Seat No.	

B.Sc. (Part-III) Semester-VI (CBCS) Examination, March 2024.

PHYSICS (Paper-XIII)

Nuclear and Particle Physics

Sub. Code : 81668

Day and Date: Tuesday, 26-03-2024 **Total Marks: 40**

Time: 02.30 p.m. to 04.30 p.m.

Instructions:
1) **All questions are compulsory.**
2) **Draw neat labelled diagrams wherever necessary.**
3) **Figures to the right indicate full marks.**

Q.1 Select the correct alternative. **(8)**

1) ..... force is an interaction.
   (A) Centrifugal (B) Frictional
   (C) Electromagnetic (D) Viscous

2) The gas amplification in GM-counter is .....
   (A) less than unity (B) equal to unity
   (C) $\sim 10^3$ (D) $\sim 10^8$

3) Cyclotron is suitable to accelerate .....
   (A) neutrons (B) protons (C) electrons (D) positron

4) The nucleus contains .....
   (A) protons and electrons (B) protons and neutrons
   (C) neutrons and electrons (D) neutrons and α-particles

5) Quarks have ..... electronic charges.
   (A) zero (B) one unit of positive
   (C) one unit of negative (D) fractional

6) Quenching gas in GM tube is .....

(A) air (B) argon

(C) bromine vapour (D) water vapour

7) Betatron is specially designed to accelerate .....

(A) electronics (B) positrons

(C) both electrons and positrons (D) protons

8) One atomic mass unit (a.m.u.) is equal to .....

(A) 931 gm (B) 931 kg (C) 931 MeV (D) 931 eV

Q.2 Attempt ANY TWO. **(16)**

1) Explain construction, working and theory of cyclotron.

2) Explain construction, working and theory of Geiger-Muller (GM) counter.

3) Derive semi-empirical mass formula.

Q.3 Attempt ANY FOUR. **(16)**

1) Explain gravitational and electromagnetic interaction.

2) Explain the construction and working of a scintillation counter.

3) Explain construction and working of betatron.

4) Write a note on 'magic numbers'.

5) Obtain an expression for maximum energy obtainable from a cyclotron.

6) Explain liquid model for a nucleus.

SU-290

Total No. of Pages : 2

Seat No.	

B.Sc. (Part - III) (Semester - VI) (CBCS)

Examination, March - 2024

PHYSICS

Solid State Physics (Paper XIV)

Sub. Code : 81669

Day and Date : Wednesday, 27-03-2024 **Total Marks : 40**

Time : 02.30 p.m. to 04.30 p.m.

Instruction : 1) All questions are compulsory.

2) Figures to the right indicate full marks.

3) Draw neat labelled diagrams wherever necessary.

4) Use of scientifc calculator is allowed.

Q.1) Choose the correct alternative and rewrite the sentence. **[8]**

i) Packing fraction of hcp crystal structure is .....

a) 0.52 b) 0.68

c) 1 d) 0.74

ii) Band gap energy of silicon is ..... eV.

a) 1.12 b) 0.72

c) 0.65 d) 0.56

iii) ..... materials have large and positive value of succeptibility.

a) Diamagnetic b) Ferrimagnetic

c) Ferromagnetic d) Paramagnetic

iv) The condition to produce X-ray diffraction effect is .....

a) $\lambda = 2d$ b) $\lambda < d$

c) $\lambda < 2d$ d) $\lambda > 2d$

v) The number of lattice points in a primitive unit cell are .....

a) 1 b) 2
c) 3 d) 4

vi) The value of magnetization which remains even after the magnetizing field is reduced to zero is .....

a) hysteresis b) retentivity
c) coercivity d) saturation magnetisation

vii) In Hall effect if the current is flowing due to motion of holes, then the Hall coefficient is .....

a) zero b) negative
c) positive d) either positive or negative

viii) The number of planes of symmetry elements present in cubic crystal are .....

a) 3 b) 9
c) 8 d) 12

Q.2) Attempt any two of the following. **[16]**

i) Obtain an expression for diamagnetic susceptibility using the Langevin's theory.

ii) Distinguish between metal, semiconductor and insulator on the basis of their energy band structure.

iii) Discuss the various types of symmetry elements present in cubic crystal.

