



**PAMIBIA UNIVERSITY**  
OF SCIENCE AND TECHNOLOGY

**FACULTY OF HEALTH AND APPLIED SCIENCES**

**DEPARTMENT OF NATURAL AND APPLIED SCIENCES**

<b>QUALIFICATION : BACHELOR OF SCIENCE HONOURS</b>	
<b>QUALIFICATION CODE: 08BOSH</b>	<b>LEVEL: 8</b>
<b>COURSE CODE: ISP811S</b>	<b>COURSE NAME: INSTRUMENTATION PHYSICS</b>
<b>SESSION: JUNE 2019</b>	<b>PAPER: THEORY</b>
<b>DURATION: 3 Hours</b>	<b>MARKS: 100</b>

<b>FIRST OPPORTUNITY EXAMINATION QUESTION PAPER</b>	
<b>EXAMINER</b>	Prof Dipti R Sahu
<b>MODERATOR:</b>	Dr Zivayi Chiguvare

<b>INSTRUCTIONS</b>
1. Answer all questions. 2. Write clearly and neatly. 3. Number the answers clearly.

**PERMISSIBLE MATERIALS**

Non-programmable Calculators

**THIS QUESTION PAPER CONSISTS OF 3 PAGES (Including this front cover)**

- Question 1** [20]
- 1.1 What do you understand by process control? What are the main reasons for manufacturers to control a process ? (5)
- 1.2 Write down the difference between simple ON/OFF action and differential ON/OFF action. (5)
- 1.3 What is PID action? Draw the wave form of PID action. (10)
- Question 2** [20]
- 2.1 What is X-ray powder diffraction (XRD)? What is the difference between XRD patterns of amorphous and crystalline materials? (5)
- 2.2 Use Bragg law to determine the indices of the first three reflections in a powder diffraction pattern taken from a simple cubic crystal. (5)
- 2.3 Draw a schematic diagram of an X –ray diffractometer system and explain the function of basic elements. (10)
- Question 3** [20]
- 3.1 Suggest two simple methods for increasing the resolving power of an optical microscope. (5)
- 3.2 Mention advantages of Electron Microscopes over Optical microscopes. (5)
- 3.3 With the aid of a diagram, explain the basic operational principle of an Atomic Force Microscope (AFM). (10)
- Question 4** [20]
- 4.1 Sketch the cooling curve of pure aluminium as it is cooled from 750<sup>0</sup> C. Given mp = 660<sup>0</sup> C, how would the Differential Thermal Analysis (DTA) plot look like? (5)
- 4.2 What is the difference between Thermogravimetric analysis (TGA), Differential Scanning Calorimetry (DSC) and Differential thermal analysis (DTA) characterizations? (5)
- 4.3 Write down and explain the Beer-Lambert Law. (10)
- Given that only 50% of a certain light beam is transmitted through a 2 cm long cuvette containing a substance in a solution (4 g/litre), calculate the extinction coefficient.

**Question 5**

**[20]**

- 5.1 State the two methods that are used to measure high resistance of materials. (5)
- 5.2 How does a Gamma ray spectrometer work? (5)
- 5.3 With the aid of a diagram, explain the principle of the four probe method used to find resistivity. (10)

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