Roll No. .....

Question Booklet Number

O. M. R. Serial No. | | | | | | | | |

M. Sc. (Electronics) (Fourth Semester)

EXAMINATION, July, 2022

(Elective Course)

FOUNDATION OF NANO ELECTRONICS

Paper Code				
ELC	4	0	4	(E)

Questions Booklet Series
C

Time : 1:30 Hours] [*Maximum Marks : 100*

Instructions to the Examinee :

1. Do not open the booklet unless you are asked to do so.
2. The booklet contains 60 questions. Examinee is required to answer any 50 questions in the OMR Answer-Sheet provided and not in the question booklet. If more than 50 questions are attempted by student, then the first attempted 50 questions will be considered for evaluation. All questions carry equal marks.
3. Examine the Booklet and the OMR Answer-Sheet very carefully before you proceed. Faulty question booklet due to missing or duplicate pages/questions or having any other discrepancy should be got immediately replaced.

परीक्षार्थियों के लिए निर्देश :

1. प्रश्न-पुस्तिका को तब तक न खोलें जब तक आपसे कहा न जाए।
2. प्रश्न-पुस्तिका में 60 प्रश्न हैं। परीक्षार्थी को किन्हीं 50 प्रश्नों को केवल दी गई OMR आन्सर-शीट पर ही हल करना है, प्रश्न-पुस्तिका पर नहीं। यदि छात्र द्वारा 50 से अधिक प्रश्नों को हल किया जाता है तो प्रारम्भिक हल किये हुए 50 उत्तरों को ही मूल्यांकन हेतु सम्मिलित किया जाएगा। सभी प्रश्नों के अंक समान हैं।
3. प्रश्नों के उत्तर अंकित करने से पूर्व प्रश्न-पुस्तिका तथा OMR आन्सर-शीट को सावधानीपूर्वक देख लें। दोषपूर्ण प्रश्न-पुस्तिका जिसमें कुछ भाग छपने से छूट गए हों या प्रश्न एक से अधिक बार छप गए हों या उसमें किसी अन्य प्रकार की कमी हो, तो उसे तुरन्त बदल लें।

(Remaining instructions on the last page) (शेष निर्देश अन्तिम पृष्ठ पर)

(Only for Rough Work)

1. The depletion layer of tunnel diode is very small because ..... .

(A) its abrupt and has high dopants

(B) uses positive conductance property

(C) its used for high frequency ranges

(D) tunneling effect

2. Who introduced 'First Vertical Power MOSFET' ?

(A) Mohammed Atalla

(B) Dawon Kahng

(C) Hitachi

(D) Both (A) and (B)

