C 3998 (Pages : 3) Name.....

Reg. No.....

FOURTH SEMESTER B.Sc. DEGREE EXAMINATION, APRIL 2016

(CUCBCSS–UG)

Complementary Course

PHY 4C 04—ELECTRICITY, MAGNETISM AND NUCLEAR PHYSICS

Time : Three Hours Maximum : 64 Marks

Section A (One word)

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

1. Two wires of equal lengths, one of copper and other of manganin have same resistance. The thicker wire is ————.
2. Trajectory of a charged particle in a uniform electric field is ————.
3. In a semiconductor detector the p-n junction is ———— biased.
4. Size of a nucleus is of the order of ————.
5. The exchange particle in the electromagnetic force is ————.
6. The magnetic substance when placed in a magnetic field moves from stronger part of the magnetic field to weaker part is called ———— substance.
7. Aluminum and manganese are ———— magnetic substances.
8. One a.m.u. = ———— MeV.
9. The particle responsible for carrying away the missing energy and momentum in a nuclear process is ————.
10. The first antiparticle found was ————.

(10 × 1 =10 marks)

Section B (Short answer questions)

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

11. State Coulomb's law in vector form and prove that, $F_{12} = -F_{21}$, where the letters have their usual meaning.
12. Deduce the expression for electric field at a distance r from a uniformly charged spherical shell. What information do you gather from the result ?
13. Why is manganin used for making standard resistors ? Give two reasons.

Turn over

14. A magnetic needle is placed on a cork floating in still lake in the northern hemisphere. Does needle together with cork move towards the north of the lake ?

15. Distinguish between Type I and Type II superconductors.

16. Draw a graph showing the variation of binding Energy per nucleon with mass number of diff nuclei. Mark the regions, where the nuclei are (i) prone to fusion ; (ii) prone to fission ; (iii) most stable.

17. What are Leptons ? Discuss the decay modes of Leptons.

(7 × 2 = 14 ma

Section C (Paragraph questions)

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

18. Derive the expression for the capacitance of a parallel plate capacitor with a dielectric medi dielectric constant K between its plates. Obtain also the expression for the energy stored in above case.

19. With the help of a neat diagram and necessary theory, explain how resistance a resistor ca determined using a potentiometer.

20. An alpha particle and a beta particle are entering normally into a strong magnetic field with e velocity. With necessary theory and equations explain the nature of the trajectories of these parti on entering the field.

21. Distinguish between nuclear fission and nuclear fusion. Give an equation for each process. Comm on the energy released in each case.

22. Discuss the quantum numbers involved in the classification of elementary particles.

(2 × 4 = 8 mar

Section D (Problems)

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

23. The electric potential V (x) in a region along x- axis varies with distance x (in meters) accordin relation $V(x) = 4x^2$. Calculate the force experienced by I μ C charge placed at a point $x = 1$ m.

24. At room temperature (27°C), the resistance of heating element is 100 Ω. What is the temperat of the element, if the resistance is found to be 117 Ω ? Given that the temperature coefficient the material of the resistor is $1.70 \times 10^{-4}\ C^{-1}$.

25. Two tangent galvanometers having equal radius of coils are connected in parallel to electric cell. The ratio of currents in the galvanometer is 1 : 2 and respective mean deflec are 30° and 45°. Compare the ratio of number of turns of tangent galvanometer.

26. After certain lapse of time, the fraction of radioactive polonium undecayed is found to be 12.5% of the initial quantity. What is the duration of this time if half life of uranium is 138 days ?

27. Calculate the (i) mass defect ; (ii) binding energy ; and (iii) binding energy per nucleon for ${}_6C^{12}$ nucleus. Nuclear mass of ${}_6C^{12}$ = 12.0000 a.m.u., mass of hydrogen nucleus = 1.007825 a.m.u. and mass of neutron 1.008665 a.m.u.

(3 × 4 = 12 marks)

Section E (Essays)

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

28. Explain the construction, theory and working of a Tangent Galvanometer. How is it used for the measurement of current ?

29. With a neat diagram and necessary theory describe the working of a cyclotron accelerator. Obtain the expression for kinetic energy of the accelerated ion and explain how it can be improved. Also discuss the limitations

30. (a) In the realm of elementary particles discuss the conservation laws related to symmetry operations.

    (b) Classify various types of quarks and list their properties. Write the quark structures of proton and neutron.

(2 × 10 = 20 marks)