

(6 pages)

Reg. No. : .....

Code No. : 30049 E      Sub. Code : GMPH 61

B.Sc. (CBCS) DEGREE EXAMINATION,  
APRIL 2020.

Sixth Semester

Physics – Main

NUCLEAR PHYSICS

(For those who joined in July 2012 – 2015)

Time : Three hours

Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL the questions.

Choose the correct answer :

1. The atomic nucleus was dissolved by
  - (a) Fermi
  - (b) Bohr
  - (c) Rutherford
  - (d) Sommer field

2. Nuclear forces are
- Electrostatic
  - Force between electron and proton
  - Force between electron and positron
  - Change independent
3. The penetrating power is maximum for
- $\alpha$  -particles
  - $\beta$  -particles
  - gamma rays
  - protons
4. The relation connecting half life and mean life of radio active sample is
- $C = 0.6931 T_{y2}$
  - $T_{y2} = 0.6931/C$
  - $C = 0.6931/T_{y2}$
  - $T_{y2} = 06931C$
5. In a nuclear reaction  $X + x \rightarrow Y + y$  where  $X, x, Y, y$  are the target nucleus, bombarding particle product nucleus and product particle respectively and the respective masses are  $M_x, m_x, M_y$  and  $m_y$ . Q value of the reaction is
- $(M_y + m_y - M_x - m_x)C^2$
  - $(M_x + m_x - M_y - m_y)C^2$
  - $(M_x + M_y - m_x - m_y)C^2$
  - $(m_x + m_y - M_x - m_y)C^2$

6. In the nuclear reaction  ${}_2\text{He}^4 + {}_7\text{N}^{14} \rightarrow {}_8\text{O}^{17} + \text{X}$ . X stands for
- (a) An electron                      (b) A proton  
(c) A neutron                        (d) A positron
7. In the process of fission, the binding energy per nuclear
- (a) increases                        (b) decreases  
(c) remain unchanged    (d) none of the above
8. Chain reaction is possible only if the size of the nuclear mass is
- (a) Less than the critical size  
(b) Half of the critical size  
(c) Greater than the critical size  
(d) None of the above
9. Wilson-dour chamber detects
- (a)  $\alpha$  -particles only  
(b)  $\beta$  -particles only  
(c)  $\gamma$  -particles only  
(d)  $\alpha$  and  $\beta$  particles only
10. The antiparticle of electron is
- (a) positron                        (b)  $\alpha$  -particle  
(c)  $\beta$  -particle                      (d) proton

PART B — (5 × 5 = 25 marks)

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

Each answer should not exceed 250 words.

11. (a) Explain the nuclear composition on the basis of proton-neutron theory.

Or

- (b) What are nuclear forces? Give their properties.

12. (a) State the properties of  $\alpha$  -rays.

Or

- (b) Write a note on origin of Gamma rays.

13. (a) Describe the construction and working of proton-synchrotron.

Or

- (b) Explain the balance of mass and energy in nuclear reactions.

14. (a) Briefly discuss thermo nuclear reactions.

Or

- (b) Write a note on radiation hazards.

15. (a) Explain the working of Cerenkov counter.

Or

- (b) Write a note on elementary particles.

PART C — (5 × 8 = 40 marks)

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

Each answer should not exceed 600 words.

16. (a) Discuss in detail the liquid drop model of the nucleus.

Or

- (b) Write an essay on the general properties of nucleus.

17. (a) Describe the laws of radioactive disintegration.

Or

- (b) Outline the theory of gamma-decay.

18. (a) Describe the working of betatron.

Or

- (b) Derive the Q-value equation for a nuclear reaction. Find the energy balance in nuclear reactions and the Q-value.

19. (a) Explain in detail the critical size of a reactor.

Or

(b) Outline Bohr-Wheeler's theory of nuclear fission.

20. (a) Describe the constructional features of bubble chamber. Explain the working of a bubble chamber.

Or

(b) Describe a GM counter and explain its working as a particle detector.

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Reg. No. : .....

**Code No. : 30050 E      Sub. Code : GMPH 62**

B.Sc. (CBCS) DEGREE EXAMINATION,  
APRIL 2020.

Sixth Semester

Physics – Main

**SPECTROSCOPY**

(For those who joined in July 2012 – 2015)

Time : Three hours

Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL the questions.

Choose the correct answer :

1. The source used in UV spectrometer is
  - (a) Hydrogen lamp
  - (b) Xenon discharge lamp
  - (c) Mercury arc lamp
  - (d) All the above

2. Isotope shift is rotational spectra
- (a) Increases with J
  - (b) Decreases with J
  - (c) Zero
  - (d) Does not happen
3. Which one of the following does not have permanent dipole moment?
- (a) HCl
  - (b) CO
  - (c) CO<sub>2</sub>
  - (d) H<sub>2</sub>O
4. The vibration–rotation spectrum has
- (a) P–branch
  - (b) R-branch
  - (c) Both P and R branch
  - (d) Neither P nor R branch
5. The lines having wavelengths greater than that of the incident wavelength are called
- (a) Anti stokes lines
  - (b) Stokes lines
  - (c) Raman lines
  - (d) Rayleigh lines
6. In Raman effect stokes line is given by
- (a)  $\gamma = \gamma_0$
  - (b)  $\gamma = \gamma_0 - \gamma_m$
  - (c)  $\gamma = \gamma_0 + \gamma_m$
  - (d)  $\gamma = 0$



7.  $\Delta J$  value corresponding to R-branch in electronic vibration transition is  
(a) -1 (b) +1  
(c) 2 (d) -2
8. Pure rotational spectrum takes place between  
(a) UV and IR (b) IR and visible  
(c) Microwave and IR (d) None
9. The sources of IR spectroscopy are  
(a) Globar (b) Nickel  
(c) Cobalt (d) None
10. Which is difficult to examine in IR spectrometer?  
(a) liquid sample (b) solid sample  
(c) gas sample (d) none

PART B — ( $5 \times 5 = 25$  marks)

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

Each answer should not exceed 250 words.

11. (a) Outline the instrumentation technique by microwave spectroscopy.

Or

- (b) Explain the symmetric top molecules.

12. (a) Outline the applications of IR spectroscopy.

Or

(b) State and explain the principle of IR spectroscopy.

13. (a) Explain the quantum theory of Raman effect.

Or

(b) Discuss the pure rotational Raman spectra of linear molecules.

14. (a) Explain Fortrat parabolas.

Or

(b) Explain Frank – Condon principle.

15. (a) Discuss the preparation of different samples used in IR spectrometer.

Or

(b) Outline the advantages of beam spectrometer.

PART C — (5 × 8 = 40 marks)

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

Each answer should not exceed 600 words.

16. (a) Describe the rigid diatomic molecules.

Or

- (b) How does the microwave spectrum of a non rigid rotator differ from that of a rigid rotator?

17. (a) Explain the vibrations of Polyatomic molecules with examples.

Or

- (b) Explain the energy of diatomic molecule of harmonic and an harmonic oscillator.

18. (a) Explain the structure determination from Raman and Infrared spectroscopy.

Or

- (b) Outline the applications of Raman Spectroscopy.

19. (a) Explain the rotational fine structure of electronic vibration spectra.

Or

(b) Explain Born Oppenheimer approximation.

20. (a) Discuss briefly the IR instrumentation.

Or

(b) Explain the different parts of a IR spectrometer.

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Reg. No. : .....

Code No. : 30051 E      Sub. Code : GMPH 63

B.Sc. (CBCS) DEGREE EXAMINATION,  
APRIL 2020.

Sixth Semester

Physics – Main

DIGITAL ELECTRONICS

(For those who joined in July 2012 – 2015)

Time : Three hours

Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL the questions.

Choose the correct answer :

1. The binary number corresponding to the decimal number 5 is
  - (a) 110
  - (b) 101
  - (c) 111
  - (d) 100

2. The hexadecimal number of the binary 1000 1100 is
- (a) 2A                      (b) 4C  
(c) 6B                      (d) 8C
3. The value of Boolean expression  $(\overline{AB} + AB)$  is
- (a) AB                      (b)  $\overline{AB}$   
(c) B                      (d) A
4. The value of  $A + 1$  is
- (a) zero                      (b) A  
(c) 1                      (d)  $\overline{A}$
5. The number of cells in a three variable Karnaugh map is
- (a) 3                      (b) 6  
(c) 8                      (d) 10
6. How many entries are there on a four-variable Karnaugh map?
- (a) 4                      (b) 8  
(c) 16                      (d) 32

7. A half adder
- (a) add two bits
  - (b) add three bits
  - (c) perform decimal addition
  - (d) has one output
8. A demultiplexer is
- (a) decoder                      (b) encoder
  - (c) 8-bit                         (d) 16-bit
9. A flip flop is
- (a) monostable multivibrator
  - (b) square wave generator
  - (c) astable multivibrator
  - (d) bistable multivibrator
10. Which counter have highest speed?
- (a) synchronous counter
  - (b) asynchronous counter
  - (c) ripple counter
  - (d) ring counter

PART B — (5 × 5 = 25 marks)

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

Each answer should not exceed 250 words.

11. (a) (i) Convert  $(1000)_2$  into its decimal equivalent.

(ii) Convert  $(21.6)_{10}$  into binary number.

Or

(b) Discuss the theory of BCD codes.

12. (a) Explain positive and negative logic gates.

Or

(b) Describe the NAND gate with symbol and truth table.

13. (a) Solve using K-map.  $BCD + \overline{ACD} + ABD$ .

Or

(b) What is K-map? Explain with examples.

14. (a) Differentiate multiplexer and demultiplexer.

Or

(b) Discuss full adder circuit with truth table.



15. (a) Describe RS flip flop with diagram.

Or

- (b) Write short notes on Binary counter.

PART C — ( $5 \times 8 = 40$  marks)

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

Each answer should not exceed 600 words.

16. (a) (i) Explain binary addition and subtraction with examples.  
(ii) Explain with example the hexadecimal and BCD number systems.

Or

- (b) Explain the different code systems with example.

17. (a) Use Boolean algebra to prove  $(AB + BC + CA) = (A + B)(B + C)(C + A)$ .

Or

- (b) Describe NAND, NOR, EX-OR, EX-NOR gates with circuit diagram and truth table.

18. (a) Explain the Karnaugh map with three variables.

Or

- (b) Describe the Karnaugh map with four variables.

19. (a) Explain the construction and working of a full adder.

