(7 pages) Reg. No. : .....

Code No. : 9245 **Sub. Code : PNNM 14**

M.Sc. (CBCS) DEGREE EXAMINATION, NOVEMBER 2018.

First Semester

Nanoscience and Nanotechnology

ELECTRONICS

(For those who joined in July 2018 onwards)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. Boolean algebra can be used to ————.

(a) Simplify and algebraic expressions

(b) Minimize the number of switches in a circuits

(c) Solve the mathematical problem

(d) Perform arithmetic calculations

2. An inverter gate can be developed using ————.

(a) Two diodes

(b) A resistance and a capacitance

(c) A transistor

(d) An industance and a capacitance

3. The output of a two input NANO gate is high

(a) only if both the inputs are high

(b) only if both the inputs are low

(c) only if one inputs is high and another is low

(d) if atleast one of the inputs is low

4. The logic expression AB + AB can be implemented by given input and B to a two input

(a) NOR gate

(b) Exclusive NOR gate

(c) Exclusive OR gate

(d) NANO gate

5. The total number of cells in the Karnaugh map of a switching function (A, B, C) consisting of only 3 variables are ————.

(a) 8 (b) 4

(c) 16 (d) 3

6. Current cannot flow to ground through _____.

(a) a mechanical ground

(b) an a.c. ground

(c) a virtual ground

(d) an ordinary ground

7. The tail current in a differential amplifier equals _____.

(a) difference between two emitter currents

(b) sum of two emitter currents

(c) collector current divided by current again

(d) collector voltage divided by collector resistance

8. A 555 timer in monostable application mode can be used for

(a) pulse position modulation

(b) frequency shift keying

(c) speed control and measurement

(d) digital phase detector

9. Following is not an example of transducer

(a) Analogue voltmeter

(b) Thermocouple

(c) Photoelectric cell

(d) Preumatk cylinder

10. The sensors are classified on the basis of

(a) functions (b) performance

(c) output (d) all of the above

PART B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 250 words.

11. (a) Prove that NOR is a universal gate.

Or

(b) Simplify the Boolean expressions using Commutative, Distributive law

(i) $(A + B)(A + C)$

(ii) $A + \overline{A}.B$.

12. (a) Obtain POS form of Boolean functions.

Or

(b) Explain the implementations of SOP form using NAND and NOR gates.

13. (a) Write a short note on Integrator.

Or

(b) Write the characteristics of OP AMP.

14. (a) Write a note on modes of operation of Timer 555.

Or

(b) Describe about PLL IC 565.

15. (a) Write a note on Transducers.

Or

(b) What is noise? What are the sources of Noise.

PART C — (5 × 8 = 40 marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 600 words.

16. (a) Explain how :

(i) AND gate

(ii) OR gate

(iii) NOT gates are using diodes.

Or

(b) Prove Mathematically De Morgan's theorem for any two elements A, B in Boolean algebra.

(i) $\overline{A+B} = \overline{A}.\overline{B}$

(ii) $\overline{A.B} = \overline{A} + \overline{B}$.

17. (a) Find out the minimal expression for the switching function give below using the Karnaugh map

$f(A,B,C,D) = \sum(1, 3, 6, 7, 9, 13, 14, 15)$.

Or

(b) Find out the minimal expression for the switching function given below using the Karnaugh map

$f(A,B,C,D) = \sum(0, 1, 4, 5, 6, 7, 12, 14)$.

18. (a) Drew a Analog multiplexer and explain its working.

Or

(b) Describe about DC analysis of IC OP AMP.

19. (a) Explain Voltage Control oscillator.

Or

(b) Describe about Monostable and Astable operation.

20. (a) Describe about Electronic measurement and control in sensors.

Or

(b) Describe about Impedance Matching Amplification.

(6 pages) Reg. No. : .....

Code No. : 9244 **Sub. Code : PNNM 13**

M.Sc. (CBCS) DEGREE EXAMINATION, NOVEMBER 2018.

First Semester

Nanoscience and Nanotechnology

SOLID STATE PHYSICS

(For those who joined in July 2018 onwards)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the best answer.

