><br>Estimation<br><br>Addition and subtraction<br><br>Multiplication and division | Carrying out experiments such as measuring using various instruments, rounding off to significant figures, decimal places. |

| 5.0 Representation of data | -list ways of representing data | Pictorial representation | Illustrating different ways of representing data. |
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| | | • pictogram | |
| | | • charts | |
| | -represent data in various forms | -pie charts, | Discussing the advantages and disadvantages of the various forms of representing data. |
| | | -bar charts, | |
| | -state the advantages and disadvantages of each the various ways of representing data. | -sectional bar | |
| | | - percentage bar charts, | **NB –**discuss suitability of each method of representing data. |
| 5.1. Classification, tabulation and interpretation of data | | -dual bar charts , | |
| | | -change charts | |
| | | Advantages and disadvantage of each method of representing data | |

| 5.2. Frequency distributions | -draw the graphs  -use graphs to answer given questions | - Histogram - Frequency Polygons - Cumulative frequency polygon - Cumulative frequency curve (ogive) | Drawing and interpreting the graph  Highlighting the idea of class boundaries , mid points and class intervals |
|---|---|---|---|
| 6.0. Measures of central tendency and dispersion | | | |
| 6.1. Measures of central tendency | -calculate the arithmetic mean | arithmetic mean given  - raw set of data - ungrouped frequency distribution - grouped frequency distribution - assumed mean    Mode given  - raw set data | Calculating the arithmetic mean |

|  |  | • grouped data |  |
|---|---|---|---|
|  | -find the mode (modal class). |  | Finding the mode including the graphical method(exclude interpolation method) |
|  |  | Median given |  |
|  |  | • raw set data<br>• ungrouped data<br>• grouped data |  |
|  | -determine the median. |  | Finding the median including the interpolation method and graphical method. |
|  |  |  | Discussing the advantages and disadvantages of each measure of central tendency. |
|  |  | Quartiles : |  |
|  |  | • given raw data<br>• using cumulative frequency curve |  |
| 6.2. Measures of relative position |  | Percentiles and deciles using the cumulative frequency curve |  |
|  | -define the | Range given set of data | Drawing cumulative frequency curve. |

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| 6.3. Measures of dispersion | quartiles.<br><br>-find the quartiles.<br><br>-define deciles and percentiles.<br><br>-estimate the deciles and percentile.<br><br>-relate the quartiles, deciles and percentiles | Inter quartile range and semi inter quartile range<br><br>Variance and standard deviation given:<br><br>• raw data<br>• ungrouped frequency distribution<br>• grouped frequency distribution | Stating the relationship between<br><br>• Q1 and p25<br>• Q2,D5 and p50<br>• Q3and p75<br>Calculating the inter-quartile range and semi- inter quartile range |
| | -find the range.<br><br>-calculate the inter quartile and semi-inter quartile range. | | Discussing the steps taken in calculating variance and standard deviation |
| | -calculate variance and standard deviation. | | Discussing effects on the mean and standard deviation of adding, subtracting a constant to each observation and of multiplying and dividing each observation by a constant |
| 7. Index Numbers | -define index number terms and demographic rates.<br><br>-state the importance of | Base year ,Price relatives, un weighted and weighted aggregate cost index<br><br>Demographic rates such as<br><br>• Crude death rate<br>• Crude birth rate | Calculating and interpreting the |

| | weighting | • Standardised rates | price relatives. |
|---|---|---|---|
| | -calculate and interpret index numbers and demographic rates | | -discussing demographic rates |
| 8. Time series | -define time series<br><br>-identify the four components of time series<br><br>-explain the purpose of smoothening<br><br>-calculate moving averages and centred moving averages where appropriate | Components of time series<br><br>• seasonal variation<br>• cyclic variation<br>• random variation<br>• trend<br>Smoothening<br><br>• moving averages | Illustrating time series on a graph and identifying time series components<br><br><br>Plotting moving averages<br><br><br><br>Drawing of the trend line and commenting |
| 9. Simple linear regression | -identify the dependent and independent variables<br><br>-plot the scatter | Variables<br><br>• dependent variable(Y)<br>• independent variable(X)<br>Scatter diagram<br><br>Line of best fit:<br><br>• by eye | Plotting and commenting on the relationship between variables.<br><br>Drawing the line and deducing its equation.<br><br>Estimating Y using equation |

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|---|---|---|---|
| | diagram | • using averages and semi- averages | y=m x +c |
| | Interpret the scatter diagram | Equation of the line in the form **y=mx+c** | |
| | -draw the line of best fit | | |
| | -deduce the equation of the line of best fit in the form **y=m x +c** | | |
| | -use the equation of the line of best fit to estimate value of Y given X | | |
| 10. Probability | -define the terms | Definition of terms<br><br>• probability<br>• Trial<br>• sample space<br>• outcome<br>• event<br><br>Equally likely outcomes | Carrying out experiments such as tossing a coin and throwing a die |
| | -define experimental probability | Relative frequency<br><br> Addition | |
| | -define theoretical probability | Mutually exclusive<br><br>Exhaustive<br><br>Multiplication(Independent) | Distinguishing between experimental and theoretical probability |

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|---|---|---|---|
| | -state and use probability rules<br><br>-calculate probabilities | Probabilities<br><br>• Single events<br>• Combined events Including conditional probability | Calculating probabilities including the use tree diagrams, outcome tables and Venn -diagrams |
| 11. Discrete random variables | -define discrete random variable<br><br>-State the properties of a discrete random variable<br><br>-construct the probability distribution table<br><br>-Calculate E(x) and Var(x) | Definition of the term discrete random variable.<br><br>Properties of a probability distribution function.<br><br>Probability distribution table.<br><br>Expectation (E(X)) and variance(Var(X)) | Carrying out experiments such as tossing a coin, throwing a die<br><br>Including expected profit and loss in simple games ,idea of a fair game |

## **Suggested Texts:**

David Rayner:     Extended Mathematics for IGSCE Walker & McLean, 2nd Edition
                  Ordinary Statistics 2nd Edition.