

Reg. No. :

Name :

Sixth Semester B.Sc. Degree Examination, April 2022
Career Related First Degree Programme under CBCSS

Group 2(b)-Electronics

Core Course

Ex 1643 : NANO ELECTRONICS

(2018 Admission)

Time : 3 Hours

Max. Marks : 80

SECTION – A

Answer **all** questions. **Each** question carries **1** mark.

1. A material with one dimension in Nano range and the other two dimensions are large is called _____
2. For milling operations, what kind of environment is preferred?
3. Which gas serves as buffer gas in Laser ablation?
4. In modified chemical vapor deposition, vapor phase reactant _____ and _____ pass through a hot zone.
5. The colour of the nano gold particle is _____
6. _____ property of nanomaterials make them suitable to be used for the elimination of pollutants.

7. On both ends of the CNTs, which carbon nanostructure is placed?
8. Nano crystalline materials synthesised by sol-gel technique results in a foam-like structures called _____
9. NEMS is the abbreviation of _____
10. Give Beer-Lambert Law.

SECTION – B

(10 × 1 = 10 Marks)

Answer any **eight** questions. Each question carries 2 marks.

11. What are the limitations of microelectronics compared to nanoelectronics?
12. What is Raman effect?
13. What are the steps involved in the top-down approach for the synthesis of nano materials.
14. Why the characterisation of nano materials is done?
15. What is photoluminescence?
16. What are the application restrictions of scanning tunneling microscopy?
17. What is the principle of IR spectroscopy?
18. Explain Bragg's Law in XRD.
19. What are the applications of carbon nano tubes?
20. What are the different types of nanowires?
21. What is graphene?
22. What is quantum confinement effect?
23. Define density of states.

24. Draw the schematic diagram of Single Electron Transistor.
25. What are the advantages of Resonant Tunneling Transistors?
26. What are MEMS?

(8 × 2 = 16 Marks)

SECTION – C

Answer any **six** questions. **Each** question carries **4** marks.

27. Explain the iron ball milling process.
28. Explain PVD process for the fabrication of nano-layers.
29. Explain Atomic Force Microscopy method for the characterisation of nano materials.
30. Explain the working principle of UV characterisation instrument with a neat sketch.
31. Briefly explain laser ablation.
32. What are the different types of single wall carbon nano tubes? Explain.
33. Explain the principle behind the quantum dot. What are the applications of quantum dots?
34. What are SAED patterns? How is it used for analysis?
35. What is nano manipulation? Explain with a block diagram.
36. Write a note on the challenges in designing a nano scale MOSFET.
37. What is phase contrast transfer function? Explain.
38. What is coulomb blockade?

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two** questions. Each question carries **15** marks.

39. Explain the following nano — layer fabrication process
- (a) Ion Implantation process.
 - (b) Sol gel process
40. Explain the principle of operation of STM, with necessary diagram.
41. Explain different types of quantum wells.
42. Explain the following single electron devices with necessary diagrams.
- (a) Single Electron Transistor
 - (b) Resonant Tunnelling Transistor
43. Explain the arc discharge method of synthesis of nanotubes with a neat sketch.
44. What are the applications of mechanical molecular nanodevices? Explain.
(2 × 15 = 30 Marks)
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Reg. No. :

Name :

Sixth Semester B.Sc. Degree Examination, March 2021
Career Related First Degree Programme under CBCSS

Group 2(b) - Electronics

Core Course

EX 1643 - NANO ELECTRONICS

(2015-2017 Admission)

Time : 3 Hours

Max. Marks : 80

PART – A

Answer **all** questions. Each question carries **1** mark.

1. What are nanomaterials?
2. What is rapid thermal CVD?
3. What is Abbe criterion?
4. List some important physicochemical characteristics of nanoparticles.
5. What is multi-walled nanotube (MWNT)?
6. What spectroscopic methods are there for nanotechnology analysis?
7. What do you mean by multiple quantum well?
8. Name any two important nanotube parameters.

9. What are nanobot?

10. Indicate the areas where MEMS has application?

(10 × 1 = 10 Marks)

PART – B

Answer any **eight** questions. **Each** question carries 2 marks.

