Mansoura University	Department: Biomedical Program Total Marks : 40 Marks	Faculty of Engineering

Course Title: ***Biomaterials***	Course Code : ***PDE393***	Level : ***300***
Date: ***4 April 2019 (Mid-Term Exam)***	Allowed Time: ***One Hour***	No. of Pages: ***(2)***

Question 1: ***(10 Marks, each point 1 mark)***

(a) **Fill in the spaces the correct answer :**

1. ..... investigates the relationships that exist between the structure and properties of materials.
2. Deteriorative characteristics indicate the ..... reactivity of materials.
3. In ..... bonds has strong Coulomb interaction among negative ions and positive ions.
4. ..... is a measure of how willing atoms are to accept electrons.
5. The ..... is the smallest structural unit or building block that can describe the crystal structure.

(b) **Choose the right answer :**

1. What type(s) of electron subshell(s) does an L shell contain?

   ☐ A. s ☐ B. p ☐ C. d ☐ D. f
   ☐ E. s and p ☐ F. s, p and d ☐ G. All of the above

2. What is the maximum number of electrons that an N shell may contain

   ☐ A. 32 ☐ B. 18 ☐ C. 8 ☐ D. 2

3. What is the predominant type of bonding for semiconductor materials?

   ☐ A. Ionic ☐ B. Covalent ☐ C. Metallic
   ☐ D. Secondary ☐ E. Both A and B ☐ F. Both B and D

4. Which crystal system(s) listed below has (have) the following relationship for the unit cell edge lengths? $a \neq b \neq c$

   ☐ A. Cubic ☐ B. Hexagonal ☐ C. Triclinic
   ☐ D. Monoclinic ☐ E. Rhombohedral ☐ F. Orthorhombic
   ☐ G. Tetragonal ☐ H. C, D and F ☐ I. Both E and F

5. Which crystal system(s) listed below has (have) the following interaxial angle relationship? $\alpha = \beta = \gamma = 90°$

   ☐ A. Cubic ☐ B. Tetragonal ☐ C. Hexagonal
   ☐ D. Triclinic ☐ E. Orthorhombic ☐ F. Both A and D
   ☐ G. A, B, and E

Mansoura University	Department: Biomedical Program Total Marks : 40 Marks	Faculty of Engineering

Course Title: ***Biomaterials***	Course Code : ***PDE393***	Level : ***300***
Date: ***4 April 2019 (Mid-Term Exam)***	Allowed Time: ***One Hour***	No. of Pages: ***(2)***

Question 2: ***(10 Marks)***

(a) Cite four criteria that are important in the materials selection process? *(4 Marks)*

(b) Briefly discuss the types of ceramic crystal structures? *(6 Marks)*

Question 3: ***(10 Marks)***

(a) A metal having a cubic structure has a density of 2.6 g/cm^3, an atomic weight of 87.62 g/mol, and a lattice parameter of 6.0849 Å. One atom is associated with each lattice point. Examine whether the metal has a BCC or FCC crystal structure. *(4 Marks)*

(b) On the basis of ionic radii, what crystal structure would you predict for FeO where the ionic radius of Fe^{2+} and O^{2-} are 0.077 nm and 0.140 nm respectively? Then calculate the density of FeO, given that the atomic weight for Fe^{2+} is 55.85 g/mol and for O^{2-} is 16 g/mol. *(6 Marks)*

Question 4: ***(10 Marks)***

(a) Sketch the following direction and plane within a cubic unit cell. *(6 Marks)*

i) $[2\,\bar{3}\,4]$ ii) $(\bar{1}\,3\,0)$

(b) Discuss briefly the some medical and industrial applications of graphene? *(4 Marks)*