Q.3) Attempt any four of the following. **[16]**

i) Show that energy loss in hysteresis is the area of B-H curve.

ii) Show that the reciprocal of the reciprocal lattice is the direct lattice.

iii) Derive Bragg's law for X-ray diffraction.

iv) Write a note on effective mass of an electron.

v) Distinguish between crystalline solids and amorphous solids.

vi) Describe rotating crystal method of X ray diffraction.

SU-200

Total No. of Pages : 02

Seat No.	

B.Sc. (Part-III) Semester-VI (CBCS)
Examination, March 2024.
PHYSICS (Paper-XV)
Atomic and Molecular Physics and Astrophysics
Sub. Code : 81670

Day and Date: Thursday, 28-03-2024 **Total Marks: 40**

Time: 02.30 p.m. to 04.30 p.m.

Instructions:
1) **All questions are compulsory.**
2) **Figures to the right indicate full marks.**
3) **Draw neat and labelled diagrams wherever necessary.**
4) **Use of a calculator/logarithmic table is allowed.**

Q.1 Select the correct alternative. **(8)**

1) In doublet splitting due to spin-orbit interaction, the relative position of levels with $j = l + \frac{1}{2}$ and $j = l - \frac{1}{2}$ in normal order is .....

(A) $j = l - \frac{1}{2}$ level lies lower (B) $j = l + \frac{1}{2}$ level lies lower

(C) both levels lie at same energy (D) All of these

2) The Larmor frequency of precession of electron in magnetic field B is .....

(A) $W_L = \frac{B}{m}$ (B) $W_L = \frac{e}{m}$

(C) $W_L = \frac{Be}{m}$ (D) $W_L = B\frac{m}{e}$

3) When a pair of electrons is shared by two atoms in a molecule, then ..... is formed.

(A) a covalent bond (B) an ionic bond

(C) a metallic bond (D) no bond

4) Frank-Condon principle helps in estimating the .....
   (A) moment of inertia of the molecule
   (B) bond length
   (C) reduced mass of the molecule
   (D) intensity of bands

5) To observe Raman effect, molecule must be .....
   (A) polar (B) non-polar
   (C) ionic (D) Any one of these

6) Big-Bang theory was strongly supported by .....
   (A) George Gamow (B) Hubble
   (C) Fred Hoyle (D) Einstein

7) The state of universe when all the matter in the universe is concentrated in a small region is called .....
   (A) ylem (B) nucleus (C) big-bang (D) nebula

8) Majority of sunspots occur .....
   (A) in polar region (B) near the equator
   (C) at the center (D) None of these

Q.2 Attempt ANY TWO of the following. **(16)**

1) What is normal Zeeman effect? Explain normal Zeeman effect with the help of vector atom model.
2) Discuss the origin of solar system with special references to condensation theory.
3) Explain in detail, vibration-rotational spectra of diatomic molecule.

Q.3 Attempt ANY FOUR of the following. **(16)**

1) Explain classical theory of Raman Effect.
2) Discuss in brief the basic properties of stars to plot Hertzsprung-Russell diagram.
3) How H_2^+ molecular ion becomes stable by sharing an electron by two protons?
4) Write a note on Raman Effect. Define stokes and antistokes lines.
5) Give a brief account of spectral notation and optical spectral series due to alkali atoms.
6) Write a note on evolution of massive stars.

Total No. of Pages : 2

Seat No.	

B.Sc. (Part - III) (Semester- V) (CBCS)

Examination, March 2024

PHYSICS Paper - XVI

DSE - F4 : Energy Studies and Materials Science

Sub. Code : 81671

Day and Date : Saturday, 30/03/2024 **Total Marks : 40**

Time : 2.30 p.m. to 4.30 p.m.

Instructions : 1) All questions are compulsory.

2) Figures to the right indicate full marks.

3) Draw neat and labelled diagram wherever necessary.

