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Total No. of Pages : 2

B. Sc. (Part - III) (Semester - VI) (CBCS) Examination, March - 2023
PHYSICS
Atomic and Molecular Physics and Astrophysics (Paper - XV)
Sub. Code : 81670

Day and Date : Saturday, 03 - 06 - 2023 **Total Marks: 40**

Time : 10.30 a.m. to 12.30 p.m.

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

Q1) **Select the correct alternative from the following :** **[8]**

i) Raman lines are situated _____ with respect to undisplaced (incident) line.

a) only on one side b) symmetrically on both sides

c) asymmetrically on both sides d) none of these

ii) A region of the H–R diagram running from upper left to lower right corner is known as _____.

a) main sequence b) spectral class

c) absolute magnitude d) luminosity

iii) The transitions from nS levels to the lowest P-level give rise to a series of spectral lines in series called _____.

a) sharp b) principle

c) diffuse d) fundamental

iv) The state of universe when all the matter in the universe is concentrated into a small region is called _____.

a) big bang b) nucleus

c) protostar d) ylem

v) If one or more pair of electrons are shared by two interacting atoms, it forms _____ bond between them.

a) ionic b) covalent

c) no d) both a and b

P.T.O.

vi) If the light has the finite velocity, more distant galaxy refers to _____ time.

a) later b) earlier

c) infinite d) none of these

vii) In case of rotational spectra, only the molecules which possess _____ can absorb or emit electromagnetic radiations.

a) moment of inertia b) electric dipole moment

c) angular momentum d) none of these

viii) If the coupling between *l** and *s** is not broken in an external magnetic field, then we observe _____.

a) normal zeeman effect b) anomalous zeeman effect

c) paschen back effect d) stark effect

Q2) **Attempt ANY TWO of the following:** **[16]**

a) What is normal Zeeman effect? Explain normal Zeeman effect with the help of vector atom model.

b) Explain Big-bang, oscillating and steady state theories of universe. Draw conclusion about most acceptable theory.

c) Get an expression for rotational energy levels of a diatomic molecule and hence discuss the pure rotational spectra.

Q3) **Attempt ANY FOUR of the following :** **[16]**

a) Obtain an expression for rotational energy level of a diatomic molecule.

b) What is Hubble law? Define Hubble constant. Explain how approximate age and range of universe can be estimated from Hubble constant.

c) Write a note on Raman effect. What are stokes and antistokes lines?

d) Explain the supernova explosion and formation of neutron star and finally the formation of a blackhole.

e) List the characteristic properties of Raman lines.

f) Why sun-spot regions are dark? Explain.

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Total No. of Pages : 3

B.Sc. (Part - III) (Semester - VI) (CBCS) Examination, March - 2023

PHYSICS (Paper - XVI)

Energy Studies and Materials Science

Sub. Code : 81671

Day and Date : Monday, 05 - 06 - 2023 **Total Marks : 40**

Time : 10.30 a.m. to 12.30 p.m.

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

Q1) **Choose correct alternative.** **[8]**

i) Which of the following is renewable energy source?

a) Nuclear b) Biogas

c) Coal d) Oil

ii) Wind farm is a site _____.

a) where wind flows heavily

b) used for agricultural work

c) where grinding mills operate on wind turbines

d) where number of wind turbine electrical generator units are installed in large area

iii) The solar spectrum comprises of _____ parts of the electromagnetic spectrum.

a) Only visible b) Only UV

c) UV, Visible and IR d) All

P.T.O.

iv) Clarity index has unit _____.

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

c) J/m^2 d) No unit

v) Algae in the presence of sunlight and organic waste forms _____.

a) Biomass b) Carbon dioxide

c) Methane d) Ethanol

vi) According to London's equation, the magnetic field inside superconductors varies as _____, where H_0 is the magnetic field at the surface of the superconductor and λ_L is the penetration depth.

a) $H(x) = H_0 e^{x/\lambda_L}$ b) $H(x) = H_0 e^{-x/\lambda_L}$

c) $H(x) = H_0 e^{\lambda_L/x}$ d) $H(x) = H_0 e^{-\lambda_L/x}$

vii) The nanoscience deals with the materials with at least one dimension measuring less than _____ nm.

a) 1 b) 10

c) 100 d) 1000

viii) A decrease in size of quantum dots results in _____.

a) decrease in band gap energy

b) increase in band gap energy

c) emission of longer wavelengths

d) no change in either band gap or emissions

Q2) **Attempt any two.** **[16]**

a) Prove that the maximum power of wind turbine is directly proportional to the cube of incoming wind velocity.

b) With the help of current versus voltage (I-V) curve explain power of photovoltaic cell. Elaborate the knee point. Find the power of the solar PV panel having 100 modules and 50 cells in each module. Given: Power of each solar cell is 0.2 W. Also find voltage output and current delivered by the panel if the load resistor used is 1000 Ω.

c) Explain with a neat diagram photolithographic method for the synthesis of nanomaterials.

