

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fourth Semester B.Tech (Hons) Degree Examination July 2021 (2019 admission)

Course Code: ECT292**Course Name: NANO ELECTRONICS****Max. Marks: 100****Duration: 3 Hours****PART A***(Answer all questions; each question carries 3 marks)*

Marks

- | | | |
|----|--|-----|
| 1 | Explain any two characteristic lengths associated with a mesoscopic system | (3) |
| 2 | Explain the features of parabolic quantum wells | (3) |
| 3 | DC sputtering cannot be used for coating non conducting materials. Justify | (3) |
| 4 | Illustrate effusion cells used in molecular beam epitaxy. | (3) |
| 5 | Compare electron microscope and optical microscope. | (3) |
| 6 | Draw the figure showing specimen interaction of Scanning Electron
Microscope. | (3) |
| 7 | Explain modulation doped quantum wells, with the aid of energy band
diagram. | (3) |
| 8 | Explain the concept of hot electrons in parallel transport | (3) |
| 9 | Explain resonant tunnelling effect. | (3) |
| 10 | List any six properties of Graphene. | (3) |

PART B*(Answer one full question from each module, each question carries 14 marks)***Module -1**

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|----|---|-----|
| 11 | a) Derive the expression for density of states in a 1D nano material | (9) |
| | b) Consider an electron having kinetic energy 5eV and effective mass $0.511m_0$.
Calculate its De-Broglie wavelength. If the size of the measoscopic structure
having this electron is in the range of $2 \times 10^{-14}m$, will it fall in the category of
nanostructures? | (5) |
| 12 | a) Explain the physical limitations in reducing the size of devices in Nano scale. | (6) |
| | b) Explain the classifications of the nanostructures in detail | (8) |

Module -2

- 13 a) Explain the different steps involved in a CVD technique for fabricating nano layers. (9)
b) Explain reduction method for fabricating metallic nano particles (5)
- 14 a) Explain sol-gel process for fabrication of nano-particles. (9)
b) Explain laser beam ablation method for fabricating nano layers (5)

Module -3

- 15 a) Illustrate the principle of imaging using STM (9)
b) Explain the working of XRD analyzer and how it can be used to analyze a crystal. (5)
- 16 Explain the principle of operation and operating modes of AFM (14)

Module -4

- 17 (a) Explain coulomb blockade effect. Explain the conditions to be satisfied to observe coulomb blockade effect (10)
(b) Compare MQW with superlattice structure. (4)
- 18 a) Explain resonant tunnelling effect in quantum structure. (8)
b) Explain the Shubnikov-de Hass effect of magnetic fields in 2D systems. (6)

Module -5

- 19 a) Draw the schematic and explain the working of a single electron transistor (8)
b) Explain Hot Electron Transistors (6)
- 20 a) With the help of a neat schematic diagram explain MODFETs. (8)
b) Illustrate the working of Quantum dot laser. (6)