11. A cube-shaped nanoparticle has sides of 10 nm. Calculate its surface area to volume ratio.

12. What is the difference between top down and bottom up methods for creating nano-materials?

13. What is chromatic aberration with respect to SEM? How it can be reduced?

14. Distinguish between transmitting type and scanning type microscopes?

15. What do you mean by sputtering process?

16. Define Braggs Law?

17. Draw the schematic diagram of PL experiment setup.

18. Mention few important properties of CNT.

19. What are the applications of quantum dots?

20. Write note on graphene. Mention its applications?

21. What is the difference between resolution and magnification?

22. Explain the concept of hot electrons?

(8 × 2 = 16 Marks)

PART – C

Answer any **six** questions. Each question carries **4** marks.

23. Write short note on 0D, 1D, 2D and 3D nanomaterials.
24. Explain Laser ablation technique for synthesis of metal nanoparticle.
25. Draw and explain schematic diagram of a Raman spectrometer.
26. Briefly describe the basic operating principle of Scanning Tunnelling Microscopy (STM).
27. Explain ion implantation technique.
28. Write note on various type of nanowires with mechanical properties.
29. Describe armchair, zig-zag and helical structure of nanotubes?
30. Discuss the design issues related with a nano-scale MOSFET?
31. Explain the working of a resonant tunnelling transistor?

(6 × 4 = 24 Marks)

PART – D

Answer any **two** questions. Each question carries **15** marks.

32. With neat diagram explain the sol-gel technique of preparing nanomaterials and also mentions its merits and demerits.
33. (a) Explain the construction and working of an Atomic Force Microscope.
(b) Write a brief note on X-Ray Diffraction technique for materials characterization. (10+5 marks)
34. Explain any three techniques to produce carbon nano tubes?
35. Explain the formation and working of a single electron transistor?

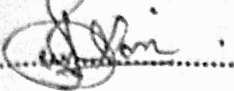
(2 × 15 = 30 Marks)



Reg. No. : 340158050102

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E - 1916

Name : 

Sixth Semester B.Sc. Degree Examination, April 2018
Career Related FDP under CBCSS
Group 2(b) : ELECTRONICS
Core Course
EX 1643 : Nano Electronics
(2015 Admission)

Time : 3 Hours

Max. Marks : 80

PART - A

Answer **all** questions, **each** question carries **1** mark.

1. What are nanomaterials ?
2. Name two techniques for the fabrication of nanolayers.
3. Write the expansion of NEMS.
4. How many carbon atoms are there in a fullerence molecule ?
5. Who invented carbon nanotubes ?
6. Name two characterization techniques used for studying surface morphology of nanomaterials.
7. Write down the expression for de Broglie wavelength.
8. Write any two novel properties of carbon nanotubes.
9. Write an example for zero dimensional nanostructure.
10. What is direct bandgap semiconductor ?

PART - B

Answer **any eight** questions, **each** carries **2** marks.

11. What do you mean by the resolving power of a microscope ?
12. Write down Scherrer equation for finding crystallite size.

P.T.O.

E – 1916

13. What is graphene ?
14. Explain Raman Effect
15. Compare energy band diagrams of metals, insulators and semiconductors.
16. What is quantum confinement ?
17. Why the properties of nanomaterials are different from their bulk counterparts ?
18. Write a note on coulomb blockade.
19. What is density of states ?
20. What are the advantages of MEMS ?
21. Why bottom-up approach is more convenient for nano-fabrication ?
22. State the merits of solution based nano-fabrication techniques.

PART – C

Answer **any six** questions, **each** question carries 4 marks.

23. Explain the various steps involved in chemical vapour deposition technique.
24. What are SAED patterns ? Explain.
25. Derive Bragg's equation.
26. Write a note on nanoscale MOSFET.
27. Explain the applications of carbon nanotubes.
28. Describe the concepts of quantum wells, wires and dots.
29. Explain principles of IR spectrometer. What is FTIR ?
30. With the help of schematic diagram, explain nanoimprint lithography process.
31. Describe the basic structure of carbon nanotubes.

PART - D

Answer **any 2** questions, **each** question carries **15** marks.