Q3) **Attempt any four :** **[16]**

a) Write a note on classification of energy resources.

b) Define solar constant, clarity index and solar insolation.

c) Discuss in brief biomass energy resources i) biomass from cultivated crops ii) biomass from waste organic matter.

d) Explain in short Meissner effect.

e) What is isotope effect in superconductors? Explain it with few examples.

f) Write a note on quantum confinement.

▽▽▽▽

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Total No. of Pages : 3

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B.Sc. (Part - III) (Semester - VI) (CBCS) Examination, March - 2023

PHYSICS (Paper - XIII)
Nuclear and Particle Physics
Sub. Code : 81668

Day and Date : Thursday, 01 - 06 - 2023 **Total Marks : 40**

Time : 10.30 a.m. to 12.30 p.m.

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

Q1) **Select the correct alternative :** **[8]**

i) Betatron works on the principle of _____.
a) transformer
b) induction coil
c) phase stability
d) magnetic resonance

ii) Energy equivalent 1 a.m.u. is _____.
a) 931 MeV
b) 931 GeV
c) 931 KeV
d) 931 eV

iii) The field particle in electromagnetic forces is _____.
a) muon
b) pion
c) photon
d) positron

P.T.O.

iv) Nuclear _____ can be explained with the help of semi-empirical mass formula.

a) fission
b) fusion
c) both fission and fusion
d) formation

v) Nucleons are _____.

a) bosons
b) fermions
c) both bosons and fermions
d) neither bosons nor fermions

vi) As per betatron condition, the flux density at the centre should be _____.

a) maximum
b) minimum
c) zero
d) only one

vii) In case of _____ the particle track is made visible and can be photographed.

a) Scintillation detector
b) Cerenkov detector
c) Wilson cloud chamber
d) Semiconductor detector

viii) The total magnification produced by photo multiplier tube is of the order of _____.

a) 10^3
b) 10^6
c) 10^9
d) 10^{12}

Q2) **Attempt any two of the following :** **[16]**

a) Explain construction and working of a cyclotron. Derive an expression for kinetic energy attained by an ion.

b) Explain the construction of Geiger-Muller Counter. Explain how ionization, discharge and avalanche of electrons take place in the G.M. tube.

c) Give the classification of the fundamental particles.

Q3) **Attempt any four of the following :** **[16]**

a) Explain the Bohr-Wheeler liquid drop model of nucleus.

b) Define binding energy of nucleus. Explain characteristic nature of the curve.

c) Explain quark model.

d) Explain principle of phase stability.

e) Explain Scintillation detector and counter.

f) What is shape and size of nucleus?

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QP Code: 4108QP

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Total No. of Pages: 2

Summer Examination March - 2023

Subject Name: B.Sc. (CBCS)_79677_65802_79677_79924 - Physics Paper IX_01.06.2023_02.30 PM To 04.30 PM

Subject Code: 79677

Day and Date: - Thursday, 01-06-2023 **Total Marks: 40**

Time: - 02:30 pm to 04:30 pm

Instructions.:

1) All questions are compulsory
2) Use of log table and calculator is allowed
3) Use of Scientific calculator is allowed
4) Use of scientific calculator and logarithmic table is allowed

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Q.1. **Choose the correct alternative** **[8]**

1) The wave equation is of the form .....

a) $\frac{\partial^2 u}{\partial x^2} = \frac{1}{c^2}\frac{\partial u}{\partial t}$

b) $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$

c) $\frac{\partial^2 u}{\partial x^2} = \frac{1}{c^2}\frac{\partial^2 u}{\partial t^2}$

d) $\frac{\partial u}{\partial t} = k\frac{\partial^2 u}{\partial x^2}$

2) Which of the following is called Laplace equation?

a) $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = \frac{\partial u}{\partial t}$ **b)** $\frac{\partial^2 u}{\partial x^2} = C^2\frac{\partial u}{\partial t}$

c) $\frac{\partial^2 u}{\partial x^2} = \frac{\partial^2 u}{\partial y^2}$ **d)** $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$

3) The Bessel's equation $x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} + (x^2 - n^2)y = 0$ **has regular singularity at ..... point.**

a) x = -1 **b) x = 0** **c) x = 1** **d) x = n**

4) For the equation $x^2(x+1)^2\frac{d^2y}{dx^2} + (x^2-1)\frac{dy}{dx} + 2y = 0$**, the point x = 0 is ..... point.**

a) ordinary **b) regular singular** **c) irregular singular** **d) both a) and b)**

5) erf (x) + erfc(x) = ...

a) 1 **b) 2** **c) 0** **d) none of these**

6) The value of integral $\int_0^\infty e^{-x^2}dx$ **is .....**

a) □ **b)** $\frac{\sqrt{\pi}}{2}$ **c)** $\frac{\sqrt{\pi}}{2\sqrt{2}}$ **d) 1**

7) Which of the following function is not analytic?

a) $f(z) = z$ **b)** $f(z) = e^z$

c) $f(z) = x^2 + 2ixy$ **d)** $f(z) = z^2$

8) The exponential form of complex number 1 – i is .....