1. In solids the regularity can extend through out the crystal hence they possess ———— order.

(a) medium range (b) long range

(c) short range (d) both long and short

2. The regular arrangements of lattice points that can occur in two dimensions are called ————.

(a) Reciprocal lattice (b) Lattice constant

(c) Bravais lattice (d) Unit cell

3. In three dimensions the number of Bravais lattice are ————.

(a) 14 (b) 41

(c) 4 (d) 11

4. The conductivities of semiconductors increases with the ———— of temp.

(a) decreases (b) increases

(c) independent (d) none

5. The conductivity of intrinsic semiconductor is ———— than the *n* type semiconductor.

(a) greater (b) smaller

(c) greater or smaller (d) none

6. The density of electrons in the conduction band is ————.

(a) directly proportional to the square root of the donor concentration

(b) inversely proportional to the square root of the donor concentration

(c) directly proportional to the cube root of the donor concentration

(d) none

7. A superconductor exhibits

(a) only zero resistance

(b) only diamagnetism

(c) zero resistant and paramagnetism

(d) zero resistant and diamagnetism

8. When a material become superconductor

(a) the properties of lattice structure do not change

(b) the properties of lattice structure do change

(c) it becomes ferromagnetic in nature

(d) magnetic property does not change

9. The currents in a superconductor

(a) are confined to the surface of superconductor

(b) are confined to the middle portion of the superconductor

(c) can exist in quantized form

(d) gives in rise to a potential drop

10. Super lattices ———— nanoparticles have been produced by aerosol processing.

(a) gold (b) silver

(c) iron (d) none of these

PART B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 250 words.

11. (a) Discuss about the structure factor of (i) BCC lattice (ii) FCC lattice.

Or

(b) Give an account on scattered wave amplitude.

12. (a) Explain with suitable examples for the ionic and covalent bonding in solids.

Or

(b) Discuss in detail about quantization of elastic waves.

13. (a) Explain free electron gas in three dimension.

Or

(b) Obtain an expression for electrical conductivity and Ohm's law.

14. (a) Write short notes on band gap.

Or

(b) Discuss briefly about the thermoelectric effect.

15. (a) Explain BCS theory.

Or

(b) Discuss the theory of DC Josephson effect.

PART C — (5 × 8 = 40 marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 600 words.

16. (a) Explain with the help of suitable sketches of simple crystal structures.

Or

(b) Discuss diffraction of waves by crystals.

17. (a) Write about the vibration of crystals with monoatomic basis.

Or

(b) Explain about inelastic scattering by phonons.

18. (a) Discuss effect of temperature on the Fermi-Dirac distribution.

Or

(b) Explain heat capacity of the electron gas.

19. (a) Explain about super lattices and also what is excitons.

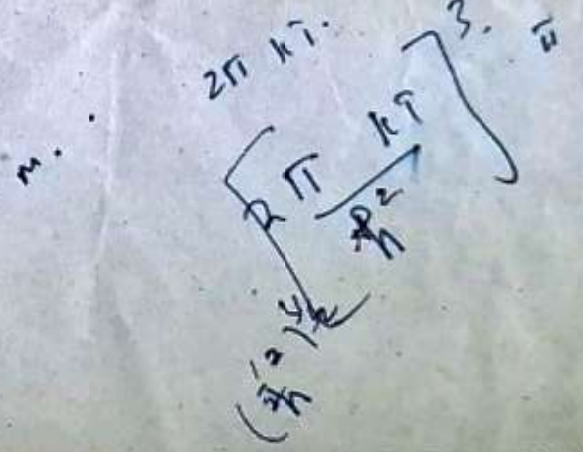
Or

(b) What is intrinsic carrier concentration and explain about it.

20. (a) Explain Type II superconductors.

Or

(b) What is Meissner effect? Derive Hondon equations using Meissner effects.



(6 pages) Reg. No. : .....

Code No. : 9243 **Sub. Code : PNNM 12**

M.Sc. (CBCS) DEGREE EXAMINATION, NOVEMBER 2018.

