Reg. No. : ....

Name : ....

**Third Semester M.A./M.Sc./M.Com. Degree (Reg./Supple./Imp.)
Examination, November 2016
PHYSICS
(2014 Admission Onwards)
PHY 3C12 : Nuclear and Particle Physics**

Time : 3 Hours

Max. Marks : 60

SECTION – A

Answer both questions (either **a** or **b**).

1. a) i) Discuss the shell model of the nucleus.

   ii) What is Solar fusion ? Explain the carbon-nitrogen cycle.

   OR

   b) What is meant by β-decay ? Describe the Fermi theory of β-decay.

2. a) i) What is binding energy ? Draw the binding energy per nucleon versus mass number curve and explain its features.

   ii) Explain deuteron binding energy. Mention its importance.

   OR

   b) Discuss the eight fold way and illustrate it in the case of Baryon and Meson octets. (2×12=24)

SECTION – B

1 mark for part **(a)**, 3 marks for part **(b)**, 5 marks for part **(c)**. Answer **any four**.

3. a) What is meant by mirror nuclei ? Give two examples.

   b) Define Q-value of a nuclear reaction.

   c) Give an account of electric quadrupole moment.

P.T.O.

4. a) Give the evidence supporting the quark model.

   b) Write a short note on liquid drop model.

   c) What is the distance of closest approach of a 2MeV proton to a gold nucleus ? How does this distance compare with those for a deuteron and an α-particle of the same energy ?

5. a) "Nuclear forces are charge independent". Comment.

   b) What are the different modes of beta radio activity ?

   c) Explain the square well potential of deuteron.

6. a) What is meant by internal conversion ?

   b) State different conservation laws in nuclear reactions.

   c) Find the energy release, if two $_1H^2$ nuclei can fuse together to form $_2He^4$ nucleus. The binding energy per nucleon of H^2 and He^4 is 1. 1 MeV and 7.0 MeV respectively.

7. a) What is meant by radiative capture ?

   b) What is meant by threshold energy of an endoergic reaction ?

   c) Estimate the energy released when two deuteron nuclei fuse together to form helium nucleus, given that binding energies per nucleon of H^2 and He^4 are 1.1 and 7 MeV respectively.

8. a) Give an account of quantum chromo dynamics.

   b) Define flavor, charm and colour.

   c) Which of the following reactions are allowed and forbidden under the conservation of strangeness, conservation of baryon number and conservation of charge.

   i) $\pi^+ + n \rightarrow K^0 + K^+$

   ii) $\pi^+ + p \rightarrow \pi^0 + \Lambda^0$

(4×9=36)