Or

(b) Explain the 1's and 2's complement adder and subtractor.

20. (a) Explain the action of a JK flip flop with diagram and truth table.

Or

(b) Explain up/down counter.

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Reg. No. : .....

**Code No. : 30065 E    Sub. Code : GMPH 6 A**

B.Sc. (CBCS) DEGREE EXAMINATION,  
APRIL 2020.

Sixth Semester

Physics — Main

Major Elective — STATISTICAL MECHANICS

(For those who joined in July 2012 – 2015)

Time : Three hours

Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. The ratio of number of cases in which event occurs to total cases is called
  - (a) Thermodynamic quantity
  - (b) Thermodynamic probability
  - (c) Probability
  - (d) None

2. All microstates of a given microstate are
  - (a) Equally probable
  - (b) Not equally probable
  - (c) Zero
  - (d) Infinity
  
3. Phase space is
  - (a) 1D space                      (b) 3D space
  - (c) 6D space                      (d) None
  
4. The disorderliness of a system is called
  - (a) Entropy                      (b) Enthalpy
  - (c) Free energy                (d) Probability
  
5. Partition function indicates the partition of particles amongst various
  - (a) Energy states              (b) Densities
  - (c) Space                        (d) None
  
6. The entropy of joint system increases by an additional facto that is not accounted this is
  - (a) Einstein paradox
  - (b) Gibbs paradox
  - (c) Chemical potential
  - (d) None of the above

7. Common gases at normal temperature obeys \_\_\_\_\_ statistics
- (a) Maxwell boltzman (b) Bose Einstein  
(c) Fermi-Disac (d) None
8. The rms speed is given by
- (a)  $1.7\sqrt{\left(\frac{KT}{m}\right)}$  (b)  $10\sqrt{KT/m}$   
(c)  $\sqrt{\frac{KT^2}{m}}$  (d)  $\sqrt{\frac{m}{KT^2}}$
9. In bose-Einstein statistics the particles are
- (a) Distinguishable  
(b) Indistinguishable  
(c) Differentiable  
(d) None
10. The highest energy that electrons can have at absolute zero is
- (a) Thermal energy  
(b) Internal energy  
(c) Fermi energy  
(d) None

PART B — (5 × 5 = 25 marks)

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

Each answer should not exceed 250 words.

11. (a) Explain the principle of equal a priori probability.

Or

- (b) Define Ensemble and average properties.

12. (a) Discuss momentum space and phase space in detail.

Or

- (b) Explain Boltzmann canonical law in detail.

13. (a) Explain the law of equipartition of energy and its implications.

Or

- (b) Discuss about Gibb's paradox.

14. (a) Discuss the applications of MB distribution law.

Or

- (b) Describe three kinds of particles in detail.

15. (a) Write about photon gas.

Or

(b) Compare classical and quantum statistics.

PART C — ( $5 \times 8 = 40$  marks)

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

Each answer should not exceed 600 words.

16. (a) Explain in detail

- (i) Micro and macrostate
- (ii) Thermodynamic probability.

Or

(b) Explain in detail

- (i) Constraints on a system
- (ii) Concept of a cell in a compartment.

17. (a) Explain in detail the density of quantum states of energy of a particle.

Or

(b) Discuss

- (i) Fundamental postulates of statistical mechanics
- (ii) Statistical ensembles.

18. (a) Explain partition function and its relation with thermodynamic quantities.

Or

- (b) Explain in detail the statistical interpretation of second law of thermodynamics and entropy.

19. (a) Explain in detail MB statistics applicable to ideal gas.

Or

- (b) Explain Maxwell - Boltzmann law of distribution of velocities.

20. (a) Discuss Bose-Einstein distribution law.

Or

- (b) Explain
- (i) Planck's distribution law
  - (ii) Fermi level and fermi energy.
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Reg. No. : .....

**Code No. : 30066 E    Sub. Code : GMPH 6 B**

B.Sc. (CBCS) DEGREE EXAMINATION,  
APRIL 2020.

Sixth Semester

Physics – Main

Major Elective — ENERGY PHYSICS

(For those who joined in July 2012 – 2015)

Time : Three hours

Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL the questions.

Choose the correct answer :

1. Which of the following is not a renewable source?

- (a) Solar energy                      (b) Biomass  
(c) Hydro                                (d) Geo thermal

2. The gaseous fuel is obtained from
- (a) bio gas                      (b) bio mass  
(c) both (a) and (b)        (d) none
3. \_\_\_\_\_ is used in Solar Power.
- (a) Photovoltaic cell  
(b) Chemical cell  
(c) Wood  
(d) None
4. Which state has maximum solar power yield?
- (a) Tamil Nadu                (b) Assam  
(c) Rajasthan                 (d) Gujarath
5. \_\_\_\_\_ is caused as Bio gas.
- (a) Bio ethanol                (b) Bio methane  
(c) Bio diesel                 (d) None
6. The percentage of CO<sub>2</sub> in Biomethane is
- (a) 30 – 40                      (b) 32 – 43  
(c) 35 – 45                      (d) 55 – 60

7. The periodic rise and fall of water in sea is
- (a) Tides                      (b) Flood
- (c) Ebb tide                  (d) None
8. Wind velocity is measured using
- (a) Hydrometer
- (b) Slew Meter
- (c) Gyroscope
- (d) Anemometer
9. The method for producing Hydrogen and Oxygen from water is
- (a) Combustion              (b) Electrolysis
- (c) Exothermic              (d) None
10. Which of the following is a green house gas?
- (a) Methane                  (b) Mercury
- (c) Uranium                  (d) None

PART B — (5 × 5 = 25 marks)

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

Each answer should not exceed 250 words.

11. (a) Demonstrate the statistical details of conventional energy sources.

Or

- (b) Write notes on different energy sources.

12. (a) Write about the renewable energy sources.

Or

- (b) Write notes on solar cooker.

13. (a) Explain about Bio-mass energy in detail

Or

- (b) Describe the method of separation of ethanol from wood.

14. (a) Write about ocean thermal energy conversion (OTEC).

Or

- (b) Write notes on energy from waves.

15. (a) Explain how hydrogen is used as a fuel.

Or

(b) Explain global warming in detail.

PART C — (5 × 8 = 40 marks)

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

Each answer should not exceed 600 words.

16. (a) Explain the sources of commercial energy and their reserve in the world.

Or

(b) Explain the merits and demerits of nuclear energy.

17. (a) Describe solar energy in detail.

Or

(b) Explain the functioning of solar ponds.

18. (a) Explain the process of obtaining energy from Biomass.

Or

(b) Write down the merits and demerits of Biomass energy.

19. (a) Explain the process of Geothermal energy conversion.

Or

(b) Explain the process of harvesting energy from waves.

20. (a) Describe the impact of non-conventional energy sources.

Or

(b) Explain Nuclear energy in detail.

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(8 pages)

Reg. No. : .....

Code No. : 30312 B Sub. Code : JMPH 61/  
SMPH 61

B.Sc. (CBCS) DEGREE EXAMINATION,  
APRIL 2020.

Sixth Semester

Physics – Main

DIGITAL ELECTRONICS

(For those who joined in July 2016 onwards)

Time : Three hours

Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. 2 பைட் நீளமுள்ள இருபடிமான எண்ணில் எத்தனை பிட்டுகள் உள்ளன?

(அ) 8

(ஆ) 4

(இ) 16

(ஈ) எதுவுமில்லை

The number of bits in a binary number of length 2 bytes is \_\_\_\_\_.

(a) 8

(b) 4

(c) 16

(d) none

2. 10010 என்ற இருபடிமான எண்ணின் 1's complement யாது?

(அ) 01101 (ஆ) 011100

(இ) 11111 (ஈ) எதுவுமில்லை

The one's complement of 10010 is \_\_\_\_\_.

(a) 01101 (b) 011100

(c) 11111 (d) none

3. டீ மார்கனின் முதல் விதிப்படி  $\overline{A+B} =$

(அ)  $\overline{A \cdot B}$  (ஆ)  $\overline{A} + \overline{B}$

(இ)  $\overline{A} \cdot \overline{B}$  (ஈ) எதுவுமில்லை

According to De Morgan's first theorem,  $\overline{A+B} =$

(a)  $\overline{A \cdot B}$  (b)  $\overline{A} + \overline{B}$

(c)  $\overline{A} \cdot \overline{B}$  (d) none

4. OR கேட் \_\_\_\_\_க்கு சமமாகும்.

(அ) பெருக்கல் (ஆ) கூட்டல்

(இ) கழித்தல் (ஈ) எதுவுமில்லை

The OR gate is equivalent to \_\_\_\_\_ of inputs.

(a) Product (b) Sum

(c) Subtraction (d) None



5. பிளிப்-பிளாப் எனப்படும் மின்னணு சாதனத்தில்  
\_\_\_\_\_ நிலையான நிலைகள் உள்ளன.

(அ) 3

(ஆ) 1

(இ) 2

(ஈ) எதுவுமில்லை

A flip flop is a bistable electronic device that has  
\_\_\_\_\_ stable states.

(a) three

(b) one

(c) two

(d) none

6. அறை கூட்டியில் மீதத்திற்கான கட்டுப்பாடு  
\_\_\_\_\_.

(அ)  $C = A + B$

(ஆ)  $C = A - B$

(இ)  $C = A \cdot B$

(ஈ) எதுவுமில்லை

The condition for carrier in a Half Adder is  
\_\_\_\_\_.

(a)  $C = A + B$

(b)  $C = A - B$

(c)  $C = A \cdot B$

(d) none

7.  $n$ -மாறிகள் உள்ள சமன்பாட்டிற்கு தேவையான minterms  
\_\_\_\_\_.

(அ)  $2n$

(ஆ)  $2/n$

(இ)  $2^n$

(ஈ) எதுவுமில்லை

For a  $n$ -variable problem there can be \_\_\_\_\_  
minterms.

(a)  $2n$

(b)  $2/n$

(c)  $2^n$

(d) none

8. கார்னாஃப் வரைபடத்தில் கண்டுகொள்ளத் தேவையில்லாத நிலையை \_\_\_\_\_ என்று குறிப்பர்.

(அ) 1 (ஆ) 0

(இ) X (ஈ) எதுவுமில்லை

The don't care condition in a Karnaugh map is referred by \_\_\_\_\_.

(a) 1 (b) 0

(c) X (d) none

9. ஷிப்ட் ரெஜிஸ்டர் அலைகளை \_\_\_\_\_ பயன்படுகின்றன.

