

2016

(6th Semester)

PHYSICS

TENTH PAPER

(Nuclear Physics—II)

Full Marks : 75

Time : 3 hours

(PART : B—DESCRIPTIVE)

(Marks : 50)

*The figures in the margin indicate full marks
for the questions*

1. What is quadrupole moment? Derive an expression for the electric quadrupole moment of a nucleus. Show that the smallest value of angular momentum (I), for which the quadrupole moment (Q) does not vanish, is one. 1+8+1=10
- Or*
- (a) Explain the terms packing fraction and mass defect. What is their difference? 3
- (b) What do you mean by semi-empirical mass formula? Explain its applications for determination of nuclear stability against α -decay. 2+3=5

- (c) Write a short note on volume energy of nucleus. 2

2. Explain in detail radioactive equilibrium. Obtain the conditions for transient equilibrium and secular equilibrium. 4+3+3=10

Or

- (a) Define (i) mean life, (ii) half-life, (iii) natural radioactivity and (iv) radio-isotopes. 4
- (b) What are different types of radioactive decay? Explain each type in brief. 6

3. (a) Explain nuclear fusion as the source of stellar energy. 4
- (b) Explain nuclear fission and nuclear fusion. Explain how the energy is released in these reactions. 6

Or

- (a) What do you mean by artificial transmutation? 1
- (b) What are the properties of neutron? Discuss the determination of mass of neutron according to Chadwick. 4+5=9

4. Explain the principle, construction and working of betatron. What is the advantage of betatron? 8+2=10

(3)

Or

- (a) Explain how photomultiplier tube is utilized in a scintillation counter. 4
- (b) Describe the construction and working of linear accelerator. 6
5. (a) Discuss extensive air shower of cosmic rays. Explain the mechanism of air shower production. 3+3=6
- (b) Write the origin of cosmic rays. What do you mean by soft component and hard component of cosmic rays? 2+2=4

Or

- (a) Write down the six universal conservation laws of elementary particles. 3
- (b) What do you mean by strangeness of elementary particles? Write the relation of baryon number (B), hypercharge (Y) and strangeness (S) of elementary particles. 2+1=3
- (c) What is quark? Discuss different quarks and their properties. 4

★★★

Subject Code : PHY/VI/10

Booklet No. **A**

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Date Stamp

To be filled in by the Candidate

DEGREE 6th Semester
(Arts / Science / Commerce /
.....) Exam., **2016**
Subject
Paper

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To be filled in by the Candidate

DEGREE 6th Semester
(Arts / Science / Commerce /
.....) Exam., **2016**

Roll No.

Regn. No.

Subject

Paper

Descriptive Type

Booklet No. B

INSTRUCTIONS TO CANDIDATES

- 1. The Booklet No. of this script should be quoted in the answer script meant for descriptive type questions and vice versa.**
- 2. This paper should be ANSWERED FIRST and submitted within 1 (one) Hour of the commencement of the Examination.**
- 3. While answering the questions of this booklet, any cutting, erasing, overwriting or furnishing more than one answer is prohibited. Any rough work, if required, should be done only on the main Answer Book. Instructions given in each question should be followed for answering that question only.**

*Signature of
Scrutiniser(s)*

*Signature of
Examiner(s)*

*Signature of
Invigilator(s)*

2 0 1 6
(6th Semester)

PHYSICS

TENTH PAPER

(Nuclear Physics—II)

(PART : A—OBJECTIVE)

(Marks : 25)

The figures in the margin indicate full marks for the questions

SECTION—A

(Marks : 10)

Put a Tick (✓) mark against the correct answer in the
brackets provided : 1×10=10

1. Binding energy increases linearly with the

- (a) mass number ()
- (b) atomic number ()
- (c) magnetic moment ()
- (d) charge ()

(2)

2. Odd nuclei are generally

- (a) lighter ()
- (b) heavier ()
- (c) less stable ()
- (d) more stable ()

3. The most penetrating ray is

- (a) alpha ray ()
- (b) beta ray ()
- (c) gamma ray ()
- (d) cathode ray ()

4. The SI unit of radioactivity is

- (a) becquerel ()
- (b) curie ()
- (c) roentgen ()
- (d) roentgen/second ()

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(3)

5. The size of the uranium in a nuclear reactor is called critical size when the multiplication factor

(a) $k < 0$ ()

(b) $k = 1$ ()

(c) $k > 1$ ()

(d) $k = 1$ ()

6. Neutrons having energies between 10 MeV–50 MeV are called

(a) very fast neutrons ()

(b) fast neutrons ()

(c) slow neutrons ()

(d) ultrahigh-energy neutrons ()

7. The type of ionization chamber which measures voltage pulses due to the entry of individual ionizing particles is

(a) integrating type ()

(b) pulse type ()

(c) spark chamber ()

(d) cloud chamber ()

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(4)

8. A device in which the frequency of the oscillator is matched with the revolution frequency of the electron is called

(a) cyclotron ()

(b) electron synchrotron ()

(c) linear accelerator ()

(d) proton synchrotron ()

9. The zenith angle distribution of cosmic rays in the East-West plane to magnetic equator is

(a) symmetrical ()

(b) linear ()

(c) non-linear ()

(d) asymmetrical ()

10. Which of the following particles is a meson?

(a) Proton ()

(b) Neutron ()

(c) Electron ()

(d) Pion ()

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(5)

SECTION—B

(Marks : 15)

Answer the following questions :

3×5=15

1. Write a short note on nuclear stability with reference to neutron-proton ratio.

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(6)

2. Half-life of radon is 3.8 days. After how many days will 1/10 of a radon sample remain behind?

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(7)

3. Give the main assumptions of liquid-drop model of the nucleus.

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(8)

4. Describe briefly about the need for particle accelerator. Where do we have accelerators in India?

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(9)

5. What are hyperons? Write the strangeness of different types of hyperons.