a) $\sqrt{2}e^{\frac{\pi}{4}i}$ **b)** $\sqrt{2}e^{\frac{\pi}{2}i}$ **c)** $\sqrt{2}e^{-\frac{\pi}{4}i}$ **d)** $\sqrt{2}e^{-\frac{\pi}{2}i}$

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

a) Explain form of two-dimensional Laplace equation in cartesian coordinates and its solution.

b) Define Gamma function and explain its properties.

c) Using Cauchy – Riemann condition, determine whether the following functions are analytic

i) $f(z) = e^y sinx + ie^x siny$

ii) $f(z) = z^3$

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

a) Define order and degree of partial differential equation.

b) Write a note on Analytic function.

c) State and prove De'Moiver's theorem

d) Explain the types of the complex numbers.

e) Find values of log (-1-i)

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Total No. of Pages : 2

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B.Sc. (Part-III) (Semester-VI) (CBCS) Examination, March - 2023
PHYSICS
DSE-F2 : SOLID STATE PHYSICS (Paper-XIV)
Sub. Code : 81669

Day and Date : Friday, 02-06-2023 **Total Marks : 40**

Time : 10.30 a.m. to 12.30 p.m.

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

Q1) Select most correct alternative for the following. **[8]**

a) The coordination number for simple cubic crystal structure is _____

i) 6 ii) 8

iii) 12 iv) 18

b) The packing fraction of hcp crystal is _____

i) 0.74 ii) 0.68

iii) 0.52 iv) 1

c) X-rays consist of _____

i) Negatively charged particles ii) Electromagnetic radiations

iii) Positively charged particles iv) Stream of neutrons

d) Reciprocal lattice to BCC lattice is _____ lattice.

i) SC ii) BCC

iii) FCC iv) HCP

P.T.O.

e) Energy loss during hysteresis is the area of _____ loop.

i) X–*T* ii) *M*–*B*

iii) *B*–*H* iv) X–*H*

f) The paramagnetic susceptibility decreases with_____

i) Decreasing temperature ii) Increasing temperature

iii) Constant temperature iv) Increasing length of material

g) In Kronig-penny model, period of one dimensional periodic potential is _____

i) a/b ii) a+b

iii) a–b iv) a.b

h) Band gap energy of silicon is _____ eV.

i) 1.12 ii) 0.72

iii) 0.65 iv) 0.56

Q2) Attempt any two of the following. **[16]**

a) Derive an expression for inter planer spacing for planes having miller indices (h k *l*) in case of cubic crystal structure.

b) Describe powder method of X-ray diffraction.

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

Q3) Attempt any four of the following. **[16]**

a) Explain BCC crystal structure.

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

c) Derive Curie Weiss law.

d) What is retaintivity and coercivity?

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

f) Explain variation of effective mass of an electron with a wave vector.

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Total No. of Pages : 2

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B.Sc.(Part-III) (Semester-VI) (CBCS) Examination, March - 2023

ENGLISH (Compulsory) (Paper - IV)
English for Communication
Sub. Code : 81667

Day and Date : Tuesday, 06 - 06 - 2023 **Total Marks : 40**

Time : 10.30 a.m. to 12.30 p.m.

Instructions : 1) All questions are compulsory.

2) Figures to the right indicate full marks.

***Q1) A)* Choose the appropriate answer and complete the following sentences: [3]**

i) Buffalo bill charges the Indians_____buck a head to enter.

a) 5

b) 12

c) 20

d) 7

ii) The earth and _____continue to rise up.

a) Tree

b) Stone

c) Women

d) Grass

iii) _____asks Govind Singh to go to the x-ray institute.

a) The general manager

b) The accountant

c) An ex-compounder

d) His wife

***B)* Answer the following questions in one word\phrase\sentence each: [3]**

i) What did Barr.P.G.Patil think when he saw the Blackburns?

ii) Where was Lachmi at the beginning of the story?

iii) What could Granny's piercing eyes reach straight?

P.T.O.

Q2) A) **Answer the following questions in three to four sentences each (2 out of 3)** **[4]**

i) Where did Barrister P.G.Patil visit during his educational tour?

ii) What kind of mad things does Govind Singh do after he receives the letter?

iii) How was the absence of Granny felt by the poetess?

B) **Write a short note on the following in about 7-8 sentences. (Any One)** **[4]**

i) The absence of Granny in the bouse

ii) Sir Mohan Lal

C) Do as directed: **[2]**

i) Antonym of "Efficient".

ii) Synonym of "Solicitude".

Q3) A) Build up a short piece of Group Discussion on the following topics making use of expressions and interactions used in Group Discussion. **[8]**

i) Stay at home, stay safe.

OR

ii) Indian Television channels expose us to Indian ways of life

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]**

Q4) A) You happen to be the editor of and English newspaper published from Maharashtra. You are expected to write an editorial on death of a famous film/sports personality. **[8]**

OR

B) As a guest editor you are supposed to write an editorial on the floods in Maharashtra to an English newspaper published from state. Develop an outline of the editorial.