First Semester

Nanoscience and Nano Technology – Main

QUANTUM MECHANICS

(For those who joined in July 2018 onwards)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL the questions.

Choose the correct answer :

1. A free particle is one for which the potential energy is

(a) V (b) V/d

(c) $1/V$ (d) O

2. The condition for normalization is

(a) $\int \psi^* \psi d\tau = 0$ (b) $\int \psi^* \psi d\tau = 1$

(c) $\int \psi^* \psi d\tau = \infty$ (d) $\int \psi^* \psi d\tau = \frac{1}{2}$

3. The commutation relation of position and momentum is equal to

(a) $\frac{1}{i\hbar}$ (b) $i\hbar$

(c) $\frac{-1}{i\hbar}$ (d) $-i\hbar$

4. The energy spectrum is _____ for $E > 0$.

(a) discrete (b) degenerate

(c) continuous (d) zero

5. $(A^+)^+ =$ _____.

(a) B (b) B^{-1}

(c) A (d) A^{-1}

6. If there exists only one eigen function belonging to a given eigen value, the eigen value is said to be _____.

(a) discrete (b) degenerate

(c) continuous (d) non-degenerate

7. The splitting of energy levels and consequent splitting of spectral lines due to the applications of an uniform electric field is

(a) Zeeman effect

(b) Stark effect

(c) Pashen – Back effect

(d) Lambda transitions

8. The Hamiltonian of two electron moving in the field of a fixed nucleus of charge z, is

(a) $H = \frac{-\hbar^2}{2m}\nabla^2 - \frac{Ze^2}{r}$

(b) $H = \frac{-\hbar^2}{2m}(\nabla_1^2 + \nabla_2^2) - \frac{Ze^2}{r}$

(c) $H = \frac{-\hbar^2}{2m}(\nabla_1^2 + \nabla_2^2) - \frac{Ze^2}{r_1} - \frac{Ze^2}{r_2} + -\frac{e^2}{r_{12}}$

(d) $H = \frac{-\hbar^2}{2m}(\nabla_1^2 + \nabla_2^2) - \frac{e^2}{r_{12}}$

9. The eigen value of J^2 is

(a) $(j+1)(j+3)\hbar$ (b) $(j+1)(j+2)\hbar/2$

(c) $j(j+1)\hbar$ (d) $j(j-1)\hbar$

10. If $\sigma_x, \sigma_y, \sigma_z$ are Pauli's spin matrices, then their sum $\sigma_x^2 + \sigma_y^2 + \sigma_z^2$ is

(a) 1/3 (b) 2/3

(c) 3 (d) 3/2

PART B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 250 words.

11. (a) Derive the schrodinger equation for a free particle in one dimension.

Or

(b) Explain Normalization and probability inter pretation.

12. (a) Write down the fundamental postulates of wave mechanics.

Or

(b) Derive the time - independent schrodinger equation.

13. (a) Give the physical interpretation of eigen values and eigen functions.

Or

(b) Discuss the eigen values and eigen functions of self – adjoint operators.

14. (a) Explain Stark effect.

Or

(b) Derive the first order equation of perturbation theory.

15. (a) Write a note on identical particles.

Or

(b) Explain the significance of Clebsch – Gordan coefficient.

PART C — (5 × 8 = 40 marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 600 words.

16. (a) State and explain the uncertainty principle. Also discuss in detail about the introducing the uncertainties in the process of measurement.

Or

(b) Discuss the operator correspondence and derive the scherodinger equation for a particle subject to forces.

17. (a) Derive an expression for a particle in a square well potential.

Or

(b) Discuss the square potential barrier.

18. (a) Discuss in detail Dirac delta function and normalization of eigen functions.

Or

(b) Explain the angular momentum in stationary states of systems with spherical symmetry.

19. (a) Discuss the Hamiltonian of two electron atom in detail.

Or

(b) Explain briefly the variation method for excited states.

20. (a) Give the general procedure to construct the Clebsch – Gordan coefficients.

Or

(b) Discuss the eigen value spectrum and matrix representation of J in the $|jm>$ basis.