(அ) கூட்ட (ஆ) கழிக்க

(இ) எண்ணுவதற்கு (ஈ) எதுவுமில்லை

Shift Register is used to \_\_\_\_\_ pulses.

(a) Add (b) Subtract

(c) Count (d) None

10. ஒரு A/D மாற்றி \_\_\_\_\_ஐ \_\_\_\_\_ ஆக மாற்றுகிறது.

(அ) அனலாக், டிஜிட்டல் (ஆ) டிஜிட்டல், அனலாக்

(இ) டெசிமல், பைனரி (ஈ) எதுவுமில்லை

The A/D converter, converts \_\_\_\_\_ in to \_\_\_\_\_.

(a) analog, digital (b) digital, analog

(c) decimal, binary (d) none

PART B — (5 × 5 = 25 marks)

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

Answer should not exceed 250 words.

11. (அ) 2F59 மற்றும் AB10 என்ற பதினாறடிமான எண்களை இருபடிமான எண்களாக மாற்றுக.

Convert the hexadecimal numbers 2F59 and AB10 into binary numbers.

Or

- (ஆ) அதிகப்படியான மூன்று code-ன் பயன்பாட்டை உதாரணத்துடன் விளக்குக.

Explain the excess three code with an example.

12. (அ) டீ மார்கன் தேற்றங்களைக் கூறி நிரூபி.

State and prove De Morgan's theorems.

Or

- (ஆ) AND மற்றும் OR கேட்களின் குறியீடுகளையும், உண்மை அட்டவணைகளையும் தருக.

Draw the symbols and truth tables for AND and OR gates.

13. (அ) அறை கூட்டியின் வேலை செய்யும் விதத்தை விவரி.

Explain the working of Half adder.

Or

(ஆ) R-S flip-flop வேலை செய்யும் விதத்தை விவரி.

Explain the working of R-S flip-flop.

14. (அ) இரு மாறிகள் கொண்ட கார்னாஃப் வரைபடத்தை விவரி.

Explain two variable Karnaugh map.

Or

(ஆ) NAND கேட்டுகளைப் பயன்படுத்தி POS அமைப்பு எவ்வாறு உருவாகின்றது.

Explain the implementation of POS form using NAND gate.

15. (அ) Register-களின் வகைகள் யாவை?

What are the types of Registers?

Or

(ஆ) Asynchronous எண்ணியின் செயல்பாட்டை விவரி.

Explain the working of Asynchronous counter.

PART C — (5 × 8 = 40 marks)

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

Answer should not exceed 600 words.

16. (அ) (i) பதினாறு அடிமானத்தில் இருந்து இருபடிமானம் மற்றும்  
(ii) இருபடிமானத்தில் இருந்து பதினாறுஅடிமானமாக மாற்றுவதை விளக்குக.

Explain the conversion of

- (i) hexadecimal number into binary number and  
(ii) binary number into hexadecimal number.

Or

- (ஆ) 2's complement மூலம் இருபடிமான எண்களின் கழித்தலை உதாரணத்துடன் விளக்குக.

Explain binary subtraction by 2's complement method with an example.

17. (அ) Boolean algebra-வில் உள்ள எடுகோள்களையும், தேற்றங்களையும் விவரி.

Explain the postulate and theorems of Boolean algebra.

Or

- (ஆ) NOR கேட் மூலம் அனைத்து கேட்களும் உருவாதலை விவரி.

Explain the universality of NOR gate.

18. (அ) முழு கூட்டியின் செயல்பாட்டினை விவரி.

Explain the working of Full adder.

Or

(ஆ) flip-flop வகைகள் யாவை? Master Slave flip-flop வேலைசெய்யும் விதத்தை விவரி.

What are the types of flip-flop? Explain the working of Master Slave flip-flop.

19. (அ) Boolean சார்புகள் மூலம் SOP அமைப்பினை விவரி.

Explain the SOP form of Boolean functions.

Or

(ஆ) கார்னாஃப் வரைபடம் மூலம் சுருக்குக :

$$Y = F(A, B, C, D) = \sum M(7,9,10,11,12,13,14,15)$$

Using Karnaugh map simplify :

$$Y = F(A, B, C, D) = \sum M(7,9,10,11,12,13,14,15)$$

20. (அ) Decade எண்ணியின் செயல்பாட்டினை விவரி.

Explain the working of decade counter.

Or

(ஆ) D/A மாற்றியின் செயல்பாட்டை விவரி.

Explain the working of D/A converter.

(6 pages)

Reg. No. : .....

Code No. : 30312 E      Sub. Code : JMPH 61/  
SMPH 61

B.Sc. (CBCS) DEGREE EXAMINATION,  
APRIL 2020.

Sixth Semester

Physics – Main

DIGITAL ELECTRONICS

(For those who joined in July 2016 onwards)

Time : Three hours

Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. The number of bits in a binary number of length 2 bytes is \_\_\_\_\_.  
(a) 8                                      (b) 4  
(c) 16                                     (d) none

2. The one's complement of 10010 is \_\_\_\_\_.
- (a) 01101                      (b) 011100  
(c) 11111                      (d) none
3. According to De Morgan's first theorem,  $\overline{A+B} =$
- (a)  $\overline{A \cdot B}$                       (b)  $\overline{A} + \overline{B}$   
(c)  $\overline{A} \cdot \overline{B}$                       (d) none
4. The OR gate is equivalent to \_\_\_\_\_ of inputs.
- (a) Product                      (b) Sum  
(c) Subtraction                      (d) None
5. A flip flop is a bistable electronic device that has \_\_\_\_\_ stable states.
- (a) three                      (b) one  
(c) two                      (d) none
6. The condition for carry in a Half Adder is \_\_\_\_\_.
- (a)  $C = A + B$                       (b)  $C = A - B$   
(c)  $C = A \cdot B$                       (d) none



7. For a  $n$ -variable problem there can be \_\_\_\_\_ minterms.
- (a)  $2n$                       (b)  $2/n$   
(c)  $2^n$                       (d) none
8. The don't care condition in a Karnaugh map is referred by \_\_\_\_\_.
- (a) 1                      (b) 0  
(c)  $X$                       (d) none
9. Shift Register is used to \_\_\_\_\_ pulses.
- (a) Add                      (b) Subtract  
(c) Count                      (d) None
10. The A/D converter, converts \_\_\_\_\_ in to \_\_\_\_\_.
- (a) analog, digital      (b) digital, analog  
(c) decimal, binary      (d) none

PART B — (5 × 5 = 25 marks)

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

Answer should not exceed 250 words.

11. (a) Convert the hexadecimal numbers 2F59 and AB10 into binary numbers.

Or

- (b) Explain the excess three code with an example.

12. (a) State and prove De Morgan's theorems.

Or

- (b) Draw the symbols and truth tables for AND and OR gates.

13. (a) Explain the working of Half adder.

Or

- (b) Explain the working of R-S flip-flop.

14. (a) Explain two variable Karnaugh map.

Or

- (b) Explain the implementation of POS form using NAND gate.

15. (a) What are the types of Registers?

Or

(b) Explain the working of Asynchronous counter.

PART C — (5 × 8 = 40 marks)

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

Answer should not exceed 600 words.

16. (a) Explain the conversion of

(i) hexadecimal number into binary number and

(ii) binary number into hexadecimal number.

Or

(b) Explain binary subtraction by 2's complement method with an example.

17. (a) Explain the postulate and theorems of Boolean algebra.

Or

(b) Explain the universality of NOR gate.

18. (a) Explain the working of Full adder.

Or

(b) What are the types of flip-flop? Explain the working of Master Slave flip-flop.

19. (a) Explain the SOP form of Boolean functions.

Or

(b) Using Karnaugh map simplify :

$$Y = F(A, B, C, D) = \sum M(7, 9, 10, 11, 12, 13, 14, 15)$$

20. (a) Explain the working of decade counter.

Or

(b) Explain the working of D/A converter.

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2. Zeeman effect is splitting of spectral lines due to \_\_\_\_\_.
- (a) Magnetic field      (b) Electric field  
(c) Gravitational field      (d) None
3. The nucleus of  ${}^4_2\text{He}$  is \_\_\_\_\_ nucleus.
- (a) even – even      (b) odd – odd  
(c) odd – even      (d) even – odd
4. The nuclear force is \_\_\_\_\_ and \_\_\_\_\_.
- (a) strong, attractive      (b) weak, attractive  
(c) strong, repulsive      (d) none
5.  $\beta$  – particle is equivalent to \_\_\_\_\_.
- (a) proton      (b) electron  
(c) neutron      (d) none
6. The expression for half life period of a radioactive nucleus is \_\_\_\_\_.
- (a)  $\frac{\lambda}{6.93}$       (b)  $\frac{\lambda}{0.693}$   
(c)  $\frac{0.693}{\lambda}$       (d) none

7. The nuclear fusion is due to \_\_\_\_\_ of \_\_\_\_\_ nucleus.
- (a) joining, light
  - (b) splitting, heavy
  - (c) joining, heavy
  - (d) none
8. The controlled thermo nuclear reaction is achieved in \_\_\_\_\_.
- (a) Cyclotron
  - (b) G.M. Counter
  - (c) Nuclear Reactor
  - (d) None
9. The idea of elementary particles is proposed by \_\_\_\_\_.
- (a) Dalton
  - (b) J.J. Thomson
  - (c) Yukawa
  - (d) None
10. Positron is a positive \_\_\_\_\_.
- (a) proton
  - (b) neutron
  - (c) electron
  - (d) none

PART B — (5 × 5 = 25 marks)

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

Each answer should not exceed 250 words.

11. (a) Explain L – S coupling.

Or

- (b) State and explain Stark effect.

12. (a) Give the general properties of nucleus.

Or

- (b) What are the characteristics of nuclear force?

13. (a) State and explain Geiger – Nuttal law.

Or

- (b) Write short note on nuclear isomers.

14. (a) Calculate the energy released during the fusion of  $4\text{ }^1_1\text{H}^1$  into  $^4_2\text{He}^4$ .

Or

- (b) Explain the principle and action of atom bomb.



15. (a) Explain the latitude effect of cosmic rays.

Or

(b) What are Van – Allen belts? What are their uses?

PART C — ( $5 \times 8 = 40$  marks)

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

Each answer should not exceed 600 words.

16. (a) Explain in detail the fine structure of sodium D line.