Q. 1) Select correct alternative. **[08]**

i. Which of the following is the conventional source of energy?

a) Sun b) Coal

c) Biomass d) Wind

ii. The maximum power of wind mill is proportional to

a) incoming wind velocity b) square of the incoming wind velocity

c) cube of the incoming wind velocity d) reciprocal of the incoming wind velocity

iii. The value of solar constant is------

a) 1353 W/m^2 b) 1535 W/m^2

c) 3135 W/m^2 d) 5135 W/m^2

iv. The process of decomposition of organic matter by microorganisms is called as ----------.

a) anaerobic digestion b) pyrolysis

c) fermentation d) incineration

v. The critical temperature Tc of a superconductor varies with its isotopic mass M as

a) $T_c \alpha M^{-1/2}$ b) $T_c \alpha M^{1/2}$

c) $T_c \alpha M^{2}$ d) $T_c \alpha M^{-2}$

P.T.O.

vi. The susceptibility of perfect superconductors is.....

a) zero b) infinity

c) +1 d) — 1

vii. The surface to volume ratio of nanoparticle is -------

a) zero b) very high

c) infinity d) one

viii. ..... method is top-down approach for synthesis of nanomaterials.

a) Physical vapor deposition b) nucleation and growth

c) sol - gel d) Photolithography

Q. 2 Attempt any TWO **[16]**

A. Explain essential subsystems in solar energy plant.

B. Define Critical temperature and critical magnetic field of superconductor. Explain Type-I and Type-II superconductors.

C. What is a nanostructure? Explain 1D, 2D and 3D nanostructures.

Q. 3 Attempt any FOUR **[16]**

a. Explain construction of Horizontal axis propeller type wind turbine generator unit.

b. What are merits and limitations of solar PV systems?

c. Explain efficiency factor of wind turbine using P-H graph

d. Write a note on 'Biomass Energy Resources'

e. Write a note on 'Meissner Effect'

f. Explain Ball Milling method of synthesis of nanomaterials.

Total No. of Pages : 2

Seat No.	

B.Sc. (Part - III) (Semenster - VI) (CBCS)

Examination, April 2024

ENGLISH (Compulsory) (Paper - IV)

Ability Enhancement Compulsory Course

English for Communication

Sub. Code : 81667

Day and Date : Monday, 01/04/2024 **Total Marks : 40**

Time : 2.30 p.m. to 4.30 p.m.

Instructions : 1) All questions are compulsory.

2) Figures to the right indicate full marks.

Q.1 A) Rewrite the following choosing the correct alternative: [3]

1. Buffalo Bill stays open .....a day, ...a week.

   a. 12 hours, 3 days b. 6 hours, 2 days

   c. 24 hours, 7 days d. 20 hours, 5 days

2. Granny's piercing eyes could detect.....

   a. any disease b. uneasiness

   c. deep buried pain d. unhappiness

3. The grass lifts its head into flat ..... by the frenzied machine.

   a. tree b. velvet

   c. women d. grass

B. Answer the following questions in one word/ phrase /sentence each. [3]

1. Who is regarded as the Booker T. Washington of Maharashtra?
2. What is Lachmi doing while chatting?
3. Who cures Govind Singh of his madness?

P.T.O.

Q.2)A) Answer any two of the following questions in 3 to 4 sentences each. [4]

1. What does the word 'pawn' mean? Which meaning fits this poem?
2. How was the absence of Granny felt by the poetess?
3. What does the grass do?

B) Write a short note on any one of the following in about 7 to 8 sentences.[4]

1. Anna's education mission
2. Lachmi

C) Do as directed [2]

Write antonym of the following word.

'Aggressive'

Write synonym of the following word.

'Dirty'

Q.3.A) Build up a short piece of group discussion on the following topics making use of expressions and interactions used in group discussion. [8]

Save Environment means Save the Earth.

OR

Terrorism is serious problem in our country.

B) You are planning a family trip to your favourite place. Make notes of what you must do to get most out of this trip. Use the 'mind mapping' technique for this purpose. [8]

Q.4. Write a summing up or a part of a talk/discussion/Interview/Musical programme on television. [8]

OR

You happen to be the editor of an English newspaper published from Maharashtra. You are expected to write an editorial on death of a famous film personality.