3. Which type of a device is MOSFET ?

(A) Current-controlled

(B) Voltage-controlled

(C) Voltage-controlled current source

(D) Voltage-controlled voltage source

4. What are the main terminals that carry current ?

(A) Source

(B) Drain

(C) Source and Drain

(D) Gate

5. The phenomenon of scattering of light by the colloidal particles is called ..... .

(A) Dispersion of light

(B) Tyndall effect

(C) Atmospheric scattering

(D) Atmospheric refraction

6. There are three important lengths which enter the theory of superconductivity, except :

(A) London penetration length

(B) Intrinsic coherence length

(C) Normal electron mean free length

(D) Mean path length

7. The magnetic lines of force cannot penetrate the body of a superconductor, a phenomenon is known as :

(A) Isotopic effect

(B) BCS theory

(C) Meissner effect

(D) London theory

8. Which of the following conductor has highest critical temperature ?

(A) Aluminium

(B) Zinc

(C) Molybdenum

(D) Tin

9. The different types of energies associated with a molecule are ..... .

(A) Electronic energy

(B) Vibrational energy

(C) Rotational energy

(D) All of the above

10. During the motion, if the centre of gravity of molecule changes, the molecule possess ..... .

(A) Electronic energy

(B) Rotational energy

(C) Translational energy

(D) Vibrational energy

11. Which of the following is an application of molecular spectroscopy ?

(A) Structural investigation

(B) Basis of understanding of colors

(C) Study of energetically excited reaction products

(D) All of the above

12. The transition zone for Raman spectra is :

(A) Between vibrational and rotational levels

(B) Between electronic levels

(C) Between magnetic levels of nuclei

(D) Between magnetic levels of unpaired electrons

13. The criteria for electronic spin resonance is ..... .

(A) Periodic change in polarisability

(B) Spin quantum number of nuclei > 0

(C) Presence of unpaired electron in a molecule

(D) Presence of chromophore in a molecule

14. Brownian motion occurs in ..... .

(A) Inertial impaction

(B) Diffusion

(C) Electrostatic attraction

(D) Interception

15. Phase space is a ..... .

(A) 3-dimensional space

(B) 4-dimensional space

(C) 5-dimensional space

(D) 6-dimensional space

16. Maxwell-Boltzmann's law is for the ..... .

(A) Distinguishable particles

(B) Indistinguishable particles

(C) Particles with half integral spin

(D) Particles with integral spin

17. The average kinetic energy associated with each degree of freedom is ..... .

(A) kT

(B) $2kT$

(C) $kT/2$

(D) $kT/4$

18. The density of molecules is maximum at which speed ?

(A) V_{rms}

(B) V_p

(C) V_{mean}

(D) V_{inst}

19. Which gates in digital circuits are required to convert a NOR-based SR latch to an SR flip- flop ?

(A) Two 2 input AND gates

(B) Two 3 input AND gates

(C) Two 2 input OR gates

(D) Two 3 input OR gates

20. Which of the following digital logic circuits can be used to add more than 1-bit simultaneously ?

(A) Full-adder

(B) Ripple-carry adder

(C) Half-adder

(D) Serial adder

21. When can one logic gate drive many other logic gates in Digital Electronics ?

(A) When its output impedance is low and the input impedance is low.

(B) When its output impedance is high and the input impedance is high.

(C) When its output impedance is high and the input impedance is low.

(D) When its output impedance is low and the input impedance is high.

22. What is a switching function that has more than one output called in Digital Electronics ?

(A) Multi-gate function

(B) Multi-output function

(C) Multiple gate function

(D) Multiple output function

23. Which of the follow is a type of digital logic circuit ?

(A) Combinational logic circuits

(B) Sequential logic circuits

(C) Both (A) and (B)

