STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 600 086.
(For candidates admitted during the academic year 2011-12 & thereafter)

SUBJECT CODE : 11PH/MC/NP64

B.Sc. DEGREE EXAMINATION APRIL 2015
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. Among the following which is not a nucleon?
   a) Proton b) neutron c) electron d) meson

2. 1 amu. is equal to
   a) 931 eV b) 931 MeV c) 931 meV d) 931 μeV.

3. Nuclear forces are
   a) charge independent b) electrostatic
   c) force between proton and electron d) force between electron and positron

4. Due to the emission of an α particle from $_{92}U^{235}$,the mass number of the daughter nucleus is
   a) 235 b) 231 c) 88 d) 92

5. When a radioactive substance is heated its activity
   a) decreases b) unaffected c) increases d) doubles

6. γ- rays have the same nature as
   a) X-rays b) Cosmic rays c) α-rays d) β-rays

7. Avalanche effect is observed in
   a) ionization chamber b) linear accelerator
   c) Scintillation counter d) G. M counter

8. The inductive type accelerator is
   a) linear accelerator b) cyclotron c) Van de Graff generator d) Betatron

9. The nuclear emulsion technique is used as a particle
   a) detector b) counter c) accelerator d) amplifier

10. Atom bomb is based on the principle of
    a) nuclear emission b) nuclear fusion c) nuclear fission d) nuclear absorption

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11. If the Q value is positive then the nuclear reaction is
a) endothermic b) spontaneous c) nonspontaneous d) exothermic

12. The fourth state of matter is called
a) Quarks b) quanta c) Phonon d) Plasma

13. In NMR nucleus is considered as
a) tiny magnets b) charges c) liquid drop d) wave particle

14. Protons and particles heavier than protons are
a) Baryon b) hyperon c) meson d) lepton

15. The quadrupole moment is greater than zero then the shape of the nucleus is
a) Spherical b) prolate c) oblate d) elliptical

II. FILL IN THE BLANKS:

16. The nucleus is stable if it contains _____ number of nucleons.

17. β particles are identical with _____.

18. In linear accelarators high energy particles are produced by the principle of _____.

19. Reactor which produces its own fuel is called a _____.

20. The standard molecule used in NMR is _____.

III. STATE WHETHER TRUE OR FALSE:

21. Nuclear radius is proportional to cube of mass number.

22. Gamma rays are electromagnetic waves.

23. Synchrotron is a frequency modulated cyclotron.

24. Moderators in general are materials which absorb neutrons.

25. Strange quark is represented as‘s’

IV. ANSWER BRIEFLY:

26. What are nuclear forces?

27. What is the cause of natural radioactivity?

28. What is a particle accelerator?

29. Give any one use of radio isotopes in medicine.

30. Define the term chemical shift.

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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 and binding energy per nucleon in $_6C^{12}$. Given masses of neutron, proton, electron and $_6C^{12}$ atom are1.008amu, 1.007amu, 0.0005amu and 12 amu respectively.

2. Find the minimum energy required for an α-particle to initiate the following nuclear reaction

   $_7N^{14} + _2He^4 + 1.18$ MeV $\rightarrow {}_8O^{17} + {}_1H^1$

   Given : atomic mass of nitrogen – 14 = 14.003074 amu
   Atomic mass of helium -4 = 4.002604 amu

3. The half life periods of U^{238} and U^{235} are 4.5×10^9 years and 7×10^8years.The present relative wealth of natural uranium is 99.3 % and 0.7%. Estimate the age of the earth.

4. The half life of radon is 3.8 days After how many days 1/20 of sample of radon be left over?

5. In a linear accelerator, proton accelerated thrice by a potential of 40 kV leaves a tube and enters and accelerating space of length 30 cm before entering the next tube. Calculate the frequency of the r.f. voltage and the length of the tube entered by the proton.

6. Explain nuclear fusion and fission reaction s with example.

7. Explain particles and anti-particles? Give example.

SECTION C

ANSWER ANY THREE QUESTIONS: (3X15= 45)

8. Explain the liquid drop model of the nucleus and explain the semi – empirical mass formula.
9. Explain in detail the Fermi's theory of beta decay and K- electron capture with examples.
10. Describe with diagram the construction, working and the limitations of a cyclotron
11. Explain the working of a power reactor and mention its uses.
12. Explain NQR spectroscopy. Also mention its applications.

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