**2017**

( 6th Semester )

PHYSICS

TENTH PAPER

**( Nuclear Physics—II )**

( Pre-revised )

*Full Marks* : 75

*Time* : 3 hours

( PART : B—DESCRIPTIVE )

( *Marks* : 50 )

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

**1.** *(a)* Explain the terms—binding energy, mass defect and packing fraction of nuclei. 3

*(b)* How does the binding energy per nucleon for light, medium and heavy nuclei vary with mass number? 3

*(c)* How will you classify stable nuclei according to even and odd numbers of protons and neutrons? 4

*Or*

Obtain semiempirical mass formula of a nucleus. 10





**2.** *(a)* What is the cause of alpha decay? State and explain Geiger-Nuttal law in alpha decay. 2+4=6

*(b)* What are radioisotopes? Write the three uses of radioisotopes. 4

*Or*

Write down the origin of gamma rays. Describe one method of measurement of energy of gamma rays. 5+5=10

**3.** *(a)* Describe the liquid-drop model of the nucleus. Point out its limitations in understanding the nuclear phenomenon. 7

*(b)* What is nuclear fission? Write the importance of secondary neutrons in the reaction. 3

*Or*

How are neutrons classified according to their kinetic energy? Write an account of the discovery, production and properties of neutron. 2+8=10

**4.** Describe the construction and working principle of cyclotron. Obtain the expression for maximum kinetic energy. Write down some of its limitations. 10

*Or*

Explain the construction and working principle of GM counter. Write the applications and its limitations. 10

**5.** What do you understand by mesons? Characterize different kinds of mesons. Describe how muons and pions were discovered in cosmic rays. 10

*Or*

What are elementary particles? How are the elementary particles classified on the basis of their masses, interaction or statistics? 2+8=10

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**Subject Code : PHY/VI/10 (PR)**

**Booklet No. A**

Date Stamp .....

.....

**To be filled in by the Candidate**

DEGREE 6th Semester
(Arts / Science / Commerce / ..... ) Exam., **2017**

Subject .....

Paper .....

**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, over-writing 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.**

**To be filled in by the Candidate**

DEGREE 6th Semester
(Arts / Science / Commerce / ..... ) Exam., **2017**

Roll No. .....

Regn. No. .....

Subject .....

Paper .....

Descriptive Type

Booklet No. B .....

*Signature of Scrutiniser(s)*

*Signature of Examiner(s)*

*Signature of Invigilator(s)*

**/414**

**2 0 1 7**

( 6th Semester )

# PHYSICS

TENTH PAPER

**( Nuclear Physics—II )**

( Pre-revised )

( 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.** The difference in the mass of the resultant nucleus and the sum of the masses of two parent nuclear particles is known as

*(a)* mass defect ( )

*(b)* solid defect ( )

*(c)* weight defect ( )

*(d)* nucleus defect ( )

**2.** Bohr magneton is defined as

*(a)* B $\frac{eh^2}{4\ m_e}$ ( )

*(b)* B $\frac{eh}{4\ m_e}$ ( )

*(c)* B $\frac{4\ m_e}{eh}$ ( )

*(d)* B $\frac{4\ e}{hm_e}$ ( )

**3.** During fission of $U_1^{235}$, the number of neutrons released per fission is

*(a)* 1·5 ( )

*(b)* 2 ( )

*(c)* 2·5 ( )

*(d)* 3 ( )

**4.** Elements undergo radioactive decay when proton number becomes greater than

*(a)* 50 ( )

*(b)* 40 ( )

*(c)* 83 ( )

*(d)* 73 ( )

**5.** Gamma radiation is emitted in order to

*(a)* excite atom ( )

*(b)* release excess energy from the atom ( )

*(c)* destabilize atom ( )

*(d)* stabilize atom ( )

**6.** Nuclear fusion releases energy when

*(a)* uranium splits into two fragments ( )

*(b)* uranium emits a neutron ( )

*(c)* heavy ions fuse together ( )

*(d)* very light nuclei fuse together ( )

**7.** In proportional counter, if the radius of the wire (anode) be $a$ and that of the counter (cathode) be $b$, then the radial field $E$ at a distance $r$ is given by

*(a)* $E \quad \frac{Vr}{\log_e(b / a)}$ ( )

*(b)* $E \quad \frac{r}{V \log_e(b / a)}$ ( )

*(c)* $E \quad \frac{V^2}{r^2 \log_e(b / a)}$ ( )

*(d)* $E \quad \frac{V}{r \log_e(b / a)}$ ( )

**8.** In case of cyclotron, the frequency of oscillator is given by

*(a)* $f \quad \frac{B^2 e^2}{2\ m}$ ( )

*(b)* $f \quad \frac{Be}{4\ m^2}$ ( )

*(c)* $f \quad \frac{Be}{2\ m}$ ( )

*(d)* $f \quad \frac{2\ m}{Be}$ ( )

**9.** Positron was discovered by C. D. Anderson in

*(a)* 1932 ( )

*(b)* 1832 ( )

*(c)* 1923 ( )

*(d)* 1823 ( )

**10.** The mean life of decay of muons is about

*(a)* 20 s ( )

*(b)* 2 s ( )

*(c)* 200 s ( )

*(d)* 2000 s ( )

## SECTION—B

( *Marks* : 15 )

Answer the following questions : 3×5=15

**1.** Explain the proton-electron hypothesis and proton-neutron hypothesis of nuclear composition.

**2.** What is the difference between -decay and *K*-capture?

**3.** What is radioactive series? Name the three naturally occurring radioactive series.

**4.** Explain the principal action of a scintillation counter.

**5.** Give an account of the discovery of the positron.

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