15U608 (Pages: 3) Name: ……..…….

Reg. No……..……

SIXTH SEMESTER B.Sc. DEGREE EXAMINATION, MARCH 2018

(CUCBCSS - UG)

CC15U PH6 B12 - NUCLEAR PHYSICS, PARTICLE PHYSICS AND ASTROPHYSICS

Physics - Core Course

(2015 Admission)

Time: Three Hours Maximum: 80 Marks

Section A

Answer ***all*** questions. Each question carries 1 mark.

Choose the correct option:

1. 1 a.m.u. is nearly equal to ……. (1.6×10^{-19} C, mass of one C-nucleus, 940 MeV, 6.02×10^{23})
2. The machine used to accelerate electron. (Cyclotron, LINAC, Betatron, Bubble chamber)

Answer in a word or sentence:

3. What is the major content of primary cosmic rays?
4. What is the antiparticle of proton?
5. What is vernal equinox?
6. Name the two third generation quarks.
7. What is the charge of antineutrino?
8. Expand L.H.C. in connection with the determination of Higg's Boson.

State true or false for the following three questions:

9. Since neutron is neutral (i.e. net charge = 0), its magnetic moment is zero.
10. Observable galaxies and radiations contribute major fraction to the density of universe.

(10 × 1 = 10 Marks)

Section B

Answer ***all*** the questions. Each question carries 2 marks.

11. What is N.M.R? Give its two applications.
12. What is the Q value of a nuclear reaction?
13. What is the principle of scintillation counters?
14. What is East-West asymmetry in cosmic rays?
15. Differentiate absolute and apparent magnitude.
16. What are gluons?

17. What is North Pole Sequence in the contest of magnitude of stars?

(7 × 2 = 14 Marks)

Section C

Answer any ***five*** questions**.** Each question carries 4 marks.

18. Describe nuclear fission and fusion with the help of Binding energy curve?
19. What is Carbon-Nitrogen cycle? What is the role of Carbon in these reactions?
20. Describe the principle of G.M counter.
21. What is Standard model? What are the basic building units of universe according to this model?
22. Describe the principle of LINAC.
23. Describe altazimuth system in celestial coordinates? What is its limitation?
24. Describe semi-emperical binding energy formula? **(5 × 4 = 20 Marks)**

Section D

Answer any ***four*** questions. Each question carries 4 marks

25. Estimate the approximate mass of Yukawa particles using uncertainty principle?
26. What is the probability that a particular nucleus of ^{38}Cl undergo betadecay in one second? The half life of ^{38}Cl is 37.2 minutes.
27. In the following reaction, show that the unknown particle 'x' is a chargeless fermion from the anti baryon family. Also show that it is not a strange particle.

$$\pi^+ + p \rightarrow p + p + x$$

28. What is the maximum kinetic energy attainable by a proton using a cyclotron with radius of 0.6m and frequency 15MHz? (Mass of proton is 1.67×10^{-27}kg and charge = 1.6×10^{-19}C).
29. If the mean radius of earth's orbit around the sun is nearly 3×10^{11}m, obtain the approximate numerical values of 1 A.U., 1 parsec and 1 light year.
30. Find the energy difference between the spin up and spin down states of a proton in a magnetic field of 1 tesla. What is the Larmour frequency of proton in this field? (Given: μ_{pz}= 2.793 Nuclear Bohr Magneton).
31. Evaluate the approximate total energy released if
    (a) 1 g of ^{235}U undergoes complete fission. (Energy released per fission is nearly 200MeV).
    (b) 1 g of Hydrogen undergoes complete fusion to form He.
    (Energy released per fusion is nearly 25 MeV).
    (Given: Avogadro number is nearly 6.02×10^{23}).

(4 × 4 = 16 Marks)

Section E

Answer any ***two*** questions. Each question carries 10 marks.

32. Explain nuclear properties using shell model.
33. (a) Explain the five basic types of nuclear transformations.
    (b) Explain also the issues faced while explaining beta decay and, also, how it was rectified by Pauli.
34. Describe the working of a Betatron. Also,
    (a) Draw a chart showing the classification of high energy particle.
    (b) Briefly describe the formation of Hadrons from quarks.
    (c) Draw a table showing the fundamental forces and the mediating particles.
35. Classify the elementary particles. Also explain various quantum numbers associated with elementary particles.

(2 × 10 = 20 Marks)

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