Or

(b) Explain the theory and experiment for Zeeman effect.

17. (a) Explain the meson theory of nuclear forces.

Or

(b) Explain the Shell model of a nucleus.

18. (a) (i) Derive expression for half life period  
(ii) Explain Radio carbon dating.

Or

(b) Explain the theory of alpha decay.

19. (a) Explain the construction and working of nuclear reactor.

Or

(b) Explain the construction and working of Scintillation Counter.

20. (a) Explain Cosmic ray showers.

Or

(b) Explain briefly the quark model about elementary particles.

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(6 pages)

Reg. No. : .....

Code No. : 30314 E      Sub. Code : JMPH 63

B.Sc. (CBCS) DEGREE EXAMINATION,  
APRIL 2020.

Sixth Semester

Physics – Main

QUANTUM MECHANICS

(For those who joined in July 2016 only)

Time : Three hours

Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. According to Wien's displacement law  $\lambda_m$  is \_\_\_\_\_ to absolute temperature.
  - (a) equal
  - (b) directly proportional
  - (c) inversely proportional
  - (d) none

2. When the angle of scattering is 180 degree, the Compton shift  $d\lambda$  is = \_\_\_\_\_.
- (a)  $\frac{2h}{m_0c^2}$                       (b)  $\frac{2h}{m_0c}$
- (c)  $\frac{2h^2}{m_0c}$                       (d) none
3. The de Broglie wavelength of an electron accelerated by a potential  $V$  is,  $\lambda =$
- (a)  $\frac{h}{\sqrt{2m_0eV}}$                       (b)  $\frac{h}{\sqrt{m_0eV}}$
- (c)  $\frac{he}{\sqrt{2m_0V}}$                       (d) none
4. If  $k$  is the propagation constant, the momentum  $p$  of a particle is given by \_\_\_\_\_.
- (a)  $\frac{\hbar}{k}$                       (b)  $\frac{k}{\hbar}$
- (c)  $\hbar k$                       (d) none
5. If the uncertainty in locating the position of the particle is its deBroglie wavelength, the uncertainty in locating the momentum  $p$  is \_\_\_\_\_.
- (a)  $p \geq 2\pi$                       (b)  $p \geq 4\pi$
- (c)  $p \geq 6\pi$                       (d) none

6. The value of Planck's constant is \_\_\_\_\_.
- (a)  $6.626 \times 10^{-14}$  JS      (b)  $6.626 \times 10^{34}$  JS  
(c)  $6.626 \times 10^{-34}$  JS      (d) none
7. The value of the commutation bracket  $[x, p_x]=$
- (a) 0                              (b) 1  
(c)  $i\hbar$                               (d)  $-i\hbar$
8. The potential energy of a free particle in a time independent Schrodinger equation is \_\_\_\_\_.
- (a) V                              (b) 0  
(c) 2V                              (d) none
9. The energy of a particle in a 1-D box is \_\_\_\_\_.
- (a)  $\frac{8n^2h^2}{ma^2}$                               (b)  $\frac{n^2h^2}{8ma^2}$   
(c)  $\frac{\pi^2h^2}{8ma^2}$                               (d) none
10. For a particle encountering a potential barrier, the sum of the reflection and transmission coefficients is always \_\_\_\_\_.
- (a) 1                              (b) infinity  
(c) 0                              (d) none

PART B — ( $5 \times 5 = 25$  marks)

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

Answer should not exceed 250 words.

11. (a) What are the observations of black body radiation?

Or

- (b) State and explain Rayleigh – Jeans law.

12. (a) Derive the expression for the deBroglie wavelength of a charged particle accelerated by a potential  $V$ .

Or

- (b) Calculate the deBroglie wavelength of electron accelerated by a voltage of 100V.

13. (a) Explain the Heisenberg uncertainty relation between energy and time.

Or

- (b) What are the consequences of Heisenberg uncertainty principle?

14. (a) What are the properties of wave function?

Or

- (b) Write short note on operators in quantum mechanics.

15. (a) Explain Tunnel effect through a rectangular barrier.

Or

- (b) Write short notes on free states.

PART C — ( $5 \times 8 = 40$  marks)

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

Answer should not exceed 600 words.

16. (a) Define photo electric effect. Give the Einsteins explanation for photoelectric effect.

Or

- (b) State Compton effect. Derive the formula for shift in wave length during Compton Scattering.

17. (a) Discuss the relation between deBroglie wave and phase velocity.

Or

- (b) Describe Davison and Germer's experiment on electron diffraction.

18. (a) State and prove Heisenberg Uncertainty principle.

Or

- (b) Illustrate Heisenberg uncertainty principle by Thought experiment.

19. (a) State and explain Ehrenfest Theorem.

Or

(b) Discuss in detail about

(i) momentum wave function

(ii) momentum eigen function

20. (a) Explain the emission of alpha particles from a radioactive element.

Or

(b) Discuss in detail about 1-D simple harmonic oscillator in quantum mechanics.

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Reg. No. : .....

Code No. : 30563 B Sub. Code : SMPH62

B.Sc. (CBCS) DEGREE EXAMINATION,  
APRIL 2020.

Sixth Semester

Physics – Core

QUANTUM MECHANICS

(For those who joined in July 2017 onwards)

Time : Three hours

Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. கரும்பொருளொன்றின் உறிஞ்சும் திறன் \_\_\_\_\_,  
உமிழ் திறன் \_\_\_\_\_.

(அ) 1, 0

(ஆ) 0, 1

(இ) 1, 1

(ஈ) 0, 0

For a black body, absorptivity is \_\_\_\_\_ and  
emissivity is \_\_\_\_\_.

(a) 1, 0

(b) 0, 1

(c) 1, 1

(d) 0, 0

2. அணு ஒன்றின் சராசரி வெப்ப ஆற்றல்

(அ)  $kT$  (ஆ)  $3kT$

(இ)  $k/T$  (ஈ)  $3T/k$

Mean thermal energy of an atom is

(a)  $kT$  (b)  $3kT$

(c)  $k/T$  (d)  $3T/k$

3. கீழ்க்கண்ட சமன்பாடுகளில் எது சரியானது?

(அ)  $E^2 = c^4 p^2 + m_o^2 c^2$  (ஆ)  $E^2 = c^2 p^4 + m_o^2 c^2$

(இ)  $E^2 = c^4 p^2 - m_o^2 c^4$  (ஈ)  $E^2 = c^2 p^2 + m_o^2 c^4$

In the following equations, which one is true?

(a)  $E^2 = c^4 p^2 + m_o^2 c^2$  (b)  $E^2 = c^2 p^4 + m_o^2 c^2$

(c)  $E^2 = c^4 p^2 - m_o^2 c^4$  (d)  $E^2 = c^2 p^2 + m_o^2 c^4$

4. அலைக்குழுத் திசைவேகத்திற்கும், அலைக்கட்டத் திசைவேகத்திற்கும் இடையேயான தொடர்பு

(அ)  $v_g = v_p - \lambda \frac{dv_p}{d\lambda}$  (ஆ)  $v_g = v_p + \lambda \frac{dv_p}{d\lambda}$

(இ)  $v_p = \lambda v_g - \frac{dv_g}{d\lambda}$  (ஈ)  $v_p = v_g - \frac{dv_g}{d\lambda}$

The relationship between group velocity and phase velocity is

(a)  $v_g = v_p - \lambda \frac{dv_p}{d\lambda}$       (b)  $v_g = v_p + \lambda \frac{dv_p}{d\lambda}$

(c)  $v_p = \lambda v_g - \frac{dv_g}{d\lambda}$       (d)  $v_p = v_g - \frac{dv_g}{d\lambda}$

5.  $\hbar$  என்ற மாறிலியின் மதிப்பு

(அ)  $1.504 \times 10^{-13} \text{ Js}$       (ஆ)  $1.054 \times 10^{-31} \text{ Js}$

(இ)  $1.045 \times 10^{-13} \text{ Js}$       (ஈ)  $1.504 \times 10^{-31} \text{ Js}$

The value of  $\hbar$  is

(a)  $1.504 \times 10^{-13} \text{ Js}$       (b)  $1.054 \times 10^{-31} \text{ Js}$

(c)  $1.045 \times 10^{-13} \text{ Js}$       (d)  $1.504 \times 10^{-31} \text{ Js}$

6. ஃபோர் முதலாம் சுற்றுவட்ட பாதையின், கணக்கிடப்பட்ட ஆரம்

(அ)  $5.3 \times 10^{11} \text{ m}$       (ஆ)  $3.5 \times 10^{11} \text{ m}$

(இ)  $0.053 \times 10^{-11} \text{ nm}$       (ஈ)  $5.3 \times 10^{11} \text{ nm}$

The calculated value of radius of the first Bohr Orbit is

(a)  $5.3 \times 10^{11} \text{ m}$       (b)  $3.5 \times 10^{11} \text{ m}$

(c)  $0.053 \times 10^{-11} \text{ nm}$       (d)  $5.3 \times 10^{11} \text{ nm}$

7. நேர்கோட்டு உந்தத்தின் குவாண்டம் செயலி

(அ)  $-i\hbar r \times \nabla$  (ஆ)  $i\hbar \times \nabla$

(இ)  $i\hbar \nabla$  (ஈ)  $-i\hbar \nabla$

Quantum operator of linear momentum

(a)  $-i\hbar r \times \nabla$  (b)  $i\hbar \times \nabla$

(c)  $i\hbar \nabla$  (d)  $-i\hbar \nabla$

8. ஆற்றலின் குவாண்டம் செயலி

(அ)  $-i\hbar r \times \nabla$  (ஆ)  $-i\hbar \frac{\partial}{\partial t}$

(இ)  $i\hbar \frac{\partial}{\partial t}$  (ஈ)  $i\hbar \frac{\partial}{\partial x}$

Quantum operator of linear momentum

(a)  $-i\hbar r \times \nabla$  (b)  $-i\hbar \frac{\partial}{\partial t}$

(c)  $i\hbar \frac{\partial}{\partial t}$  (d)  $i\hbar \frac{\partial}{\partial x}$

9. இலாப்லேசியன் செயலி

(அ)  $\nabla^1$  (ஆ)  $\nabla^2$

(இ)  $\nabla^3$  (ஈ)  $\nabla^{-2}$

Laplacian operator is

- (a)  $\nabla^1$  (b)  $\nabla^2$   
(c)  $\nabla^3$  (d)  $\nabla^{-2}$

10. தரைமட்ட ஆற்றல் மதிப்பு

- (அ)  $\frac{1}{2}\hbar\omega$  (ஆ)  $\frac{3}{2}\hbar\omega$   
(இ)  $\frac{1}{2}h\omega$  (ஈ)  $\frac{3}{2}h\omega$

Ground state energy value is

- (a)  $\frac{1}{2}\hbar\omega$  (b)  $\frac{3}{2}\hbar\omega$   
(c)  $\frac{1}{2}h\omega$  (d)  $\frac{3}{2}h\omega$

PART B — (5 × 5 = 25 marks)

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

Each answer should not exceed 250 words.

