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**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
SEMESTER I  
SESSION 2016/2017**

COURSE NAME : SEMICONDUCTOR MATERIAL ANALYSIS  
COURSE CODE : BED 40702  
PROGRAMME CODE : BEJ  
EXAMINATION DATE : DECEMBER 2016 / JANUARY 2017  
DURATION : 2 HOURS  
INSTRUCTION : ANSWER ALL QUESTIONS

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THIS QUESTION PAPER CONSISTS OF FOUR (4) PAGES

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- Q1** (a) There are several types of bonding in solids.
- (i) List and explain **THREE (3)** types of bonding in solids. (6 marks)
  - (ii) State **ONE (1)** example in form of Lewis structure for each of the listed bonding type in **Q1(a)(i)**. (3 marks)
- (b) Recombination process is created and eliminated in semiconductors.
- (i) Define the recombination process. (3 marks)
  - (ii) Sketch complete mechanism of direct recombination process occurs in Gallium Nitride (GaN) semiconductor compound. (7 marks)
- (c) Compare **TWO (2)** types of thermoelectric phenomena. (6 marks)
- Q2** Analyze the given semiconductor elementals in form of atomic number, color, melting point, chemical reactivity and its specific application.
- (a) Boron. (5 marks)
  - (b) Silicon. (5 marks)
  - (c) Germanium. (5 marks)
  - (d) Gray tin. (5 marks)
  - (e) Phosphorus. (5 marks)
- Q3** Silicon Carbide (SiC) is a chemical compound of Carbon and Silicon.
- (a) (i) Illustrate the structure of SiC compound. (3 marks)
  - (ii) Name the shape of SiC structure. (1 mark)

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- (b) There are so many methods to synthesize SiC compound. Propose the method and provide **FIVE (5)** important parameters used to synthesize SiC. (6 marks)
- (c) Propose **THREE (3)** types of characterization tools and their purpose/s in SiC preparation. (6 marks)
- (d) Based on the method described in **Q3(b)**, and the characterization described in **Q3(c)**, provide the physical properties of the produced SiC as listed below. (5 marks)
- (i) Color/s.
  - (ii) Size.
  - (iii) Shape/s.
  - (iv) Crystal structure.
  - (v) Density (or other related property).
- (e) List **FOUR (4)** specific applications of SiC. (4 marks)
- Q4** (a) Crystal structure is one of the important properties in semiconductor elementals and compounds. Describe the definition of: (1 mark)
- (i) Unit cell. (1 mark)
  - (ii) Lattice. (1 mark)
- (b) Sketch and name the unit cell for the listed semiconductor compounds. (7 marks)
- (i) Boron Phosphide. (7 marks)
  - (ii) Gallium Nitride. (7 marks)

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- (c) Gallium Nitride (GaN) is one example of direct bandgap semiconductor while Gallium Phosphide (GaP) is one example of indirect bandgap semiconductor. Both compounds are very useful in light-emitting diodes application.
- (i) Define the direct bandgap and indirect bandgap. (4 marks)
- (ii) Sketch an E-k diagram of electron-hole recombination in GaP compound. (5 marks)

**-END OF QUESTIONS -**

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