**20DS102/20CB102**

**(PH03)**

**Hall Ticket Number:**

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| **I/IV B.Tech (Regular) DEGREE EXAMINATION** | | | |
| **July, 2021** | **Common to Data Science and Cyber Security** | | |
| **First Semester** | **Semiconductor Physics & Nanomaterials** | | |
| **Time:** Three Hours | | **Maximum:70** Marks | |
| *Answer Question No.1 compulsorily.* | | | (14X1 = 14 Marks) |
| *Answer ONE question from each unit.* | | | (4X14=56 Marks) |
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| **1**. | a) | Define Fermi level. |  |  |
|  | b) | What is effective mass of an electron? |  |  |
|  | c) | Define a direct band gap semiconductor. |  |  |
|  | d) | How a p-type semiconductor is formed? |  |  |
|  | e) | What is a drift current? |  |  |
|  | f) | Give the expression for continuity equation for p-type semiconductor. |  |  |
|  | g) | What is a donar level? |  |  |
|  | h) | Define Faraday effect? |  |  |
|  | i) | Compare LED and LCD |  |  |
|  | j) | Give applications of photocell. |  |  |
|  | k) | Determine the colour of light that emitted when we use a material of energy gap 1.9 eV. |  |  |
|  | l) | What are the two factors that influence the properties of nano materials? |  |  |
|  | m) | Classify carbon nano tubes. |  |  |
|  | n) | Give expression for Bragg’s law. |  |  |
| **UNIT I** | | | | |
| 2. | a) | Explain Sommerfeld free electron theory and mention any two failures of quantum free electron theory. |  | 9M |
|  | b) | An electron is bound in one-dimensional infinite well of width of 10-10 m. Find the energy values in the ground state and first two excited states in eV. |  | 5M |
|  |  | **OR** |  |  |
| 3. | a) | Define density of states and find the expression for density of states. |  | 9M |
|  | b) | Classify solid materials based on energy bands. |  | 5M |
|  |  | **UNIT II** |  |  |
| 4. | a) | Define n-type semiconductor and derive the expression for carrier concentration in n-type semiconductor. |  | 9M |
|  | b) | Explain how Fermi level varies with temperature in p-type semiconductor with a neat diagram. |  | 5M |
|  |  | **OR** |  |  |
| 5. | a) | Explain the construction, working of p-n junction diode and draw its V-I characteristics. |  | 9M |
|  | b) | Compare Schottky and Ohmic junctions. |  | 5M |
|  |  | **UNIT III** |  |  |
| 6. | a) | Explain the principle, symbol, construction and working of LED. |  | 9M |
|  | b) | Differentiate between PIN and APD. |  | 5M |
|  |  | **OR** |  |  |
| 7. | a) | Explain the principle, construction, working of solar cell. |  | 9M |
|  | b) | Define Kerr effect and explain with neat diagram. |  | 5M |
|  |  | **UNIT IV** |  |  |
| 8. | a) | Explain the synthesis of nano materials by sol-gel technique with neat diagram. |  | 8M |
|  | b) | Explain briefly chemical and optical properties of nano materials. |  | 6M |
|  |  | **OR** |  |  |
| 9. | a) | Explain briefly the properties of carbon nanotubes. |  | 8M |
|  | b) | Discuss applications of nano materials |  | 6M |

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