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

Code No. : 10362 E **Sub. Code : EMPH 61**

B.Sc. (CBCS) DEGREE EXAMINATION,
APRIL 2026.

Sixth Semester

Physics — Core

RELATIVITY AND QUANTUM MECHANICS

(For those who joined in July 2023 onwards)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. Which transformation replaces Galilean transformation for speeds close to the speed of light?

   (a) Lorentz transformation

   (b) Digital transformation

   (c) Galileo transformation

   (d) None of the above

2. Concept of simultaneity has only ————————.

   (a) non relative (b) relative

   (c) absolute (d) None of these

3. Wien's constant = ————————.

   (a) 2.898×10^{-3} mK (b) 3×10^{8} m/s

   (c) 5893×10^{-10} (d) None of these

4. Black body emits and absorbs ———————— wavelength.

   (a) red

   (b) green

   (c) blue

   (d) All colour wavelength

5. Calculate de Broglie wavelength associated with the 46 gm golf ball with velocity 36 m/s.

   (a) 4.0×10^{-34} m (b) 0.4×10^{-34} m

   (c) 40×10^{-34} m (d) 0.04×10^{-34} m

6. The de Broglie wavelength in terms of volts ————————.

   (a) $h/\sqrt{(2mqv)}$ (b) $h/\sqrt{(mqv)}$

   (c) $1/\sqrt{(2mqv)}$ (d) $1/\sqrt{(mqv)}$

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7. The normalised wave function is _____.

(a) $\int_a^b \psi\psi^* dx = 1$ (b) $\int_a^b \psi\psi^* dx = 0$

(c) $\int_a^b (\psi + \psi^*) dx = 1$ (d) $\int_a^b (\psi\psi^*) dx = 0$

8. Schrödinger time dependent equation is _____.

(a) $ih/2\pi \cdot \partial\psi/\partial t = h^2/8\pi^2 m\nabla^2\psi + V\psi$

(b) $ih/2\pi \cdot \partial\psi/\partial t = -h^2/8\pi^2 m\nabla^2\psi + V\psi$

(c) $\nabla^2\psi + (8\pi^2 m/h^2)(E - V)\psi = 0$

(d) $\nabla^2\psi + (8\pi^2 m/h^2) E\psi = 0$

9. The lowest energy of simple harmonic oscillator is _____.

(a) $1/2\, h\nu$ (b) $h\nu$

(c) $3/2\, h\nu$ (d) $5/2\, h\nu$

10. Eigen value of particle in a 1D potential box _____.

(a) $E_n = n^2h^2/8mL^2$

(b) $E_n = n^2 - h^2/8mL^2$

(c) $E_n = n^2 + h^2/8mL^2$

(d) h/mL^2

PART B — (5 × 5 = 25 marks)

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

Each answer should not exceed 250 words.

11. (a) Discuss the postulates of special theory of relativity.

Or

(b) Derive the expression for time dilation.

12. (a) Explain the failure of classical physics in explaining atomic spectrum.

Or

(b) State and explain the Rayleigh-Jeans Law for blackbody radiation.

13. (a) State and explain Heisenberg's uncertainty principle.

Or

(b) Derive relationship wave velocity and group velocity.

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14. (a) Discuss the postulates of quantum mechanics. Describe wave function and its interpretation.

Or

(b) Write down the properties of Hermitian operators.

15. (a) Describe the Zero point energy.

Or

(b) Write short notes on tunnelling effect.

PART C — (5 × 8 = 40 marks)

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

Each answer should not exceed 600 words.

16. (a) Derive and explain Einstein's mass – energy relation.

Or

(b) Describe the Lorentz transformation.

17. (a) Explain in detail about Blackbody radiation.

Or

(b) State and explain Einstein's photoelectric equation.

18. (a) Derive an expression for de Broglie wavelength.

Or

(b) Explain the elementary proof of Heisenberg relation.

19. (a) Derive Schrödinger's time dependent equation for matter waves.

Or

(b) Derive Schrödinger's time independent equation for matter waves.

20. (a) Obtain the eigen values and eigen function of a simple harmonic oscillator.

Or

(b) Derive Schrödinger equation for a particle in 3D potential box.

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

Code No. : 10363 E **Sub. Code : EMPH 62**

B.Sc. (CBCS) DEGREE EXAMINATION,
APRIL 2026.

Sixth Semester

Physics — Core

SOLID STATE PHYSICS

(For those who joined in July 2023 onwards)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. Which crystal structure has the highest packing efficiency?

