

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
EIGHTH SEMESTER B.TECH DEGREE EXAMINATION, MAY 2019

Course Code: EC402
Course Name: NANOELECTRONICS

Max. Marks: 100

Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks.

Marks

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|---|--|------|
| 1 | a) Explain the different characteristic lengths in a mesoscopic system? | (10) |
| | b) Describe parabolic quantum well. | (5) |
| 2 | a) Starting from Schrodinger equation, show that the density of states in a 1D semiconductor material is directly proportional to $1/\sqrt{E}$ | (10) |
| | b) Differentiate between dry and wet oxidation methods. | (5) |
| 3 | a) Explain sol-gel process for fabrication of nano-particles | (9) |
| | b) Brief up laser ablation method for nano material deposition with significance on RHEED screen. | (6) |

PART B

Answer any two full questions, each carries 15 marks.

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| 4 | a) Explain with neat diagram different types of specimen interactions taking place in a sample during SEM. | (10) |
| | b) Explain Multiple Quantum Wells and its different types with neat diagrams. | (5) |
| 5 | a) Explain Kronig-Penney model for superlattice and zone folding. | (10) |
| | b) Explain the concept of modulation doping. | (5) |
| 6 | a) Explain the working of XRD analyzer and how it can be used to analyze a crystal. | (10) |
| | b) Explain the working principle of Atomic Force Microscope. | (5) |

PART C

Answer any two full questions, each carries 20 marks.

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|---|---|------|
| 7 | a) Write notes on the following scattering mechanisms (a) Electron-phonon scattering (b) Impurity scattering (c) Surface roughness scattering (d) Inter sub band scattering | (10) |
| | b) Explain the principle of carbon nano tube transistors and its three different types. | (6) |
| | c) List the advantages of heterojunction quantum wells in MODFETs? | (4) |

- 8 a) Illustrate the principle of operation of Resonant tunnelling diode. (8)
- b) Explain the Aharonov-Bohm effect to induced phase variations in electron waves with the application of magnetic field with the help of diagrams and equations.. (8)
- c) Explain the concept of hot electrons. (4)
- 9 a) Explain the concept of coulomb blockade. Obtain the conditions to be fulfilled to observe single electron effect. (10)
- b) Explain the device structure and working of DH laser. (5)
- c) Write notes on NEMS. (5)

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Eighth semester B.Tech degree examinations, September 2020

Course Code: EC402**Course Name: NANO ELECTRONICS**

Max. Marks: 100

Duration: 3 Hours

PART A*Answer any two full questions, each carries 15 marks.*

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|---|---|-------|
| 1 | a) Explain de-Broglie wavelength & Screening length in mesoscopic systems. | (5) |
| | b) Explain parabolic & triangular quantum wells with neat diagrams. | (10) |
| 2 | a) Explain the process of Physical Vapour Deposition in the fabrication of nano-layers. | (7) |
| | b) Explain laser ablation. | (8) |
| 3 | a) Explain Quantum wells, wires & dots & compare each. | (5) |
| | b) Explain the process of grinding with iron balls in the fabrication of nanoparticles. | (5) |
| | c) Write short notes on: i) Carbon nanotubes ii) Sol-gel process | (5) |

PART B*Answer any two full questions, each carries 15 marks.*

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|---|--|------|
| 4 | a) Differentiate between electron & optical microscope. | (4) |
| | b) Explain the principle of Scanning Tunnelling Microscope with neat diagrams. | (6) |
| | c) Explain X-Ray Diffraction analysis. | (5) |
| 5 | a) Write notes on Modulation doped hetero-junctions. | (5) |
| | b) Explain SEM with suitable diagrams. | (10) |
| 6 | a) Compare STM and AFM. | (3) |
| | b) Write short notes on PL & UV spectroscopy. | (7) |
| | c) Explain the structure & energy band diagram of MOSFET. | (5) |

PART C*Answer any two full questions, each carries 20 marks.*

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|---|--|------|
| 7 | a) Explain the resonant tunnelling effect with neat diagrams. | (6) |
| | b) Explain Coulomb blockade in nanostructures. | (6) |
| | c) Derive Landauer formula for Quantum transport in nanostructures. | (8) |
| 8 | a) Explain the structure of Single electron transistor with neat diagrams. | (10) |
| | b) Write short notes on i) Quantum dot Laser ii) CNT transistors. | (10) |
| 9 | a) Explain the electron Scattering mechanism for parallel transport in semiconductor nanostructures. | (10) |
| | b) Explain the structure of MODFET. | (6) |
| | c) Write short notes on i) NEMS. | (4) |