32. a) Explain with a schematic diagram, the fabrication of nanomaterials by sol-gel technique. 10
b) What are the advantages of sol-gel technique ? 5
33. a) Describe with the help of a neat diagram, the working of atomic force microscope. 10
b) Explain the two modes of operation of STM. 5
34. a) Describe with the help of a neat diagram, the working of transmission electron microscope. 10
b) What is the basic principle of HRTEM ? 5
35. Explain the principle of operation resonant tunneling transistor and single electron transistor with structure and energy band diagrams. 15
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Reg. No. :

Name :

Sixth Semester B.Sc. Degree Examination, April 2019

Career Related FDP under CBCSS

Group 2(b) : ELECTRONICS

Core Course

EX 1643 : Nano Electronics

(2015 Admission Onwards)

Time : 3 Hours

Total Marks : 80

PART – A

Answer **all** questions, **each** question carries 1 mark.

1. Define nanotechnology.
2. Write expansion of MOSFET.
3. Fullerenes were named after _____
4. Name one method for preparing carbon nanotubes.
5. "There is plenty of room at the bottom" is the historical lecture of _____
6. List any two of the material characterization techniques.
7. Write the expansion of SAED.
8. 1 nanometer = _____ metre.
9. List any two applications of nanotechnology in electronics.
10. What is Bucky ball ?

PART – B

Answer **any eight** questions, **each** carries 2 marks.

11. Discuss the structure of fullerene molecule.
12. Distinguish between top down and bottom up approach of nanotechnology with examples.

P.T.O.

G – 1675

13. What are quantum dots ?
14. List merits of AFM over STM.
15. What is sputtering ?
16. What are excitons ?
17. Distinguish between SWNT and MWNT.
18. Define resolution of a microscope.
19. State Bragg's law.
20. Distinguish between direct and indirect band gap in semiconductors.
21. What are the two modes of operation of STM ?
22. What is single electron tunneling ?

PART – C

Answer **any six** questions, **each** question carries **4** marks.

23. Explain ion implantation technique.
24. Explain the principle of Raman spectroscopy.
25. Compare and contrast electron microscope and optical microscope.
26. Discuss the limitations of conventional microelectronics.
27. Distinguish between MEMS and NEMS.
28. Write a note on nanorobotics.
29. Discuss the principle of XRD.
30. Explain thermal evaporation technique.
31. Explain principle of IR spectrometer. What is FTIR ?

PART - D

Answer **any 2** questions, **each** question carries **15** marks.

32. a) Explain the CVD technique for the fabrication of nano layers with the help of a schematic diagram. 10
- b) Write a note on plasma enhanced Chemical Vapour Deposition Technique. 5
33. a) Describe with the help of a neat diagram, the working of Transmission Electron Microscope. 10
- b) What is the basic principle of HRTEM ? 5
34. Discuss the structure, properties and applications of carbon nanotubes. 15
35. a) Explain the concept of Coulomb blockade. 5
- b) Explain with necessary diagram, the working of
- i) Single electron transistor. 5
- ii) Resonant tunneling transistor. 5
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N – 1731

Reg. No. :

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Sixth Semester B.Sc. Degree Examination, April 2022
Career Related First Degree Programme under CBCSS

Group 2(b)-Electronics

Core Course

Ex 1643 : NANO ELECTRONICS

(2018 Admission)

Time : 3 Hours

Max. Marks : 80

SECTION – A

Answer all questions. Each question carries 1 mark.

1. A material with one dimension in Nano range and the other two dimensions are large is called _____
2. For milling operations, what kind of environment is preferred?
3. Which gas serves as buffer gas in Laser ablation?
4. In modified chemical vapor deposition, vapor phase reactant _____ and _____ pass through a hot zone.
5. The colour of the nano gold particle is _____
6. _____ property of nanomaterials make them suitable to be used for the elimination of pollutants.

P.T.O.

7. On both ends of the CNTs, which carbon nanostructure is placed?
8. Nano crystalline materials synthesised by sol-gel technique results in a foam-like structures called _____
9. NEMS is the abbreviation of _____
10. Give Beer-Lambert Law.

