

NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

APPLIED PHYSICS DEPARTMENT

SPH 4103

RESEARCH METHODS

BSc. APPLIED PHYSICS PART IV: DECEMBER 2004

DURATION : 3 HOURS

ANSWER ALL FIVE QUESTIONS

1. List the compulsory components (preliminary pages, chapters, etc.) for a scientific research project report. Give a brief description of the required format and content of each component. [15]

2. (a) Explain what the purpose of conducting scientific research is?  
(b) Comment on the importance of conducting literature review in the process of a research project preparation. Describe concisely what the review should focus on and how we summarize the findings from such a review. [20]

3. You have to carry out a research study on **The effects of introduction of computer skills education in primary school on the overall performance of students.**

Design a suitable methodology of how you would carry the research. Point out the means and techniques you will employ to collect relevant information, as well as the methods for scanning and organizing the data into manageable form.

What do we mean by saying that the research study must be conclusive? [20]

4. Explain in twenty words or less, using examples and graphs where applicable:

Independent variable	Discrete distribution
Normal distribution	Confidence interval
Probability function	Random sampling

 [15]

5. (a) Define *quality control* and explain how is it done for a production process in a plant. [5]
- (b) The following values (*see table below*) represent external diameters of test tubes, measured in millimeters, taken from ten samples of five values each

Sample Number	Sample values mm					Mean sample $\bar{x}$	sample variance	Standard deviation
1	10.06	10.08	10.11	10.08	10.10			
2	10.10	10.09	10.12	10.10	10.06			
3	10.13	10.08	10.08	10.21	10.12			
4	10.08	10.16	10.05	10.10	10.14			
5	10.12	10.10	10.08	10.14	10.08			
6	10.06	10.10	10.11	10.06	10.16			
7	10.14	10.10	10.09	10.10	10.12			
8	10.14	10.16	10.12	10.08	10.10			
9	10.11	10.08	10.14	10.16	10.14			
10	10.16	10.20	10.12	10.08	10.11			

- (i) Calculate the mean; the variance and the standard deviation for each sample and complete the table. [10]
- (ii) Draw a control chart for the mean for the above test if the required value is  $x_o = 10.10$  mm and the significance level  $\alpha = 1\%$ . [10]
- (iii) What type of errors should we expect to be present in the above measurements and how do we correct the data for it? [5]

**END OF EXAM PAPER**