



(Following Paper ID and Roll No. to be filled in your Answer Book)

**PAPER ID : 199436**

Roll No.

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## B. Tech.

(SEM. IV) THEORY EXAMINATION, 2014-15  
NUCLEAR SCIENCE

Time : 3 Hours]

[Total Marks : 100

1 Attempt any four parts from the followings :  $5 \times 4 = 20$

- (a) What do you understand by parity of nucleus ?  
(b) Define binding energy. Calculate the binding

energy per nucleon in  ${}^1_6C$

Given : Mass of hydrogen atom ( $m_H$ ) = 1.007825 amu

Mass of neutron ( $m_n$ ) = 1.008665 amu

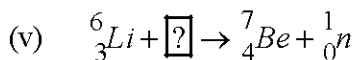
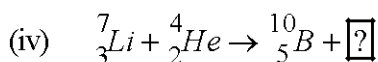
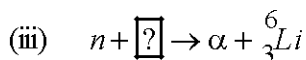
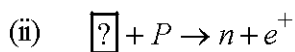
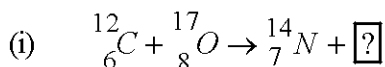
Mass of carbon atom ( ${}^{12}_6C$ )  $m = 12.00000$  amu

1 amu = 931 MeV

- (c) What do you mean by nuclear magnetic dipole moment ?  
(d) State the properties of the nuclear forces. Describe briefly Yukawa theory of nuclear forces.  
(e) Define quadrupole moment. What is the significance of existence of quadrupole moment of the nucleus ?

- 2 Attempt any two parts from the following :  $10 \times 2 = 20$
- Write down the semi-empirical mass formula and justify each term briefly.
  - State the main assumptions of the nuclear shell model. What are the experimental evidences which suggest this model ?
  - Discuss the main features of the collective model of the nucleus. How does this model help in understanding the phenomenon of nuclear fission.

- 3 Attempt any four parts from the following :  $5 \times 4 = 20$
- Define Q-value and threshold energy of a nuclear reaction.
  - What do you mean by nuclear reaction cross section ?
  - Complete the following reactions :



- (d) Describe any one nuclear reactor.
- (e) What is nuclear fusion ? What is its importance in the generation of nuclear fusion ?
- 4 Attempt any four parts from the following :  $5 \times 4 = 20$
- (a) The half life of radium is 1590 years. In how many years will 1 gram of pure element be reduced to one centigram ?
- (b) Define mean life and half life of a radioactive element. What is the relation between them ?
- (c) State Geiger-Nuttall law.
- (d) Explain neutrino hypothesis regarding  $\beta$ -decay.
- (e) Give the construction and working of Bainbridge mass spectrograph.
- 5 Attempt any two parts from the following :  $10 \times 2 = 20$
- (a) Discuss the construction and working of a cyclotron. What are its limitations ? Calculate the maximum energy given to an  $\alpha$  - particle by cyclotron.
- (b) What are the advantages of scientillation counter in comparison with other counters ?
- (c) What do you mean by radioactive tracers ? Explain their use in material science and agriculture.
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