11. (அ) பிளாங்கின் கதிர்வீச்சு விதியின் தொடர்ச்சியாய், வியன் இடப்பெயர்ச்சி விதியை வருவி.

Derive Wien's displacement law as a consequence of Planck's radiation law.

Or

(ஆ) ஒரு உலோக பரப்பில் ஏற்படும் ஒளிமின் விளைவில், ஒளிமின்மங்களின் பெருமத் திசைவேகத்திற்கும் ( $V_{\max}$ ) தடுப்பு மின்னழுத்தத்திற்கும் ( $V$ ) இடையேயான தொடர்பு  $V_{\max} = 5.927 \times 10^5 \sqrt{V_0}$  என்று நிரூபிக்க.

Prove that in the photo-electric effect from a metal surface, the maximum velocity of photo-electrons is related to the stopping potential by the equation  $V_{\max} = 5.927 \times 10^5 \sqrt{V_0}$ .

12. (அ) உருப்பொருள் அலைகள் பற்றிய தி ப்ராக்லியின் கருதுகோள்களை விளக்குக.

Describe the de Broglie's hypothesis for matter waves.

Or

(ஆ)  $\frac{3}{5}c$  திசைவேகத்தில் நகரும் எதிர் மின் துகளொன்றின் தி ப்ராக்லி அலைநீளத்தை கணக்கிடுக.

Calculate the de Broglie wavelength of an electron moving with a velocity of  $\frac{3}{5}c$ .

13. (அ) ஒரு பெட்டகதினுள் இயங்கும் ஒரு துகளின் சாத்தியப்படும் குறைந்தபட்ச இயக்க ஆற்றலை கணிக்க.

Predict the lowest possible Kinetic energy of a particle in a box.

Or

(ஆ) எதிர் மின் துகளொன்றின் வேகம் 300 m/s என்று 0.01% துல்லியத்துடன் கணக்கிடப்பட்டால், அதன் இருப்பிடத்தின் துல்லியம் என்னவாக இருக்கும்?

If the speed of an electron is measured as 300 m/s with the accuracy of 0.01%, what will the accuracy of its position be?

14. (அ) குவாண்டம் இயக்கவியலின் முற்கோள்களை சுருக்கி எழுதுக.

Brief the postulates of quantum mechanics.

Or

(ஆ) ஒற்றை பரிமானத்தில், காலம் சாரா இச்சுரோடிஞ்சரின் அலைச் சமன்பாட்டினை வருவி.

Derive the one dimensional time independent Schrodinger wave equation.

15. (அ) முடிவிலா ஆழம் கொண்ட ஒற்றை பரிமான நிலையாற்றல் கிணற்றினுள் துகளொன்றின் அலை இயக்கத்தை, அதன் இயக்கச் சமன்பாட்டினையும், அதன் தீர்வையும் கொண்டு ஆய்க.

Inspect the motion of a particle in an infinitely deep 1-D potential well using its wave equation and its solution.

Or

(ஆ)  $1 \text{ \AA}$  பக்களவு கொண்ட ஒற்றை பரிமான நிலையாற்றல் பெட்டகத்தினுள் இயங்கும் எதிமின்துகளின் சிறும ஆற்றல் மதிப்பினைக் காண்க.

Find the lowest energy of an electron confined to move in 1-D potential box of length  $1 \text{ \AA}$ .

PART C — (5 × 8 = 40 marks)

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

Each answer should not exceed 600 words.

16. (அ) கரும்பொருள் கதிர்வீச்சினையும் அதன் நிறமாலையில் உள்ள ஆற்றல் பகிர்வினையும் விளக்குக.

Explain the black body radiation and distribution of energy in its spectrum.

Or

- (ஆ) 1 முதல் 4 வரை முதன்மை குவாண்டம் எண்களை கொண்ட ஃபோர் சுற்றுவட்ட பாதைகளில் எதிர்மின்துகளொன்றின் சாத்தியப்படும் ஆற்றல் மட்டங்களின் மதிப்புகளை கணக்கிடுக. தன்வெப்ப ஏற்பு பற்றிய அயன்ச்டீனின் குவாண்டம் கொள்கையை சுருக்கி எழுதுக.

Calculate the energy values of an electron in Bohr orbits having principal quantum number n from 1 to 4. Brief the Einstein's quantum theory of specific heat.

17. (அ) எதிர் மின் துகள்களின் விளிம்பு விளைவினை பற்றிய அறிதலில், டேவிசன் & செர்மரின் பரிசோதனையை விவரிக்க. மேலும், ஆய்வின் முடிவுகள் பற்றி விவாதிக்க.

Explain the Davison & Germer's experiment on the study of diffraction of electrons. Discuss the results.

Or



(ஆ) இயக்கத்தில் உள்ள துகளொன்றினை அலைபெட்டகமாக விளக்குக.

Explain a particle in motion by a wave packet.

18. (அ) காமா கதிர் நுண்ணோக்கி பற்றிய, சிந்தனை அளவில் உள்ள பரிசோதனையை விவரிக்க.

Explain the Gamma ray microscope thought experiment.

Or

(ஆ) நிரூபிக்க :  $\Delta E \cdot \Delta t \geq \hbar$ . மேலும் அது குறிப்பிடும் இயற்பியல் பொருள் விளக்கத்தை தருக.

Prove :  $\Delta E \cdot \Delta t \geq \hbar$ , and also give its physical significance.

19. (அ) எரென்பெச்ட்டின் தேற்றத்தின் அறிக்கையை எழுதுக. மேலும் நிரூபிக்க.

Write the statement of Ehrenfest's theorem and also prove.

Or

(ஆ) அலைச் சார்பின் இயற்பொருள் விளக்கத்தையும், வரைவு எல்லைகளையும் தருக. அலைச் சார்பின் சீராக்கம் பற்றி சுருக்கி எழுதுக.

Give the physical interpretation of the wave function and its limitations. Brief the normalization of wave function.

20. (அ) செவ்வக நிலையாற்றல் கிணறு பற்றி விளக்குக.

Explain the rectangular potential well.

Or

(ஆ) ஒற்றை பரிமான எளிய சீரிசை அலையியற்றியின் குவாண்டம் இயக்க அலைச் சமன்பாட்டினை வருவித்து எளிமைபடுத்து. அதன் மொத்த ஆற்றல் மதிப்பினைக் கணக்கிடுக.

Derive the simplify the wave equation for an 1-D Simple Harmonic Oscillator in quantum mechanics. Calculate its total energy  $E_n$ .

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B.Sc. (CBCS) DEGREE EXAMINATION,  
APRIL 2020.

Sixth Semester

Physics – Core

QUANTUM MECHANICS

(For those who joined in July 2017 onwards)

Time : Three hours

Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. For a black body, absorptivity is \_\_\_\_\_ and emissivity is \_\_\_\_\_.  
(a) 1, 0                      (b) 0, 1  
(c) 1, 1                      (d) 0, 0
  
2. Mean thermal energy of an atom is  
(a)  $kT$                       (b)  $3kT$   
(c)  $k/T$                       (d)  $3T/k$

3. In the following equations, which one is true?
- (a)  $E^2 = c^4 p^2 + m_o^2 c^2$  (b)  $E^2 = c^2 p^4 + m_o^2 c^2$   
(c)  $E^2 = c^4 p^2 - m_o^2 c^4$  (d)  $E^2 = c^2 p^2 + m_o^2 c^4$
4. The relationship between group velocity and phase velocity is
- (a)  $v_g = v_p - \lambda \frac{dv_p}{d\lambda}$  (b)  $v_g = v_p + \lambda \frac{dv_p}{d\lambda}$   
(c)  $v_p = \lambda v_g - \frac{dv_g}{d\lambda}$  (d)  $v_p = v_g - \frac{dv_g}{d\lambda}$
5. The value of  $\hbar$  is
- (a)  $1.504 \times 10^{-13} \text{ Js}$  (b)  $1.054 \times 10^{-31} \text{ Js}$   
(c)  $1.045 \times 10^{-13} \text{ Js}$  (d)  $1.504 \times 10^{-31} \text{ Js}$
6. The calculated value of radius of the first Bohr Orbit is
- (a)  $5.3 \times 10^{11} \text{ m}$  (b)  $3.5 \times 10^{11} \text{ m}$   
(c)  $0.053 \times 10^{-11} \text{ nm}$  (d)  $5.3 \times 10^{11} \text{ nm}$
7. Quantum operator of linear momentum
- (a)  $-i\hbar r \times \nabla$  (b)  $i\hbar \times \nabla$   
(c)  $i\hbar \nabla$  (d)  $-i\hbar \nabla$

8. Quantum operator of linear momentum

- (a)  $-i\hbar \mathbf{r} \times \nabla$                       (b)  $-i\hbar \frac{\partial}{\partial t}$   
(c)  $i\hbar \frac{\partial}{\partial t}$                               (d)  $i\hbar \frac{\partial}{\partial x}$

9. Laplacian operator is

- (a)  $\nabla^1$                                       (b)  $\nabla^2$   
(c)  $\nabla^3$                                       (d)  $\nabla^{-2}$

10. Ground state energy value is

- (a)  $\frac{1}{2}\hbar\omega$                                   (b)  $\frac{3}{2}\hbar\omega$   
(c)  $\frac{1}{2}h\omega$                                   (d)  $\frac{3}{2}h\omega$

PART B — (5 × 5 = 25 marks)

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

Each answer should not exceed 250 words.

11. (a) Derive Wien's displacement law as a consequence of Planck's radiation law.

Or

(b) Prove that in the photo-electric effect from a metal surface, the maximum velocity of photo-electrons is related to the stopping potential by the equation  $V_{\max} = 5.927 \times 10^5 \sqrt{V_0}$ .

12. (a) Describe the de Broglie's hypothesis for matter waves.