(D) None of the above

24. Which of the following is correct for Digital Circuits ?

(A) Less susceptible to noise or degradation in quality

(B) Use transistors to create logic gates to perform Boolean logic

(C) Easier to perform error detection and correction with digital signal

(D) All of the above

25. Resistance temperature detector is ..... .

(A) an electrical transducer

(B) a mechanical transducer

(C) a chemical transducer

(D) a physical transducer

26. Relation between temperature and resistance of a conductor is ..... .

(A) $R_t = R_{ref}[1 + t]$

(B) $R_t = R_{ref}[1 + \alpha\Delta t]$

(C) $R_t = R_{ref}[1 - \alpha t]$

(D) $R_t = R_{ref}[1 - t]$

27. Sensing element in the thermometer must provide ..... .

(A) small change in resistance

(B) no change in resistance

(C) large change in resistance

(D) infinite change in resistance

28. Platinum is used for industrial applications because ..... .

(A) it is cheap

(B) it is available readily

(C) it is a noble metal

(D) it gives accurate measurements

29. Most metallic conductors have a ..... .

(A) neutral temperature coefficient of resistance

(B) negative temperature coefficient of resistance

(C) positive temperature coefficient of resistance

(D) zero temperature coefficient of resistance

30. In a temperature sensing element ..... .

(A) low value of α is required

(B) infinite value of α is required

(C) α must be zero

(D) high value of α is required

31. Nanomaterials are the materials with at least one dimension measuring less than ..... .

(A) 1 nm

(B) 10 nm

(C) 100 nm

(D) 1000 nm

32. A material with one dimension in Nano-range and the other two dimensions are large is called ..... .

(A) Micro-material

(B) Quantum wire

(C) Quantum well

(D) Quantum dot

33. The colour of the nanogold particles is ..... .

(A) Yellow

(B) Orange

(C) Red

(D) Variable

34. The melting point of particles in nano-form ..... .

(A) Increases

(B) Decreases

(C) Remains same

(D) Increases then decreases

35. The first talk about Nanotechnology was given by :

(A) Albert Einstein

(B) Newton

(C) Gordon E. Moore

(D) Richard Feynman

36. Which of the processes of materials was not described as Nanotechnology ?

(A) Separation

(B) Creation

(C) Processing

(D) Consolidation

37. The initial tools used to help launch the nanoscience revolution were ..... .

(A) Binoculars

(B) Microscope

(C) Scanning probe instruments

(D) Interferometer

38. The size of atoms is nearly ..... .

(A) 0.01 nm

(B) 0.1 nm

(C) 1 nm

(D) 10 nm

39. Nanosized polymers built from branched units are called :

(A) dendrimers

(B) composites

(C) carbon-based materials

(D) metal-based materials

40. Which property of nanoparticles provides a driving force for diffusion ?

(A) Optical properties

(B) High surface area to volume ratio

(C) Sintering

(D) There is no such property

41. On both ends of the CNTs, which carbon nanostructure is placed ?

(A) Graphite

(B) Diamond

(C) C-60

(D) Benzene

42. Quantum dots can be used in ..... .

(A) crystallography

(B) optoelectronics

(C) mechanics

(D) quantum physics

43. Vesicle is a type of ..... .

(A) nanostructure

(B) nanoparticle

(C) nanocrystal

(D) supramolecular system

44. Specific heat of materials is expressed in terms of :

(A) W/m-K

(b) J/k

(C) J/kg-K

(D) m^3/kg

45. Which term is used to define the temperature at which a substance changes its status from solid to liquid ?

(A) Boiling point

(B) Melting point

(C) Condensation point

(D) Freezing point

46. What is the procedure in top-down fabrication method ?

(A) nanoparticles $\rightarrow$ powder $\rightarrow$ bulk

(B) powder $\rightarrow$ bulk $\rightarrow$ nanoparticles

(C) bulk $\rightarrow$ powder $\rightarrow$ nanoparticles

(D) nanoparticles $\rightarrow$ bulk $\rightarrow$ powder

47. What kind of metals are used for milling operations ?

(A) Soft and brittle

(B) Soft and elastic

(C) Hard and brittle

(D) Hard and elastic

48. CVD stands for :

(A) Carbon Vapour Density

(B) Chemical Vapour Density

(C) Chemical Vapour Deposition

(D) Carbon Vapour Deposition

49. Ultrasonic machining process can be used for :

(A) Conductors

(B) Insulators

(C) Metals

(D) All of the above

50. Who first produced nanostructured materials ?

(A) Gerd Binning

(B) Alex Zettl

(C) P.M. Ajayan

(D) H. Gleiter

51. The range of magnetoelectrostatic force in the air is around _____.

(A) 10 mm

(B) 100 cm

(C) 100 nm

(D) None of the above

52. What is the standard form of TEM ?

(A) Transformer Element Microscopy

(B) Transistor Electron Microscopy

(C) Transmission Electron Microscopy

(D) None of the above

53. Which one of the following is a characterization technique in carbon nanotubes ?

(A) TEM

(B) SEM

(C) AFM

(D) All of the above

54. Which one of the following nanosensors measures the flux density ?

(A) Mechanical

(B) Thermal

(C) Magnetic

(D) Chemical

55. Which one of the following nanosensors measures the wavelength ?

(A) Mechanical

(B) Thermal

(C) Magnetic

(D) Optical

56. Which one of the following is an example of two-dimensional nanostructure ?

(A) Nanotubes

(B) Nanorods

(C) Nanolayers

(D) All of the above

57. What is the standard form of VLS ?

(A) Vacuum Liquid Solid

(B) Vapour Liquid Surface

(C) Vapour Liquid Solid

(D) None of the above

58. If 'X' corresponds to a tunnel diode and 'Y' to an avalanche diode, then :

(A) X operates in reverse bias and Y operates in forward bias

(B) X operates in reverse bias and Y operates in reverse bias

(C) X operates in forward bias and Y operates in forward bias

(D) X operates in forward bias and Y operates in reverse bias

59. The range of tunnel diode voltage V_D, for which slope of its V-I characteristics is negative would be (The V_P is the peak voltage and V_V is the valley voltage) ..... .

