LEAD CITY UNIVERSITY, IBADAN
Faculty of Sciences
Department of Microbiology

COURSE PARTICULARS

Course Title: STATISTICS FOR BIOLOGY AND AGRIC STUDENTS

Course Code: STA 211

Lecturers:-

Name: Dr. B.A. Bamkefa

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Qualification: B.Sc. and M.Sc.

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Area of specialization:

Name: Mr Emeka Umezurike

Area of specialization:

Course description: This course will deal with the use of statistical data derived from obtained observations to draw inferences on stated hypothesis and objectives. This will help to arrive at the necessary inference from research observations and findings. Taking cognizance of stated hypothesis as well as limitations to expected inferences from research, the course will derive data from replicates of data in research findings, and then utilize the same through analysis and data interpretation to derive the necessary inference. Sample collection, experimental design, data collation, analysis and interpretation will form the basis of this course.

Course Objectives: By the end of this course, students would have been able to understand the design, analysis and statistical interpretation of obtained data of different biological experiments.

Assessment

Class attendance	5 marks
Tests and Assignments	35marks
Final Examination	60 marks

LECTURE PLAN

WEEK 1: Some Basic concepts in Biometry: Measurement and measurement scales: Sampling and statistical inference; the scientific method and design of experiments.

WEEK 2: Data and data description: Ordered array, Grouped data (frequency distribution; descriptive statistics; Measures of central tendency; Measures of dispersion

WEEK 3: Continuous probability distribution; the normal distribution.

WEEK 4: Estimation of population parameters: Confidence Interval for a population mean; t – distribution; Confidence Interval for the difference between two population means.

WEEK 5: Determination of sample size for estimating means, proportions.

WEEK 6: Hypothesis testing: Single population means; the difference between two population means

WEEK 7-8: Analysis of variance: Completely Randomized design; Randomized complete block design.

WEEK 9-10: Analysis of variance: The factorial experiment; repeated measures of design.

WEEK 11-12: Statistical Inference and relationship between two variables; the regression model; sample regression equation.

WEEK 13- 14: Relationship between two variables: Using the regression equation; the correlation coefficient.

WEEK 15: Revision

COURSE REQUIREMENT / ASSESSMENT

No particular course at any level is expected to serve as background or prerequisite for this course. However students will be expected to know arithmetical as well as geometrical observations and collation of data expected for this course.

Term Paper/ Assignment/ CAT	40%
Examination	60%
Total	100%

REFERENCES

Daniel, Wayne W. (2010). Biostatistics: Basic concepts and Methodology for the Health Sciences. 9th edition. John Wiley and Sons, Inc. NY. Toronto. London.

Rolph, P.S. and Sokhal, M. N. (2010). Biometry. 17th edition. John Wiley and Sons, Inc. NY. Toronto. London.

TUTORIAL QUESTIONS
SECTION A

1. Given the following data

68	36	35	22	65	35	25	12	27	16	22	23
63	28	46	23	43	42	45	32	31	24	43	19
42	32	47	24	25	25	12	49	50	69	27	46
										46	30

27	79	26	25	74	31	53	38	38	47		
30	27	27	46	51	28	51	42	21	22	28	43

a. Calculate the class width and interval. Use the data obtained to construct a frequency distribution table having tally marks, class midpoint, frequency and relative frequency.
b. Calculate the mean, median and use your frequency table to estimate which class interval had the highest frequency.
c. Construct a histogram to represent the data you have.

2a. What is research. State the characteristics of research
2b. Explain the different modes by which research can be conducted.

3a. Draw a normal distribution curve. State the factors that can affect its spread and position on a graph
3b. In a class test, the mean score was 80 and the standard deviation 30.

i. Find the proportion of individuals who scored greater than 95
ii. What is the probability the an individual picked at random will have a score between 75 and 95
iii. Find P($70 \leq X \leq 90$).

4a. If the average weight of lab rats aged between 3-4 months is 300g and the variance of the population is 100. Taking these estimates as mean μ and variance σ^2, consider the sampling distribution of the sample mean based on sample 50 drawn from these rats. What is the mean of the sampling distribution? What is the standard error?
4b. State the characteristics observed when sampling from a normally distributed population.

SECTION B

5a. Explain what is meant by linear correlation
b. Use graphical examples to illustrate the relationship between two variables.
6. The following are the data for X= standard quantity of carbon source, Y= Growth rate (µg/min).

X	20	18	16	40	50	60	65	70	90	100
Y	0.36	0.16	0.30	0.72	0.86	1.22	1.42	2.18	2.75	2.9

a. Using linear regression, test the significance of the relationship between the two variables
b. Predict the growth rate at carbon quantities of 70 and 90g.