Or

(b) Calculate the de Broglie wavelength of an electron moving with a velocity of  $\frac{3}{5}c$ .

13. (a) Predict the lowest possible Kinetic energy of a particle in a box.

Or

(b) If the speed of an electron is measured as 300 m/s with the accuracy of 0.01%, what will the accuracy of its position be?

14. (a) Brief the postulates of quantum mechanics.

Or

(b) Derive the one dimensional time independent Schrodinger wave equation.

15. (a) Inspect the motion of a particle in an infinitely deep 1-D potential well using its wave equation and its solution.

Or

(b) Find the lowest energy of an electron confined to move in 1-D potential box of length  $1 \text{ \AA}$ .

PART C — (5 × 8 = 40 marks)

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

Each answer should not exceed 600 words.

16. (a) Explain the black body radiation and distribution of energy in its spectrum.

Or

- (b) Calculate the energy values of an electron in Bohr orbits having principal quantum number  $n$  from 1 to 4. Brief the Einstein's quantum theory of specific heat.

17. (a) Explain the Davison & Germer's experiment on the study of diffraction of electrons. Discuss the results.

Or

- (b) Explain a particle in motion by a wave packet.

18. (a) Explain the Gamma ray microscope thought experiment.

Or

- (b) Prove :  $\Delta E \cdot \Delta t \geq \hbar$ , and also give its physical significance.

19. (a) Write the statement of Ehrenfest's theorem and also prove.

Or

- (b) Give the physical interpretation of the wave function and its limitations. Brief the normalization of wave function.

20. (a) Explain the rectangular potential well.

Or

- (b) Derive and simplify the wave equation for an 1-D Simple Harmonic Oscillator in quantum mechanics. Calculate its total energy  $E_n$ .

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B.Sc. (CBCS) DEGREE EXAMINATION,  
APRIL 2020.

Sixth Semester

Physics – Core

NUCLEAR PHYSICS

(For those who joined in July 2017 onwards)

Time : Three hours

Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the best answer :

1. பிணைப்பு ஆற்றல் அதிகம் எனில் உட்கரு,  
(அ) நிலையான (ஆ) நிலையற்ற  
(இ) மிதமான (ஈ) குறைவான

If the binding energy is large, the nucleus is  
\_\_\_\_\_.

- (a) stable (b) unstable  
(c) moderate (d) low

2. உட்கரு இயற்பியலில் பரப்பின் அளவீடு  
(அ) மீட்டர் (ஆ) பார்ன்ஸ்  
(இ) நீளம் (ஈ) கிலோ மீட்டர்

In nuclear physics area is measured in \_\_\_\_\_.

- (a) Meter (b) Barns  
(c) Length (d) Kilometer

3. மின்தடையில் ஆல்பா துகள்களின் கசிவின் நிகழ்தகவை எவ்வாறு அழைப்போம்?

- (அ) பெல்சியர் விளைவு (ஆ) ஊடுருவல் விளைவு  
(இ) டனல் விளைவை (ஈ) ஜீமன் விளைவு

The probability of leaking of alpha particles through the barrier is called \_\_\_\_\_.

- (a) Peltier Effect (b) Penetration Effect  
(c) Tunnel Effect (d) Zeeman effect

4. உட்கரு ஐசோமரிசம் O. ஹானால் கண்டுபிடிக்கப்பட்ட வருடம்

- (அ) 1923 (ஆ) 1922  
(இ) 1912 (ஈ) 1921

The phenomenon of nuclear isomerism was discovered by O. Hahn in \_\_\_\_\_.

- (a) 1923 (b) 1922  
(c) 1912 (d) 1921

5. இணைவு ஆற்றலின் வெளிப்பாடு

- (அ) 23.84 MeV (ஆ) 25.84 MeV  
(இ) 24.84 MeV (ஈ) 22.84 MeV

The energy release in fusion is \_\_\_\_\_.

- (a) 23.84 MeV                      (b) 25.84 MeV  
(c) 24.84 MeV                      (d) 22.84 MeV

6. ஸ்டெல்லர் ஆற்றலின் மூலம் எது?

- (அ) இணைவு  
(ஆ) பிளவு  
(இ) இணைவு மற்றும் பிளவு  
(ஈ) எதுவுமில்லை

The source of stellar energy is \_\_\_\_\_.

- (a) Fission  
(b) Fusion  
(c) Fission and Fusion  
(d) None

7. மேக அறையில் பயன்படுத்தும் மாறுபாடு

- (அ) உயர் அயனியாக்கம்  
(ஆ) குறைந்த அயனியாக்கம்  
(இ) குறிப்பிட்ட அயனியாக்கம்  
(ஈ) நடுத்தர அயனியாக்கம்

Cloud chambers can be used to study the variation of \_\_\_\_\_.

- (a) High ionization  
(b) Slow ionization  
(c) Specific ionization  
(d) Medium Ionization

8. துகளின் ஆற்றலானது ஒளியுடன் இணையும் அடிப்படை

(அ) குமிழி அறை

(ஆ) வில்சன் மேக அறை

(இ) G.M. எண்ணி

(ஈ) சிண்டில்லேஷன்

The energy of the particle is converted to light, is the basis of \_\_\_\_\_.

(a) Bubble Chamber

(b) Wilson Cloud Chambers

(c) G.M. Counter

(d) Scintillation Counter

9. முதன்மை காஸ்மிக் கதிரின் ஆற்றலின் அளவு

(அ) 1 MeV to  $10^4$  MeV

(ஆ) 2 MeV to  $10^4$  MeV

(இ) 1 MeV to  $10^{12}$  MeV

(ஈ) எதுவுமில்லை

The energy of primary cosmic ray's ranges from \_\_\_\_\_.

(a) 1 MeV to  $10^{14}$  MeV

(b) 2 MeV to  $10^{14}$  MeV

(c) 1 MeV to  $10^{12}$  MeV

(d) None

10. காஸ்மிக் கதிரின் உயர் ஆற்றல் —————.

(அ) மின்னமை அற்ற துகள்

(ஆ) மின்சுமை துகள்

(இ) நேர்மின் சுமை துகள்

(ஈ) எதிர்மின் துகள்

Cosmic ray consists of high energy —————.

(a) Charge less Particle

(b) Charged Particle

(c) Positive Particle

(d) Negative Particle

PART B — (5 × 5 = 25 marks)

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

Each answer should not exceed 250 words.

11. (அ) புரோட்டான் - எலக்ட்ரான் (ஹைபோதிஸிஸ்) இணைவு.

Describe Proton – Electron hypothesis.

Or

(ஆ) உட்கருவின் பொதுப் பண்புகள்.

The general properties of nucleus.

12. (அ) காமா கதிரின் ஏதேனும் ஐந்து பண்புகள்.

To write any five properties of gamma rays.

Or

(ஆ) சராசரி வாழ்க்கையின் காலத்தை விவரி.

Describe the term mean life.

13. (அ) உட்கரு வினையின் q-மதிப்பு சமன்பாட்டை விவரி.  
To derive the q value equation for nuclear reaction.

Or

- (ஆ) பிளவு உலையை பற்றி விவரி.  
Briefly explain the term fusion reactors.

14. (அ) சிண்டில்லேஷன் எண்ணியின் செயல்பாட்டை விவரி.  
Explain the action of scintillation counter.

Or

- (ஆ) சிண்க்ரோடரான்ஸ் பற்றி விவரி.  
Describe the term synchrotrons.

15. (அ) முதன்மை மற்றும் இரண்டாம் நிலை காஸ்மிக் கதிரின் ஐந்து வித்தியாசங்கள்.  
To write any five difference of primary and secondary cosmic rays.

Or

- (ஆ) கீழ்க்கண்ட சிறு துகள் குவாண்டம் எண்களின் விளக்கம் தருக.  
(i) பேரியான்  
(ii) லெப்டான்

Explain the following elementary particle quantum number.

- (i) Baryon  
(ii) Lepton

PART C — (5 × 8 = 40 marks)

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

Each answer should not exceed 600 words.

16. (அ) பிணைப்பு ஆற்றலின் முக்கியத்துவத்தை விவரி.  
Explain the binding energy curve and its significance.

Or

- (ஆ) செல் அமைப்பு மற்றும் மேஜிக் எண்களை விவரி.  
Explain the shell model and evidence of magic number.

17. (அ) ரேடியோ ஐசோடோப்புகளின் விதிகளை விரிவாக விவரி.  
Explain the laws of radioactive disintegration.

Or

- (ஆ) ரேடியோ ஐசோடோப்புகளின் பயன்பாடுகள் விரிவாக விவரி.  
Briefly explain the application of radio isotopes.

18. (அ) உட்கரு வினையின் அமைப்பு, செயல்படும் விதம் மற்றும் பயன்பாடுகளை விவரி.  
Explain the construction and working of nuclear reactor and uses.

Or

(ஆ) பிளாஸ்மா சிறையை பற்றி விவரி.

Explain the term plasma confinement.

19. (அ) G.M. எண்ணியின் கொள்கை, அமைப்பு செயல்படும் விதத்தை விவரி.

Explain the principle, construction and working of G.M. Counter.

Or

(ஆ) சைக்ளோட்ரானின் கொள்கை, அமைப்பு மற்றும் செயல்படும் விதத்தை விவரி.

Explain the principle, construction and working of cyclotron.

20. (அ) காஸ்மிக் கதிர்களின் உண்மைத் தன்மையை விவரி.

Describe origin of cosmic rays.

Or

(ஆ) குவார்க் மாதிரியின் வேறுபட்ட வகைகளை விரிவாக விவரி.

Briefly explain the different types of quark model.



(6 pages)

Reg. No. : .....

**Code No. : 30564 E      Sub. Code : SMPH 63**

B.Sc. (CBCS) DEGREE EXAMINATION,  
APRIL 2020.