(10 × 1 = 10 Marks)

SECTION – B

Answer any **eight** questions. Each question carries **2** marks.

11. What are the limitations of microelectronics compared to nanoelectronics?
12. What is Raman effect?
13. What are the steps involved in the top-down approach for the synthesis of nano materials.
14. Why the characterisation of nano materials is done?
15. What is photoluminescence?
16. What are the application restrictions of scanning tunneling microscopy?
17. What is the principle of IR spectroscopy?
18. Explain Bragg's Law in XRD.
19. What are the applications of carbon nano tubes?
20. What are the different types of nanowires?
21. What is graphene?
22. What is quantum confinement effect?
23. Define density of states.

24. Draw the schematic diagram of Single Electron Transistor.
25. What are the advantages of Resonant Tunneling Transistors?
26. What are MEMS?

(8 × 2 = 16 Marks)

SECTION – C

Answer any **six** questions. Each question carries 4 marks.

27. Explain the iron ball milling process.
28. Explain PVD process for the fabrication of nano-layers.
29. Explain Atomic Force Microscopy method for the characterisation of nano materials.
30. Explain the working principle of UV characterisation instrument with a neat sketch.
31. Briefly explain laser ablation.
32. What are the different types of single wall carbon nano tubes? Explain.
33. Explain the principle behind the quantum dot. What are the applications of quantum dots?
34. What are SAED patterns? How is it used for analysis?
35. What is nano manipulation? Explain with a block diagram.
36. Write a note on the challenges in designing a nano scale MOSFET.
37. What is phase contrast transfer function? Explain.
38. What is coulomb blockade?

(6 × 4 = 24 Marks)

SECTION - D

Answer any two questions. Each question carries 15 marks.

39. ✓ Explain the following nano — layer fabrication process

✓ (a) Ion Implantation process.

✓ (b) Sol gel process

40. ✓ Explain the principle of operation of STM, with necessary diagram.

41. ✓ Explain different types of quantum wells.

42. Explain the following single electron devices with necessary diagrams.

(a) Single Electron Transistor

(b) Resonant Tunnelling Transistor

43. Explain the arc discharge method of synthesis of nanotubes with a neat sketch.

44. What are the applications of mechanical molecular nanodevices? Explain.

(2 × 15 = 30 Marks)

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Sixth Semester B.Sc. Degree Examination, April 2022
Career Related First Degree Programme under CBCSS

Group 2 (b) : Electronics

Core Course

EX 1643 : NANO ELECTRONICS

(2019 Admission)

Time : 3 Hours

Max. Marks : 80

PART – A

Answer all questions. Each carries 1 mark.

1. The major difference between the nano materials compared to the bulk form is _____.
2. A material with one dimension in Nano range and the other two dimensions are large is called _____.
3. Typical precursor used in sol-gel are _____.
4. Nano crystalline materials synthesised by sol-gel technique results in a foam-like structures called _____.
5. Carbon nano tubes are the sheets of graphite about _____ thickness.
6. _____ is a complex phenomenon which complies two quantum tunnelling and quantum interference.

7. In laser ablation method carbon source is vaporised _____ times with a laser pulse.
8. The diameter of the nanowire is _____.
9. In _____ a drain and source electrode are connected through a tunneling junction to an island.
10. UV-visible spectrophotometer measures _____ and _____.

(10 × 1 = 10 Marks)

PART – B

Answer any **eight** questions. Each question carries **2** marks.

11. What is the procedure order in top-down fabrication method?
12. What are the limitations of conventional microelectronics?
13. Explain Bragg's Law for X-ray diffraction.
14. What are the applications of quantum dots?
15. What are the impacts of nanoelectronics?
16. What is milling?
17. What is meant by the resolution of microscope?
18. What is quantum confinement?
19. Explain the Scherrer Formula.
20. What are the components of a spectrometer?
21. What is the purpose of nano wires?
22. What are the four different types of artificial nanomaterials?

23. What is sputtering?
24. What are the applications of graphene nanomaterials?
25. What is meant by zero-point energy?
26. What is laser ablation method?

(8 × 2 = 16 Marks)

PART – C

Answer any **six** questions. Each question carries **4** marks.