7. The data below records the production of polysaccharide (measured in µg) at different temperatures on different days by *Pseudomonas putida* :

	DAY 1	DAY 2	DAY3	DAY 4
30ºC	44	52	58	65
40ºC	68	67	46	53
50ºC	51	42	50	61
60ºC	55	62	62	60
70ºC	40	60	70	52

Constructing your ANOVA table.

8. The following table shows the marks of 10 students in 2 courses in the department of microbiology. Find the product moment correlation coefficient and comment on the table.

Marks in mycology	22	31	28	30	40	46	54	60	70	80

(x)										
Marks in bacteriology (y)	32	54	60	54	62	65	80	67	75	90

SECTION C

9(a) Define Factorial Experiment

(b) What are the advantages and disadvantages of Factorial Experiment?

(c) Define the followings in Factorial Experiment: (i) Factors (ii) Levels

(d) A biologist is interested in investigating the effect of temperature and pressure on the result of the experiment. The biologist chose three levels of pressure and four temperature in the conduct of the experiment. Twenty-four pieces of the component with eight from each pressure were randomly assigned to the temperature levels. The result of the experiment conducted in two replicates were as follows:

Pressure	Temperature				
		B1	B2	B3	B4
	A1	10, 0	80, 110	30, 35	40, 50
	A2	25, 15	105, 90	45,50	30, 35
	A3	130,120	130, 110	110, 120	140, 135

Analyse the data from the experiment at 5% level of significance.

10(a) Define the following terms in test of hypothesis:

(i) Statistical Hypothesis

(ii) Test of Hypothesis

(iii) Critical Region

(iv) Acceptance Region

(v) Type I error and Type II error

(vi) One Tail and Two Tail test

(vii) Null Hypothesis and Alternative Hypothesis

(b) A manufacturer of sports equipment has developed a new synthetic fishing line which he claims has a mean breaking strength of 15 kg with a standard deviation of 0.5 kg. If a random sample of 50 lines were tested and found to have a mean breaking strength of 14.8 kg. Verify the claim by the manufacturer at α=1%

11(a) Define the following terms:

(i) Estimation (ii) Estimator (iii) Estimate (iv) Point Estimate (v) Interval Estimate

(b) The association between the output of an experiment (y) and climatic condition (x) is given by the model $Y_i = a + bx_i + e_i$, find the estimates of a and b.

12(a) What are the properties of a good estimator

(b) State the most widely used method of obtaining estimate.

(c) A pharmaceutical company believes that the drugs produced by method A on an average is more effective than the drugs produced by method B. To test this belief, random sample of drugs produced by the two methods were tested and the results are:

Methods	Sample size	Average effectiveness	Standard deviation
A	50	22400	1000
B	50	21800	1000

Is there any evidence at a 5% level of significance that the company is correct in its belief and construct the corresponding confidence interval.

MARKING GUIDE
SECTION A

1a. Definition of research and characteristics	7 marks
1b. Explanation of different research modes	$10^1/_2$ marks
	TOTAL = $17^1/_2$ MARKS
2a. Formula	1x2 = 2 marks
Calculations	2 marks
Frequency table	4 marks
b. Formula for mean and median	1x2 marks = 2 marks
Calculations	3 marks
c. Histogram	$4^1/_2$ marks
	TOTAL = $17^1/_2$ MARKS
3a. Diagram and characteristics	7 marks
b. Calculations	$10^1/_2$ marks
	TOTAL = $17^1/_2$ MARKS
4a. Calculations	8 marks
b. Characteristics	$9^1/_2$ marks
	TOTAL = $17^1/_2$ MARKS

SECTION B

5. Explanation	8 marks
Graphs	3x4 = 12 marks
	TOTAL = 20 MARKS
6a. Formula	2 marks
Calculation	8 marks
b. Calculation	10 marks
	TOTAL = 20 MARKS

7.Calculations – setting up the hypothesis, CF, SS, Error SS, Error SS, Anova table - 20 marks

TOTAL = 20 MARKS

8. Calculations of x, y, sum of xy, sum of $x^{2,}$ sum of $y^{2,}$ etc.	16 marks
Comments	4 marks
	TOTAL = 20 MARKS

SECTION C

9(a) 2 marks

(b) 6 marks

(c) (i) 1 mark (ii) 1 mark

(d) 10 marks

10(a) (i) 1 mark

(ii) 1 mark

(iii) 1 mark

(iv) 1 mark

(v) 2 marks

(vi) 2 marks

(vii) 2 marks

(b) 10 marks

11(a) (i) $1\frac{1}{2}\ marks$ (ii) $1\frac{1}{2}\ marks$ (iii) $1\frac{1}{2}\ marks$ (iv) $1\frac{1}{2}\ marks$ (v) $1\frac{1}{2}\ marks$

(b) $12\frac{1}{2}\ marks$

12(a) 6 marks

(b) 3 marks

(c) 11 marks