UNIVERSITY OF GHANA

BSc. (ENG) MATERIALS SCIENCE & ENGINEERING
END OF FIRST SEMESTER EXAMINATIONS: 2017/2018
MTEN 311: SOLID STATE TECHNOLOGY (3 Credits)
DEPARTMENT OF MATERIALS SCIENCE & ENGINEERING

Answer All Questions **Time Allowed: 2.5 Hours**

100 MARKS

1. The problems encountered in our daily lives for the past decades has been resolved with the understanding of classical physics and quantum mechanics.
   (a) Explain the distinction between classical physics and the Quantum Mechanics in terms of Heisenberg Uncertainty principles.
   (b) Discuss the usefulness of the wave-particle duality in the realm of quantum mechanics. **20 Marks**
2. Gordon Moore's law of scaling has for the past decades given a clear path to device engineers in increasing functionality and improving the performance of electronic gadgets.
   (a) State Moore's law and describe the significance of the law to modern day electronics?
   (b) In semiconductor device fabrication the two main deposition methods are chemical vapour and physical vapour deposition. Discuss the differences in the deposition mechanism of these two techniques with examples. **20 Marks**
3. The PN junction form can be considered as one of the basic units in all electronic devices which can be electrically manipulated to achieve devices such as solar cells, light emitting diodes, photodectors etc.
   (a) Describe with schematic diagrams the fundamental principles of a PN junction in a forward biased mode.
   (b) Describe with schematic diagrams the fundamental principles of a PN junction in a reverse biased mode. **20 Marks**
4. The MOS Capacitor is the simplest unit of the transistor as shown in Figure 1.
   (a) Discuss why the study of MOS capacitor is vital for understanding the MOSFET.
   (b) Describe the three (3) regimes of operation using a p-type semiconductor.
   20 Marks

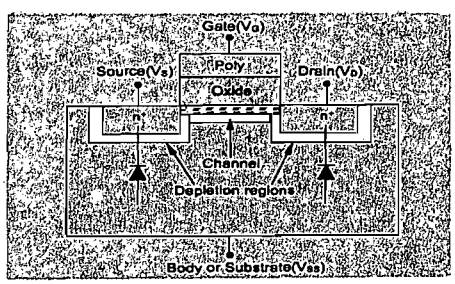

Figure 1: Cross Sectional Area of a MOSFET

5. A **LASER** (light amplification by stimulated emission of radiation) is a device common found in modern day electronic gadgets that emits light through a process of optical amplification based on the stimulated emission of electromagnetic radiation and are different from other light sources.
   (a) Describe four unique characteristics of a LASER beam.
   (b) Using schematic diagrams explain the fundamental principles governing the operation of a LASER device. **20 Marks**