STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 600 086.
(For candidates admitted during the academic year 2008-09 & thereafter)

SUBJECT CODE : 11PH/MC/NP64

B.Sc. DEGREE EXAMINATION APRIL 2014
BRANCH III - PHYSICS
SIXTH SEMESTER

REG. No._____

COURSE : MAJOR – CORE
PAPER : NUCLEAR PHYSICS
TIME : 30 MINS. **MAX. MARKS : 30**

SECTION – A
TO BE ANSWERED IN THE QUESTION PAPER ITSELF

ANSWER ALL QUESTIONS:
I. CHOOSE THE CORRECT ANSWER:

1. The empirical formula for nuclear radius R is proportional to
   a. A b. A3 c. $A^{1/3}$ d. $A^{1/2}$

2. $_6C^{14}$, $_7N^{15}$ and $_8O^{16}$ are called
   a. Isotope b. isotone c. isobar d. isomer

3. Nuclear forces are effective when distance between nucleons is about
   a. 10^{15} m b. 10^{10} m c. 10^{-15} m d. 10^{-10} m

4. The radioactive constant of radium having half value period of 1590 years is…..
   a. 4.35×10^{-4} b. 4.35×10^{4} c. 2.3×10^{4} d. 2.3×10^{-4}

5. S.I unit of radiation dosage is
   a. Ray b. Gray c. radian d. poise

6. Proton turns into neutron by absorbing an….
   a. Positron b. neutrino c. antineutrino d. electron

7. Nuclear emulsion is affected by…
   a. Volume b. pressure c. size d. temperature

8. Synchrocyclotron can accelerate
   a. Electrons b. protons c. neutrons d. neutrino

9. In a synchrotron the radius of the orbit of a charged particle is kept constant by increasing.
   a. Magnetic field b. electric field c. speed d. temperature

10. The fission chain reaction will be critical if multiplication factor is
    a. < 1 b. > 1 c. $= 1$ d. 0

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11. Hydrogen bomb is a device which makes use of the principle of
    a. Controlled Nuclear fission b. uncontrolled nuclear fission
    c. nuclear fusion.

12. Uranium oxide is used as a fuel in
    a. A. FBR b. BWR c. FBTR d. PWR

13. Which of these is not a lepton?
    a. Electron b. photon c. neutrino d. meson

14. Interaction between leptons is
    a. Strong b. weak c. gravitational d. electromagnetic

15. Range of gravitational interaction is
    a. 1 b. 0 c. -1 d. infinity

II. FILL IN THE BLANKS:

16. Volume energy of a nucleus is ……..
17. An alpha particle is a helium atom that has ……..…… both its electrons.
18. The region of GM counter operation in which the counting rate is independent of small change in potential difference is called……..
19. Sun radiates ……..…….. J of energy per second.
20. Hyperons are ……..… particles.

III. STATE WHETHER TRUE OR FALSE:

21. A neutron emits a π meson and is converted into a proton.
22. Gamma rays are affected by electric and magnetic fields.
23. Proton synchrotron can produce protons of billion electron volt energy.
24. A nuclear fission reaction releases 200 MeV of energy.
25. The strangeness of u quark is zero.

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IV. ANSWER BRIEFLY:

26. What are magic numbers?

27. State Geiger - Nuttal law.

28. Give the principle of a Vandegraff generator.

29. What is meant by chain reaction?

30. Give the principle of NMR.

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TIME : 2 ½ HOURS **MAX. MARKS : 70**

SECTION – B

ANSWER ANY FIVE QUESTIONS: **(5X 5 = 25)**

1. Calculate the binding energy of an alpha particle and express your result in joule and MeV.

2. Calculate the weight in kg of one curie of Ra B (Pb^{214}) from the half- life of 26.8 minutes.

3. Deutron of mass 3.32 x 10^{-27} kg in a cyclotron describe a circle of radius 0.32 m when an electric field of 10 MHz is applied between the dees. Calculate the flux density of the magnetic field and the velocity of deuterons emerging out of the cyclotron.

4. Find the product nucleus. Determine the Q value and the type of the following reaction ${}_1H^1 + {}_9F^{19} = {}_2He^4 + X + Q$, given mass of $H = 1.007825$ amu mass of $F = 18.99405$ amu, mass of $He = 4.002603$ amu and mass of $X = 15.994915$ amu.

5. Discuss the C-N cycle and find the energy released.

6. A nuclear reactor develops energy at a rate of 3000 kW. Find the number of atoms of U^{235} undergoing fission per second? If the reactor is operated for 1000 hours and if on an average 200 MeV of energy is released per fission find the mass of U^{235} required.

7. Write short note on strange particles.

SECTION C

ANSWER ANY THREE QUESTIONS: **(3X15= 45)**

8. Explain shell model of the nucleus in detail.

9. Discuss Fermi neutrino theory of beta decay and internal conversion.

10. Explain the construction working of a GM counter with the help of characteristic curves.

11. a. Distinguish between controlled and uncontrolled chain reaction.
    b. Write short note on reactors in India.

12. Give the principle, experimental technique and application of NQR.