Sixth Semester

Physics – Core

**NUCLEAR PHYSICS**

(For those who joined in July 2017 onwards)

Time : Three hours

Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the best answer :

1. If the binding energy is large, the nucleus is  
\_\_\_\_\_.

(a) stable                      (b) unstable

(c) moderate                 (d) low

2. In nuclear physics area is measured in —————.
- (a) Meter                      (b) Barns  
(c) Length                      (d) Kilometer
3. The probability of leaking of alpha particles through the barrier is called —————.
- (a) Peltier Effect              (b) Penetration Effect  
(c) Tunnel Effect              (d) Zeeman effect
4. The phenomenon of nuclear isomerism was discovered by O. Hahn in —————.
- (a) 1923                      (b) 1922  
(c) 1912                      (d) 1921
5. The energy release in fusion is —————.
- (a) 23.84 MeV              (b) 25.84 MeV  
(c) 24.84 MeV              (d) 22.84 MeV
6. The source of stellar energy is —————.
- (a) Fission  
(b) Fusion  
(c) Fission and Fusion  
(d) None

7. Cloud chambers can be used to study the variation of \_\_\_\_\_.
- (a) High ionization
  - (b) Slow ionization
  - (c) Specific ionization
  - (d) Medium Ionization
8. The energy of the particle is converted to light, is the basis of \_\_\_\_\_.
- (a) Bubble Chamber
  - (b) Wilson Cloud Chambers
  - (c) G.M. Counter
  - (d) Scintillation Counter
9. The energy of primary cosmic ray's ranges from \_\_\_\_\_.
- (a) 1 MeV to  $10^{14}$  MeV
  - (b) 2 MeV to  $10^{14}$  MeV
  - (c) 1 MeV to  $10^{12}$  MeV
  - (d) None
10. Cosmic ray consists of high energy \_\_\_\_\_.
- (a) Charge less Particle
  - (b) Charged Particle
  - (c) Positive Particle
  - (d) Negative Particle

PART B — (5 × 5 = 25 marks)

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

Each answer should not exceed 250 words.

11. (a) Describe Proton – Electron hypothesis.

Or

- (b) The general properties of nucleus.

12. (a) To write any five properties of gamma rays.

Or

- (b) Describe the term mean life.

13. (a) To derive the  $Q$  value equation for nuclear reaction.

Or

- (b) Briefly explain the term fusion reactors.

14. (a) Explain the action of scintillation counter.

Or

- (b) Describe the term synchrotrons.

15. (a) To write any five difference of primary and secondary cosmic rays.

Or

- (b) Explain the following elementary particle quantum number.  
(i) Baryon  
(ii) Lepton

PART C — (5 × 8 = 40 marks)

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

Each answer should not exceed 600 words.

16. (a) Explain the binding energy curve and its significance.

Or

- (b) Explain the shell model and evidence of magic number.

17. (a) Explain the laws of radioactive disintegration.

Or

- (b) Briefly explain the application of radio isotopes.

18. (a) Explain the construction and working of nuclear reactor and uses.

Or

(b) Explain the term plasma confinement.

19. (a) Explain the principle, construction and working of G.M. Counter.

Or

(b) Explain the principle, construction and working of cyclotron.

20. (a) Describe origin of cosmic rays.

Or

(b) Briefly explain the different types of quark model.

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(8 pages)

Reg. No. : .....

Code No. : 30565 B Sub. Code : SMPH 64

B.Sc. (CBCS) DEGREE EXAMINATION,  
APRIL 2020.

Sixth Semester

Physics – Core

SOLID STATE PHYSICS

(For those who joined in July 2017 onwards)

Time : Three hours

Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. பின்வருவனவற்றுள் எவை HCP படிக அமைப்பு உள்ளவை?

(அ) W (ஆ) Mo

(இ) Cr (ஈ) Zr

Which of the following has a HCP crystal structure?

(a) W (b) Mo

(c) Cr (d) Zr

2. அணிக்கோவையின் சிறிய பகுதி என்று அழைக்கப்படுவது

(அ) அணிக்கோவை அமைப்பு

(ஆ) அணிக்கோவை புள்ளி

(இ) Bravais அணிக்கோவை

(ஈ) அலகு செல்

The smallest portion of the lattice is known as

(a) Lattice structure (b) Lattice point

(c) Bravais lattice (d) Unit cell

3. எந்த பொருளில் திருப்பகாந்தத் திண்மம் தொடர்கிறது?

(அ) டயா காந்தம்

(ஆ) பாரா காந்தம்

(இ) ஃபெரோ காந்தம்

(ஈ) எதிர் இரும்புக் காந்தம்

In which materials the magnetic anisotropy is followed?

(a) Diamagnetic

(b) Paramagnetic

(c) Ferromagnetic

(d) Antiferromagnetic



4. சார்பி உட்புகுதிறனின் அலகு என்பது  
(அ) henry/metre (ஆ) henry  
(இ) henry/sq.m (ஈ) பரிமாணமற்றது

The unit of relative permeability is

- (a) henry/metre (b) henry  
(c) henry/sq.m (d) it is dimensionless
5. சகபிணைப்பு என்று அழைக்கப்படுவது  
(அ) மின்முனை பிணைப்பு  
(ஆ) மின்னாற்பகுப்பு  
(இ) வேறுமுனைவுள்ள பிணைப்பு  
(ஈ) ஒரே முனைவுள்ள பிணைப்பு

Covalent bond is also known as ————— bond.

- (a) Electrovalent (b) Electrolytic  
(c) Heteropolar (d) Homopolar
6. அயனி பிணைப்புகள்  
(அ) உடைக்க எளிதானது  
(ஆ) பலவீனமான  
(இ) மின்பிணைப்புகள்  
(ஈ) உடைக்க மிகவும் கடினம்

Ionic bonds are

- (a) easy to break  
(b) weak  
(c) electrical bonds  
(d) very difficult to break

7. மீக்கடத்தியில் எலக்ட்ரான்கள் மாறுவதை தடுக்கப்படுவது

(அ) குவாண்டம் விளைவு

(ஆ) வாசல் ஆற்றல்

(இ) ஆற்றல் தடை

(ஈ) சுற்றுப்பாதைகள்

The shifting of electrons in superconductors is prevented by

(a) Quantum effect (b) Threshold energy

(c) Energy barrier (d) Orbitals

8. மென் மீக்கடத்திகள் கீழ்க்கண்ட பண்புகளில் எது பொருந்தும்?

(அ) Meissner

(ஆ) Silibee's விதி

(இ) இரண்டும் (அ) மற்றும் (ஆ)

(ஈ) ஏதும் இல்லை

The soft superconductors observe

(a) Meissner (b) Silibee's rule

(c) Both (a) and (b) (d) None of these

9. கார்பன் நானோ குழாய்கள் என்று அழைக்கப்படுவது

(அ) பக்கி குழாய்கள் (ஆ) பருமனான குழாய்கள்

(இ) பக்கி பந்துகள் (ஈ) பருமன் குழாய்கள்

Carbon nano tubes are also called as

(a) Bucky tubes (b) Bulky tubes

(c) Buck balls (d) Bulk tubes

10. Sol gel என்பது எத்தகைய நிலையை சார்ந்தது?

- (அ) பதங்கமாதல் (ஆ) உருகுதல்  
(இ) கூழ் இடை நீக்கம் (ஈ) குளிர் அடங்கிய

The sol gel is a ————— of solid particle.

- (a) Sublimation  
(b) Melting  
(c) Cottridal suspension  
(d) Cool down

PART B — (5 × 5 = 25 marks)

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

Each answer should not exceed 250 words.

11. (அ) எளிய கன அமைப்பினை படத்துடன் விவரி.

Describe simple cubic structure with a diagram.

Or

(ஆ) பரிமாற்ற அணிக்கோவையை பற்றி குறிப்பு வரைக.

Write a note on reciprocal lattices.

12. (அ) ஃபெரோ காந்தவியல் பற்றி குறிப்பு எழுதுக.

Write a note on ferromagnetism.

Or

- (ஆ) (i) மின் கடத்தா தன்மை  
(ii) முனைவாக்கம் – வரையறு.

Define the terms :

- (i) Dielectrics  
(ii) Polarization.

13. (அ) சகப் பிணைப்பு பற்றி குறிப்பு எழுதுக.  
Write a note on Covalent Bonding.

Or

- (ஆ) ஒத்திசைவான ஆற்றல் பற்றி விவரி.  
Describe Cohesive energy.

14. (அ) (i) என்ட்ரோபி  
(ii) ஐசோடோப்பு விளைவு பற்றி வரையறு.

Define the terms :

- (i) Entropy  
(ii) Isotope effect.

Or

- (ஆ) வகை-I மற்றும் வகை-II மீக்கடத்திகள்  
வேறுபடுத்துக.

Distinguish between type I and Type II  
superconductors.

15. (அ) நானோ பொருளின் தொகுப்பினை விவரி.  
Describe the synthesis of Nanomaterials.

Or

(ஆ) வேதியியல் நீராவி படிவு பற்றி விவரி.  
Describe the chemical vapour deposition.

PART C — (5 × 8 = 40 marks)

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

Each answer should not exceed 600 words.

16. (அ) படிக்களின் ஏழு வகுப்புகளை விளக்குக.  
Explain seven classes of crystals.

Or

(ஆ) மில்லர் இண்டிஸ் செயல்முறை கொண்டு  
கண்டறிவதை எழுதுக.

Write the procedure for finding Miller indices.

17. (அ) ஃபெரோ காந்தத்தின் டொமைன் கோட்பாடு பற்றி  
விளக்குக.

Explain the domain theory of ferromagnetism.

Or

(ஆ) வெளி மின்னோட்ட முனைவாக்கம் பற்றி விளக்குக.  
Explain Space charge polarization.

18. (அ) திடப்பொருட்களின் பிணைப்புக் கோட்பாடு பற்றி விளக்குக.

Explain bond theory of solids.

Or

- (ஆ) அயனி மற்றும் சுகபிணைப்பு ஒப்பிடுதலை எழுதுக.

Write the comparison between ionic and covalent solids.

19. (அ) (i) மெய்ஸ்னர் விளைவு  
(ii) குறிப்பிட்ட வெப்பம் பற்றி விவரி.

Describe the

- (i) Meissner effect  
(ii) Specific heat

Or

- (ஆ) அதிக வெப்பநிலை மீக்கடத்திகள் பற்றி விளக்குக.

Explain high temperature superconductors.

20. (அ) சோல் ஜெல் நுட்பம் பற்றி விளக்குக.

Explain sol gel technique.

Or

- (ஆ) நானோ பொருள்களின் பண்புகள் மற்றும் பயன்பாடுகள் பற்றி வரையறு.

Outline the properties and application of Nanomaterials.

(6 pages)

Reg. No. : .....

Code No. : 30565 E      Sub. Code : SMPH 64

B.Sc. (CBCS) DEGREE EXAMINATION,  
APRIL 2020.