   (a) Simple Cubic (SC)

   (b) Body-Centered Cubic (BCC)

   (c) Face-Centered Cubic (FCC)

   (d) Diamond Cubic

2. What is the coordination number of a diamond cubic structure?

   (a) 4 (b) 6

   (c) 8 (d) 12

3. What does a phonon represent in a solid?

   (a) A free electron

   (b) A quantum of lattice vibration

   (c) A magnetic moment

   (d) An impurity atom

4. In a diatomic linear chain, the optical phonon mode occurs at $k = 0$ when

   (a) Both atoms move in the same direction with the same amplitude

   (b) The atoms move in opposite directions

   (c) Only the heavier atom moves

   (d) The center of mass shifts

5. The presence of parallel alignment of magnetic dipole moment is given by which materials?

   (a) Diamagnetic (b) Ferromagnetic

   (c) Paramagnetic (d) Ferrimagnetic

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6. Polarization is defined as the dipole moment _____.

(a) per unit length

(b) per unit area

(c) per unit volume

(d) per unit time

7. When dielectrics are placed in an electric field, they become

(a) Ionized (b) Polarized

(c) Conductors (d) Decomposed

8. The magnetization of a superconductor is

(a) 0 (b) H

(c) 1 (d) –H

9. The Meissner effect demonstrates that a superconductor is a

(a) Perfect conductor

(b) Perfect diamagnet

(c) Perfect paramagnet

(d) Perfect ferromagnetic material

10. The Hall effect is used to determine which of the following properties of a semiconductor?

(a) Conductivity

(b) Type of charge carrier (n-type or p-type)

(c) Concentration of charge carriers

(d) All of the above

PART B — (5 × 5 = 25 marks)

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

Answer should not exceed 250 words.

11. (a) Describe with suitable examples the ionic and covalent type of bonding in solids.

Or

(b) Describe the Structure of Nacl.

12. (a) Write the properties of Metals.

Or

(b) State and Explain Ohm's Law.

13. (a) Derive the Relation between magnetic Permeability and Susceptibility.

Or

(b) Describe Soft and Hard Magnets.

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14. (a) Define :

(i) Dielectric constant

(ii) Polarizability and Electric susceptibility.

Or

(b) Write note on Relaxation time of polarization and Internal field of solids.

15. (a) Write a note Ferroelectric domains.

Or

(b) Write the properties of superconductors.

PART C — (5 × 8 = 40 marks)

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

Answer should not exceed 600 words.

16. (a) Describe the seven crystal system with a diagram.

Or

(b) Explain the procedure for finding miller indices.

17. (a) State and explain Dulong Petit's law.

Or

(b) Explain Drude Lorentz theory of metals.

18. (a) Write the properties of Diamagnetic and Paramagnetic materials.

Or

(b) Explain B-H Curve hystersis loss with diagram.

19. (a) Describe the Electronic Polarization processes.

Or

(b) Derive clausius mossotti relation.

20. (a) Define Hall effect. Explain four probe method measurement of conductivity.

Or

(b) Derive London Equation and Penetration Depth.

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

Code No. : 10364 E **Sub. Code : EMPH 63**

B.Sc. (CBCS) DEGREE EXAMINATION,
APRIL 2026.

Sixth Semester

Physics — Core

DIGITAL ELECTRONICS AND
MICROPROCESSOR 8085

(For those who joined in July 2023 onwards)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. Which of the following is commonly known as the 8421 code?

   (a) Excess-3 Code (b) Gray Code

   (c) BCD Code (d) ASCII Code

2. Which of the following is considered a "self-complementing" code?

   (a) 8421 BCD

   (b) Excess-3 Code

   (c) 2421 Code

   (d) Both (b) and (c)

3. In Half Adder SUM can be obtained using the logic Gate

   (a) OR (b) EX-OR

   (c) EX-NOR (d) AND

4. A demultiplexer can be used to realize a

   (a) Counter

   (b) Shift Register

   (c) Combinational circuit

   (d) Display system

5. The flip flop which produces unpredictable output for the inputs 1, 1 is

   (a) R-S flip flop (b) J-K flip flop

   (c) M-S flip flop (d) D flip flop

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6. A Shift register is a

(a) random access memory

(b) sequential accessed memory

(c) read only memory

(d) content addressable memory

7. Which memory acts as a high-speed buffer between the CPU and main memory (RAM)?

(a) ROM (b) Cache

(c) SSD (d) Hard Disk

8. Which of the following is considered "read-write" memory?

(a) ROM (b) PROM

(c) EPROM (d) RAM

9. The register that may be used as an operand register is

(a) Accumulator

(b) B register

(c) Data register

(d) Accumulator and B register

10. Program Counter is made of bits

(a) 8 (b) 32

(c) 16 (d) 20

PART B — (5 × 5 = 25 marks)

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

Each answer should not exceed 250 words.