(A) $V_D > 0$

(B) $0 < V_D < V_P$

(C) $V_V > V_D > V_P$

(D) $V_D > V_V < V_P$

60. Tunnel diode has a very fast operation in ..... .

(A) gamma frequency region

(B) ultraviolet frequency region

(C) microwave frequency region

(D) radio frequency region

(Only for Rough Work)

4. Four alternative answers are mentioned for each question as—A, B, C & D in the booklet. The candidate has to choose the most correct/appropriate answer and mark the same in the OMR Answer-Sheet as per the direction :

Example :

Question :

Q. 1 (A) ● (C) (D)
Q. 2 (A) (B) ● (D)
Q. 3 (A) ● (C) (D)

Illegible answers with cutting and over-writing or half filled circle will be cancelled.

5. Each question carries equal marks. Marks will be awarded according to the number of correct answers you have.

6. All answers are to be given on OMR Answer sheet only. Answers given anywhere other than the place specified in the answer sheet will not be considered valid.

7. Before writing anything on the OMR Answer Sheet, all the instructions given in it should be read carefully.

8. After the completion of the examination candidates should leave the examination hall only after providing their OMR Answer Sheet to the invigilator. Candidate can carry their Question Booklet.

9. There will be no negative marking.

10. Rough work, if any, should be done on the blank pages provided for the purpose in the booklet.

11. To bring and use of log-book, calculator, pager and cellular phone in examination hall is prohibited.

12. In case of any difference found in English and Hindi version of the question, the English version of the question will be held authentic.

Impt. : On opening the question booklet, first check that all the pages of the question booklet are printed properly. If there is ny discrepancy in the question Booklet, then after showing it to the invigilator, get another question Booklet of the same series.

4. प्रश्न-पुस्तिका में प्रत्येक प्रश्न के चार सम्भावित उत्तर— A, B, C एवं D हैं। परीक्षार्थी को उन चारों विकल्पों में से एक सबसे सही अथवा सबसे उपयुक्त उत्तर छाँटना है। उत्तर को OMR आन्सर-शीट में सम्बन्धित प्रश्न संख्या में निम्न प्रकार भरना है :

उदाहरण :

प्रश्न :

प्रश्न 1 (A) ● (C) (D)
प्रश्न 2 (A) (B) ● (D)
प्रश्न 3 (A) ● (C) (D)

अपठनीय उत्तर या ऐसे उत्तर जिन्हें काटा या बदला गया है, या गोले में आधा भरकर दिया गया, उन्हें निरस्त कर दिया जाएगा।

5. प्रत्येक प्रश्न के अंक समान हैं। आपके जितने उत्तर सही होंगे, उन्हीं के अनुसार अंक प्रदान किये जायेंगे।

6. सभी उत्तर केवल ओ. एम. आर. उत्तर-पत्रक (OMR Answer Sheet) पर ही दिये जाने हैं। उत्तर-पत्रक में निर्धारित स्थान के अलावा अन्यत्र कहीं पर दिया गया उत्तर मान्य नहीं होगा।

7. ओ. एम. आर. उत्तर-पत्रक (OMR Answer Sheet) पर कुछ भी लिखने से पूर्व उसमें दिये गये सभी अनुदेशों को सावधानीपूर्वक पढ़ लिया जाये।

8. परीक्षा समाप्ति के उपरान्त परीक्षार्थी कक्ष निरीक्षक को अपनी OMR Answer Sheet उपलब्ध कराने के बाद ही परीक्षा कक्ष से प्रस्थान करें। परीक्षार्थी अपने साथ प्रश्न-पुस्तिका ले जा सकते हैं।

9. निगेटिव मार्किंग नहीं है।

10. कोई भी रफ कार्य, प्रश्न-पुस्तिका के अन्त में, रफ-कार्य के लिए दिए खाली पेज पर ही किया जाना चाहिए।

11. परीक्षा-कक्ष में लॉग-बुक, कैलकुलेटर, पेजर तथा सेल्युलर फोन ले जाना तथा उसका उपयोग करना वर्जित है।

12. प्रश्न के हिन्दी एवं अंग्रेजी रूपान्तरण में भिन्नता होने की दशा में प्रश्न का अंग्रेजी रूपान्तरण ही मान्य होगा।

महत्वपूर्ण : प्रश्नपुस्तिका खोलने पर प्रथमतः जाँच कर देख लें कि प्रश्न-पुस्तिका के सभी पृष्ठ भलीभाँति छपे हुए हैं। यदि प्रश्नपुस्तिका में कोई कमी हो, तो कक्षनिरीक्षक को दिखाकर उसी सिरीज की दूसरी प्रश्न-पुस्तिका प्राप्त कर लें।