Reg. No. : ....

Name : ....

VI Semester B.Sc. Degree (CBCSS – OBE – Regular) Examination, April 2022
(2019 Admission)
CORE COURSE IN PHYSICS
6B12 PHY – Nuclear, Particle and Astrophysics

Time : 3 Hours

Max. Marks : 40

SECTION – A

Short Answer **six** questions. Answer **all** questions. **Each** carries 1 mark.　　　**6**

1. Define binding energy of a nucleus.

2. What is the unit of nuclear reaction cross section ?

3. Odd half integral spin particles are known as

4. Write the relationship between parallax and distance.

5. One parsec = _____ light year.

6. What are black holes ?

SECTION – B

Short answer eight questions. Answer **any six**. **Each** carries 2 marks.　　　**12**

7. Explain nuclear fission and nuclear fusion on the basis of binding energy per nucleon curve.

8. What is beta decay ? Write main features of beta decay.

9. Explain stellar fusion process.

10. Mention any four applications of nuclear physics.

11. Which are the four fundamental forces in nature ? Explain their role in the structure of the universe.

12. Explain baryon number conservation and lepton number conservation in particle interactions.

13. Define apparent magnitude and absolute magnitude.

14. What are pulsating stars ? Why do they pulsate ?

SECTION – C

Problem six questions. Answer **any four**. Each question carries **3 marks**.

12

15. Find the atomic mass of $_{10}Ne^{20}$ whose binding energy is 160.647MeV.

16. Find the activity of 1 mg of radon, ^{222}Rn, whose atomic mass is 222u (Given half life of radon = 3.8 days).

17. Compute Q value of the reaction $^2H +^{63}Cu -> n +^{64}Zn$.

18. Name the conservation laws that would be violated in each of the following decays.

   a) $\pi^+ -> e^+ + \gamma$

   b) $\lambda^0 -> p + K^-$

   c) $\lambda^0 -> n + \gamma$

19. Sirius is at a distance of 2.63 pc and has an apparent magnitude of –1.44. Find its absolute magnitude.

20. A star has a temperature of about 9200K. Its luminosity is about 23 times as that of the sun. Find its radius in terms of the radius of the sun. (Average temperature of sun = 5800K).

SECTION – D

Long essay four questions. Answer **any two**. Each question carries **5 marks**.

10

21. What do you mean by alpha decay of a radioactive nucleus ? Explain the quantum theory of alpha decay. Derive an expression for transmission probability.

22. What is induced fission ? Explain electrical power production using nuclear fission. Explain the parts of the nuclear fission reactor.

23. What are quarks ? Name the six quarks. Explain the quark model of mesons and baryons with examples. Briefly explain about quark confinement.

24. Describe various mechanisms possible in the death of stars.

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