BOWEN UNIVERSITY IWO, OSUN STATE, NIGERIA

PHYSICS PROGRAMME

COLLEGE OF AGRICULTURE, ENGINEERING AND SCIENCE (COAES)

2022/2023 SECOND SEMESTER BSc EXAMINATIONS

PHY 448: SEMICONDUCTOR PHYSICS AND SOLAR ELECTRICAL DEVICES (2 CREDITS)

DATE: Wednesday, 21st June, 2023 **TIME:** 12:30 – 2.30pm

INSTRUCTION: Answer any **three (3)** questions

1a (i) State **"Heisenberg's Uncertainty Principle".** 6mks

(ii) Using the principle stated in a(i), explain **"quantum tunneling".** 8mks

b. Using the Uncertainty principle, find the ground state energy of Helium atom. Take the radius "a" of the atom = 0.53Å, E_{min} for Hydrogen = -13.6eV. 15mks

c. Describe one application of the quantum tunneling. $4^{1/2}$mks

2a Briefly explain the **'WKB Approximation'?** 12mks

b. Derive the free-particle Schrödinger wave equation. 9mks

c. Solve a one dimensional Schrödinger wave equation using the WKB approximation. 12mks

3a. Briefly discuss the basic principle of a **junction field effect transistor (JFET).** 10mks

b(i). Explain the term **'pitch-off'** voltage as applied to JFET's. $3^{1/2}$mks

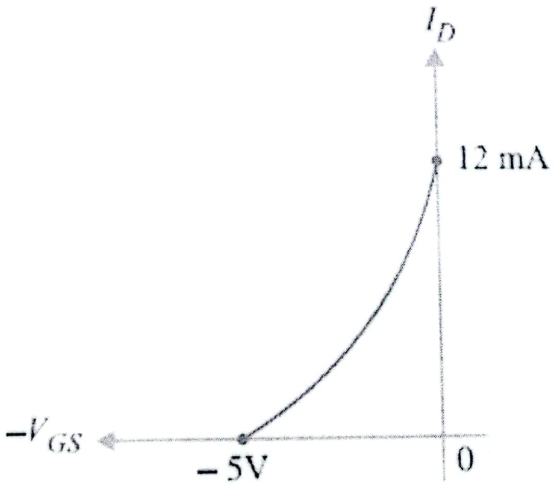
(ii). With the aid of appropriate circuit symbol, differentiate between an N-channel JFET and a P-channel JFET. 6mks

c(i). Briefly describe the two basic types of MOSFET's 10mks

(ii). Differentiate between active and passive load switching as applied to MOSFETs' 4mks

4a. With the aid of diagrams, describe the Schottky's diodes. 8mks

b. The diagram below shows the transfer characteristic curve of a Field Effect Transistors, write the equation for the drain current.



$5^{1/2}$mks

c. Describe how to design a Solar (PV) System for a standalone user showing the energy audit calculations for it 12mks

d. Briefly describe the optoelectronic devices. 8mks

Moderated
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04/06/2023