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17EC551

Fifth Semester B.E. Degree Examination, Dec.2019/Jan.2020 Nano Electronics

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. State Moore's law. Discuss the impact of Moore's law and nanotechnology on the continued miniaturization seen in electronics. (10 Marks)
- b. Discuss the classification of conductors, semiconductors and insulators based on band theory of solids. (10 Marks)

OR

- 2 a. Demonstrate the advantages and disadvantages of top-down and bottom-up approach with an example for each. (10 Marks)
- b. Discuss the different methods for templating the growth of nanomaterials and ordering of nanosystems. (10 Marks)

Module-2

- 3 a. Define Bragg's law. Explain the working principle of X-ray diffractometer with neat sketch. (10 Marks)
- b. Discuss the working principle of scanning electron microscopy with neat diagram. (10 Marks)

OR

- 4 a. What is Quantum confinement? Write a brief note on quantum confinement in quantum wires and quantum dots. (10 Marks)
- b. Write a brief note on electron density of states in Bulk (3D) and semiconductor nano structures (2D, 1D and 0D systems). (10 Marks)

Module-3

- 5 a. What are the requirements for the ideal semiconductor nanostructures? (04 Marks)
- b. What are the different fabrication methods available for the fabrication of semiconductor nanostructures of quantum wells, quantum wires and quantum dots? Discuss any one of the method with neat sketch. (16 Marks)

OR

- 6 a. What is modulation doping? How modulation doping is achieved with necessary diagram and what are its effects? Write its application. (10 Marks)
- b. Write a note on quantum Hall effect and Resonant tunneling process and their applications. (10 Marks)

Module-4

- 7 a. What are the Carbon Nanostructures? Classify the different types of carbon nanotubes and discuss their properties. (10 Marks)
- b. How can you fabricate the carbon nanotubes? Discuss any one of the synthesis method of carbon nanotubes with a neat sketch. (10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and/or equations written eg, 42+8 = 50, will be treated as malpractice.

OR

- 8 a. Discuss the electrical, vibrational and mechanical properties of single and multi-wall carbon nanotubes. (10 Marks)
- b. What are the applications of carbon nano tubes? Demonstrate the application of carbon nanotubes in field-effect transistors as sensors. (10 Marks)

Module-5

- 9 a. Discuss the working principle and applications of semiconductor injection lasers. What are the advantages of nanostructure lasers of different dimensionalities compared to bulk semiconductor injection lasers? (10 Marks)
- b. Discuss the working principle of quantum cascade lasers with neat sketch. What are the advantages of quantum cascade lasers over nanostructure lasers? (10 Marks)

OR

- 10 a. What is a sensor? What are the properties used for sensing? What are the advantages of nano-sensors compared to bulk sensors? Discuss in detail. (10 Marks)
- b. Discuss briefly the nano-sensors based on physical properties with an example. (10 Marks)

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