

This question paper contains 4+2 printed pages]

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B.Sc. (Part III) Examination, 2022

PHYSICS

(भौतिक विज्ञान)

Paper-II

(Nuclear Physics)

नाभिकीय भौतिकी

Time Allowed : Three Hours

Maximum Marks : 50

This question paper contains three sections as under :

Section-A खण्ड 'अ' **Max. Marks-5**

This section contains one compulsory question with 10 short questions, having 2 short questions from each unit, short answer in 20 words for each short question. All questions carry equal marks.

इस खण्ड में एक अनिवार्य प्रश्न है जिसमें प्रत्येक इकाई से 2 लघु प्रश्न लेते हुये कुल 10 लघु प्रश्न होंगे। प्रत्येक लघु प्रश्न का उत्तर 20 शब्दों से अधिक में न हो। सभी प्रश्नों के अंक समान हैं।

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Section-B खण्ड 'ब' **Max. Marks-25**

This section contains 10 questions having 2 questions from each unit. Answer 5 questions (250 words each) selecting one question from each unit. All questions carry equal marks.

इस खण्ड में प्रत्येक इकाई से 2 प्रश्न लेते हुये कुल 10 प्रश्न हैं। प्रत्येक इकाई से एक प्रश्न का चयन करते हुये कुल 5 प्रश्नों के उत्तर देने हैं। प्रत्येक प्रश्न का उत्तर 250 शब्दों से अधिक में न हो। सभी प्रश्नों के अंक समान हैं।

Section-C खण्ड 'स' **Max. Marks-20**

This section contains 4 descriptive type questions (questions may have sub-divisions) covering all units but not more than one question from each unit. Answer any two questions (500 words each). All questions carry equal marks.

इस खण्ड में 4 प्रश्न वर्णनात्मक होंगे (प्रश्नों के उपभाग भी हो सकते हैं) जो सभी इकाइयों में से दिये जायेंगे, किन्तु एक इकाई से एक से अधिक प्रश्न नहीं होगा। किन्हीं दो प्रश्नों के उत्तर दिये जाने हैं। प्रत्येक प्रश्न का उत्तर 500 शब्दों से अधिक न हो। सभी प्रश्नों के अंक समान हैं।

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1. (i) Define packing fraction.
- (ii) What do you understand by parity of nucleus ?
- (iii) Define nuclear fission.
- (iv) What are moderators ?
- (v) Name *two* Leptons.
- (vi) Write the names of four fundamental interactions.
- (vii) What are accelerators ?
- (viii) Why can neutrons not be accelerated by cyclotron ?
- (ix) What is ionization ?
- (x) Write the voltage range for operation of proportional chamber.

UNIT-I

2. How is Binding energy per nucleon related with atomic mass number ? Explain. 5
3. Write semi-empirical mass formula and explain each of its term. 5

UNIT-II

4. Explain the process of spontaneous fission on the basis of potential barrier. 5
5. A nuclear reactor produces energy at a rate of 3.2×10^4 KW. How many nuclei per second of U^{235} will take part in fission. What amount of Uranium will consume in 1000 hrs, if 200 MeV energy produced by per fission.

UNIT-III

6. What do you understand by plasma instabilities ?

7. Using conservation laws, identify the forbidden and allowed interactions :

(i) $\Sigma^+ + n \rightarrow \Sigma^- + p$

(ii) $\pi^+ + n \rightarrow k^+ + \Sigma^0$

(iii) $k^- \rightarrow \pi^- + \pi^0$

(iv) $\mu^+ \rightarrow e^+ + \bar{\nu} + \tau$

(v) $\pi^+ + n \rightarrow \pi^- + p$.

UNIT-IV

8. Write the difference between cyclotron and synchrotron. 5
9. What radius is needed in Proton Synchrotron to obtain particle of energy 10 GeV, assuming that a guide field of 2.0 Tesla is available. 5

UNIT-V

10. What is the significance of plateau region in GM counter ? 5
11. 20 α -particles of energy 3 MeV each enters in an ionization chamber per second. If the energy required to produce an ion pair is 35 eV, then calculate the ionization current. 5

Section C

12. Discuss the liquid drop model of nucleus. 10
13. What do you understand by electrical quadrupole moment of nucleus ? Deduce its formula. 10
14. Explain the principle and working of betatron. Derive betatron condition.
15. Explain the principle and working of proportional counter in detail. 10

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