11. (a) Explain Gray code and Excess-3 code.

Or

(b) Discuss the sum of products and product of sums with example.

12. (a) Explain the working of a Half and Full adder with circuit diagram.

Or

(b) Explain working of Seven segment Decoder.

13. (a) Describe operation of R-S flip flop with diagram.

Or

(b) Discuss the working of a four bit asynchronous ripple with logic diagram and truth table.

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14. (a) Explain ROM memory and RAM memory.

Or

(b) Write a note on PAL-Programmable Array Logic.

15. (a) Describe the Status Flags of 8085.

Or

(b) Write an ALP for addition of two numbers using 8085.

PART C — (5 × 8 = 40 marks)

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

Each answer should not exceed 600 words.

16. (a) Explain ones complement and twos complement representation method.

Or

(b) State and Prove Demorgan's theorem.

17. (a) Explain Parallel Binary Adder with diagram.

Or

(b) Describe the Construction of encoder with logic diagram and truth table.

18. (a) Explain the operation of JK Master Slave flip flop with a logic diagram.

Or

(b) Explain Mod-10 counter(decade counter) with logic diagram.

19. (a) Explain the working of RTL and TTL logic families.

Or

(b) Describe the working of CMOS Inverter.

20. (a) Explain pin configuration of 8085 with diagram.

Or

(b) Explain the addressing modes of 8085.

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

Code No. : 10370 E **Sub. Code : EEPH 61**

B.Sc. (CBCS) DEGREE EXAMINATION,
APRIL 2026.

Sixth Semester

Physics

ELECTIVE — ENERGY PHYSICS

(For those who joined in July 2023 onwards)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. Natural gas consists of

   (a) Ethane (b) Methane

   (c) Propane (d) Butane

2. Which gives very large waste deposit to earth after use?

   (a) Natural gas (b) Oil

   (c) Coal (d) Nuclear power

3. The standard value of solar constant is

   (a) $1\,kWm^2$ (b) $1.367\,kWm^2$

   (c) $1.5\,kWm^2$ (d) $5\,kWm^2$

4. Who is introduced first solar cooker?

   (a) M.K. Ghosh (b) Max Planck

   (c) Kirchoff (d) K.M. Samy

5. The principle used in the working of OTEC is

   (a) Forced convection

   (b) Heat engine

   (c) Joule-Kelvin effect

   (d) All the above

6. The unit of absorption coefficient is

   (a) m^{-1} (b) kg^{-1}

   (c) °C (d) None of the above

7. Mass-Energy relation is

   (a) $E = mc^2$ (b) $E = m^2c^2$

   (c) $E = m^3c^2$ (d) $E = mc$

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8. Methane is a ———————— gas.

(a) clean (b) impure

(c) polluted (d) pure

9. Hydrogen fuel cell is

(a) primary cell (b) secondary cell

(c) mixed cell (d) none of the above

10. The average voltage per fuel cell is

(a) 0.5 volt (b) 1.0 volt

(c) 0.75 volt (d) 0.25 volt

PART B — (5 × 5 = 25 marks)

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

Each answer should not exceed 250 words.

11. (a) Define : Non-renewable energy. State and explain the various form of energy.

Or

(b) Define : Renewable energy sources. State the advantages and limitation of renewable energy sources.

12. (a) Write a short note on solar water heater.

Or

(b) Explain solar greenhouse.

13. (a) Discuss in detail about the concepts of tidal energy.

Or

(b) Explain the working principle of a wind mill.

14. (a) Discuss any one method of biomass energy.

Or

(b) Explain biomass conversion process.

15. (a) Discuss the differences between fuel cell and battery.

Or

(b) State the advantages and disadvantages of fuel cells.

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PART C — (5 × 8 = 40 marks)

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

Each answer should not exceed 600 words.

16. (a) Compare : Renewable and conventional energy.

Or

(b) Describe the major sources of conventional energy.

17. (a) Describe the principle and working of box-type solar cooker. State its merits and demerits.

Or

(b) Describe the working principle of solar water heating system.

18. (a) Explain the following :

(i) Tidal energy

(ii) Wind energy.

Or

(b) Describe the open cycle ocean thermal energy (OTEC) conversion system with its advantages.

19. (a) Discuss in detail aspect of floating drum model gas plant.

Or

(b) State and explain advantages and disadvantages of biomass energy.

20. (a) Discuss the types of fuel cells. Explain their limitations.

Or

(b) Define : Fuel cells. Explain the advantages and disadvantages and applications of fuel cells.

———————

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