Sixth Semester

Physics – Core

SOLID STATE PHYSICS

(For those who joined in July 2017 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 has a HCP crystal structure?  
(a) W                                  (b) Mo  
(c) Cr                                  (d) Zr

2. The smallest portion of the lattice is known as
- (a) Lattice structure
  - (b) Lattice point
  - (c) Bravais lattice
  - (d) Unit cell
3. In which materials the magnetic anisotropy is followed?
- (a) Diamagnetic
  - (b) Paramagnetic
  - (c) Ferromagnetic
  - (d) Antiferromagnetic
4. The unit of relative permeability is
- (a) henry/metre
  - (b) henry
  - (c) henry/sq.m
  - (d) it is dimensionless
5. Covalent bond is also known as ————— bond.
- (a) Electrovalent
  - (b) Electrolytic
  - (c) Heteropolar
  - (d) Homopolar
6. Ionic bonds are
- (a) easy to break
  - (b) weak
  - (c) electrical bonds
  - (d) very difficult to break



7. The shifting of electrons in superconductors is prevented by
- (a) Quantum effect
  - (b) Threshold energy
  - (c) Energy barrier
  - (d) Orbitals
8. The soft superconductors observe
- (a) Meissner
  - (b) Silibee's rule
  - (c) Both (a) and (b)
  - (d) None of these
9. Carbon nano tubes are also called as
- (a) Bucky tubes
  - (b) Bulky tubes
  - (c) Buck balls
  - (d) Bulk tubes
10. The sol gel is a ————— of solid particle.
- (a) Sublimation
  - (b) Melting
  - (c) Cottridal suspension
  - (d) Cool down

PART B — (5 × 5 = 25 marks)

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

Each answer should not exceed 250 words.

11. (a) Describe simple cubic structure with a diagram.

Or

- (b) Write a note on reciprocal lattices.

12. (a) Write a note on ferromagnetism.

Or

- (b) Define the terms :

- (i) Dielectrics
- (ii) Polarization.

13. (a) Write a note on Covalent Bonding.

Or

- (b) Describe Cohesive energy.

14. (a) Define the terms :

- (i) Entropy
- (ii) Isotope effect.

Or

- (b) Distinguish between type I and Type II superconductors.

15. (a) Describe the synthesis of Nanomaterials.

Or

(b) Describe the chemical vapour deposition.

PART C — (5 × 8 = 40 marks)

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

Each answer should not exceed 600 words.

16. (a) Explain seven classes of crystals.

Or

(b) Write the procedure for finding Miller indices.

17. (a) Explain the domain theory of ferromagnetism.

Or

(b) Explain Space charge polarization.

18. (a) Explain bond theory of solids.

Or

(b) Write the comparison between ionic and covalent solids.

19. (a) Describe the  
(i) Meissner effect  
(ii) Specific heat

Or

- (b) Explain high temperature superconductors.

20. (a) Explain sol gel technique.

Or

- (b) Outline the properties and application of Nanomaterials.
-

(6 pages)

Reg. No. : .....

**Code No. : 30558 E      Sub. Code : SMPH 22**

B.Sc. (CBCS) DEGREE EXAMINATION,  
NOVEMBER 2020.

Second Semester

Physics — Core

OPTICS

(For those who joined in July 2017 onwards)

Time : Three hours

Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. The field of view Huygen's eyepiece is \_\_\_\_\_  
than Ramsden eyepiece.  
(a) greater                      (b) smaller  
(c) equal                         (d) none
2. In an aplanatic lens \_\_\_\_\_ is minimum.  
(a) astigmatism  
(b) coma  
(c) spherical aberration  
(d) none

3. Interference is due to superposition of \_\_\_\_\_ waves.
- (a) incoherent            (b) coherent  
(c) scattered            (d) bending
4. The path difference for destructive interference is \_\_\_\_\_
- (a)  $(2n+1)\lambda/2$             (b)  $n\lambda$   
(c)  $2n\lambda/3$             (d) none
5. A zone plate forms \_\_\_\_\_ image.
- (a) real            (b) virtual  
(c) real and virtual            (d) none
6. In a fresnel diffraction, the incident waves are \_\_\_\_\_ waves.
- (a) plane            (b) spherical  
(c) elliptical            (d) none
7. A quarter wave plate produces a phase difference of \_\_\_\_\_
- (a)  $\pi$             (b)  $\pi/2$   
(c)  $\lambda/2$             (d) none

8. The acceptance angle ( $\Phi_{\max}$ ) is equal to \_\_\_\_\_ (NA is the numerical aperture)
- (a)  $\sin(NA)$                       (b)  $\sin^{-1}(NA)$
- (c)  $\cos^{-1}(NA)$                       (d) none
9. The output from a laser source is \_\_\_\_\_
- (a) highly coherent      (b) less intense
- (c) highly scattered      (d) none
10. The efficiency of CO<sub>2</sub> laser is around \_\_\_\_\_
- (a) 100%                      (b) 40%
- (c) 10%                      (d) zero

PART B — (5 × 5 = 25 marks)

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

Each answer should not exceed 250 words.

11. (a) What is coma? How it is eliminated?

Or

- (b) What is an eye piece? What is its advantage over single lens.

12. (a) Give the basic conditions for the interference of light.

Or

- (b) Explain the testing of plainness of surfaces.

13. (a) Distinguish between Fresnel and Fraunhofer diffractions.

Or

- (b) What is a zone plate? How does it differ from a convex lens?

14. (a) Distinguish between quarter wave plate and half wave plate.

Or

- (b) What are the characteristics of optical fiber?

15. (a) Give any five applications of laser.

Or

- (b) Explain the process of recording and reconstruction of a three dimensional image.



PART C — (5 × 8 = 40 marks)

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

Each answer should not exceed 600 words.

16. (a) Define dispersive power. Derive the condition to produce dispersion without deviation.

Or

- (b) Explain the construction and working of Huygens eyepiece.

17. (a) Give the theory of Newton's rings. Determine the radius of curvature of a lens using it.

Or

- (b) Describe Michelson interferometer. How is it used to measure the wavelength of light?

18. (a) Derive the expression for the resolving power of a grating.

Or

- (b) Explain the construction of Fresnel's half period zones.

19. (a) Discuss in detail the production and detection of circularly polarized light.

Or

- (b) Classify the fibers on the basis of  
(i) refractive index  
(ii) number of modes  
(iii) materials.

20. (a) Derive the Schallow and Townes equations for threshold condition for laser action.

Or

- (b) Describe the construction and working of CO<sub>2</sub> laser.
-

(6 pages)

Reg. No. : .....

**Code No. : 30560 E      Sub. Code : SMPH 41**

B.Sc.(CBCS) DEGREE EXAMINATION,  
NOVEMBER 2020.

Fourth Semester

Physics — Core

**ELECTROMAGNETISM**

(For those who joined in July 2017 onwards)

Time : Three hours

Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. The direction of induced emf in a circuit is given by
  - (a) Faraday's law
  - (b) Fleming's law
  - (c) Lenz's law
  - (d) None of these
  
2. A device for storing energy in magnetic field is
  - (a) resistor
  - (b) capacitor
  - (c) inductor
  - (d) none

3. The unit of magnetic flux is  
(a) Oersted (b) Weber  
(c) Maxwell (d) Gauss
4. The force experienced by a current carrying conductor parallel to magnetic induction is  
(a) Zero (b)  $BII$   
(c)  $BII\sin\theta$  (d)  $HII$
5. The unit of magnetic susceptibility is  
(a)  $A/m$  (b)  $A/m^2$   
(c)  $Am^2$  (d) no unit
6. The displacement current through a circuit is given by  
(a)  $\epsilon_0 \frac{\partial E}{\partial r}$  (b)  $\mu_0 \epsilon_0 \frac{\partial E}{\partial r}$   
(c)  $\epsilon_0 \frac{\partial \phi}{\partial r}$  (d)  $\mu_0 \epsilon_0 \frac{\partial \phi}{\partial r}$
7. Brewster angle is the angle of  
(a) incidence (b) reflection  
(c) refraction (d) transmission

8. The refractive index of a medium is
- (a)  $\sqrt{\mu r / \epsilon r}$                       (b)  $\sqrt{\frac{\epsilon r}{\mu r}}$
- (c)  $\frac{1}{\sqrt{\epsilon r \mu r}}$                       (d)  $\sqrt{\epsilon r \mu r}$
9. Calibrating B.G. means
- (a) finding its charge sensitiveness  
(b) finding its throw  
(c) finding its damping  
(d) all the above
10. Induction coil is
- (a) an a.c. transformer  
(b) an d.c. transformer  
(c) an inverter  
(d) a dynamo

PART B — (5 × 5 = 25 marks)

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

Each answer should not exceed 250 words.

11. (a) Define coefficient of self inductance of a coil.  
Deduce an expression for the self inductance of a solenoid.
- Or
- (b) Define coefficient of coupling and derive an expression for it.

12. (a) State and prove Ampere's circuital law.

Or

(b) Explain Lorentz force on a moving charge.

13. (a) Define three magnetic vectors  $M$ ,  $B$  and  $H$ .  
Obtain the relation connecting them.

Or

(b) Derive an expression for loss of energy in one cycle of magnetization.

14. (a) Derive electromagnetic equation for the varying electric field.

Or

(b) Show that when a beam of unpolarised light is incident at Brewster angle the refracted beam is at right angles to the reflected beam.

15. (a) Explain how the ballistic constant of a B.G. Can be determined using solenoid inductor.

Or

(b) What are the applications of induction coil?

PART C — (5 × 8 = 40 marks)

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

Each answer should not exceed 600 words.

16. (a) Describe Anderson's bridge method of determining the self inductance of a coil.

Or

- (b) Describe a method of determining mutual inductance between two coils.

17. (a) A circular coil has a radius 0.1 m and a number of turns of 50. Calculate the magnetic induction at a point (i) on the axis of the coil and distance 0.2 m from the center (ii) at the center of the coil, when a current of 0.1 A flows in it.

Or

- (b) Describe an experiment of determine absolute capacity of a capacitor.

18. (a) Describe an experiment to draw B – H curve.

Or

- (b) Derive Maxwell's equations for electromagnetic wave.

19. (a) Discuss reflection and transmission of electromagnetic wave at a dielectric boundary for normal incidence.

Or

- (b) Explain polarization of electromagnetic wave by reflection. Also deduce Brewster's law of polarization.

20. (a) Describe an earth inductor and give its theory.

Or

- (b) Explain the method of measurement of intense magnetic field using search coil and B.G.
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