27. Explain the ion implantation process for fabrication of nano-layer.
28. Explain the working of Scanning Electron Microscope.
29. Explain X-Ray diffraction analysis.
30. What is the basic principle of Raman spectroscopy? How is Raman spectroscopy used in nanomaterials?
31. What are the different types of nanotubes? Give the comparison.
32. Describe parabolic quantum well
33. Draw and explain the schematic representation of single electron transistor as an inverter.
34. What are the different types of nanowires? Give their applications.
35. What are SAED patterns? How is it used for analysis?
36. Write a note on nano manipulation.
37. What is phase contrast transfer function? Explain.
38. What are the different types of photo luminescent process?

(6 × 4 = 24 Marks)

PART - D

Answer any **two** questions. Each question carries **15** marks.

39. Explain the following fabrication methods of nano-layers.

- (a) Physical Vapor Deposition
- (b) Chemical Vapor Deposition.

40. With necessary diagrams, explain the principle of operation of STM.

41. (a) Explain the arc discharge method for the production of nano tubes with a neat sketch.

(b) What are the properties of carbon nano tube?

42. (a) What are the challenges in designing the MOSFET devices in nano scale regim?

(b) Explain Resonant Tunneling Transistor with a neat sketch.

43. Explain sol-gel process for fabrication of nano-particles.

44. Write notes on

- (a) NEMS
- (b) nano robotics.

(2 × 15 = 30 Marks)

Reg. No. :

Name :

Sixth Semester B.Sc. Degree Examination, March 2021
Career Related First Degree Programme under CBCSS

Group 2(b) – Electronics

Core Course

EX 1643

NANO ELECTRONICS

(2018 Admission Regular)

Time : 3 Hours

Max. Marks : 80

SECTION – A

(Answer all questions. Each carries 1 mark.)

1. _____ is the modified evaporation technique for thin film preparation.
2. Ball milling is also known as _____
3. The frequency for the RF sputtering is _____ by FCC.
4. In thermal activated CVD the temperature is greater than _____
5. Full form of STM is _____
6. Full form of TEM is _____
7. _____ are cylindrical molecules that consist of rolled-up sheets of single-layer carbon atoms.

8. A _____ is a potential well with only discrete energy values.
9. Full form of NEMS is _____
10. Full form of SET is _____

SECTION – B

(10 × 1 = 10 Marks)

(Answer any eight questions. Each carries 2 marks)

11. Name two types of evaporation methods for fabrication of nano —layers.
12. Name two types of sputtering.
13. What is ball milling?
14. What is porous silicon?
15. What is Brillouin scattering?
16. What is SEM?
17. What is TEM?
18. What is the principle of XRD?
19. What are the applications of nano materials?
20. What is single walled nanotubes?
21. What are the properties of nano wires?
22. What is graphene?
23. Draw the N-channel MOS transistor for low frequency application.
24. What is MEMS systems?
25. What is "Pinch-off" mode in MOS transistor?
26. What are the challenges for the development of MEMS devices?

(8 × 2 = 16 Marks)

SECTION – C

(Answer any six questions. Each carries 4 marks).

27. Explain about sol gel process.
28. Draw the CVD furnace with all indications.
29. Explain the thermal evaporation method.
30. Explain about constant current mode in STM system.
31. Explain the operation of TEM.
32. How this Photoluminescence spectroscopy works?
33. Explain about different types of nano wires.
34. Explain the properties of graphene?
35. What is quantum dots?
36. Draw the n.channel cross sectional structure of mos and note each one.
37. Explain about channel length modulation in MOS transistors.
38. Explain the applications of nano robotics.

(6 × 4 = 24 Marks)

SECTION – D

(Answer any two questions. Each carries 15 marks).

39. Explain about ion implantation and its applications, advantages and disadvantages.
40. Explain the working of SEM with its diagram and its applications.
41. Explain about the IR spectroscopy in detail and its applications.

42. (a) Explain different types of GNR (Graphene nano ribbons)
(b) Explain about nanobots
43. Explain about CVD in detail with its necessary diagrams.
44. Explain about operation of Single Electron Transistor with its diagram and its VI characteristics.

(2 × 15 = 30 Marks)