Government of Karnataka

Forest Department

Recruitment examination (main) for Range Forest Officer training 2007

07th November 2007 (2.30pm to 5.30 pm)

Optional paper: PHYSICS

Max. marks: 100   Time : 3 hours

All sections are compulsory.

Note: Notations/terms used shall have their usual meaning. If any data is considered insufficient assume suitable value and indicate the same clearly.   Log table will be provided, if needed.

<div align="center">Part A</div>   (1 mark each)

A.   Choose one correct answer

    1. The principle of LASER action involves -
        a. Stimulated emission
        b. Population inversion
        c. Simplification of particular frequency emitted by the system
        d. All of these

    2. A proton is -
        a. A lepton
        b. A Nucleon
        c. Graviton
        d. Hadron

    3. A particle on earth's surface is given a velocity equal to its escape velocity. Its total mechanical energy will be -
        a. Negative
        b. Positive
        c. Zero
        d. Infinite

    4. In a spring block system length of the spring is reduced by 1%. The time period will -
        a. increase by 2%
        b. increase by 0.5%
        c. decrease by 2%
        d. decrease by 0.5%

5. In a given process of an ideal gas, dW = 0 and dQ < 0. Then for the gas -
   a) the temperature will decrease
   c) the pressure will remain constant
   b) the volume will increase
   d) the temperature will increase

B. Fill in the blanks

6. Generation of energy in the stars is mainly due to _____ of _____nuclei.

7. Conductivity of a material is reciprocal of its _____.

8. In a rolling sphere anticlockwise _____ causes decrease in _____ velocity.

9. The equation y = 4+2 sin (6t – 3x) represents a wave motion with amplitude _____ units.

10. In n-type silicon, _____ minority carriers.

C. State True of False

11. If a process occurs in a closed system, the entropy of the system increases for reversible process.

12. The number moles contained in a sample of any substance is equal to ratio of the number of molecules in the sample to the Avagadro's number.

13. In series LCR circuit at resonant frequency current amplitude is minimum.

14. If the kinetic energy of a body is directly proportional to time, then the force on body is inversely proportional to the speed of the body.

15. A ray of unpolarised light on passing through the Nicol prism becomes plane polarized.

D. Answer in one sentence / word

16. What are 'Fraunhofer lines'?

17. Write the logic symbol of NAND gate.

18. Name the theories of light in support of its wave nature.

19. Write the expression for the capacitance of a spherical capacitor.

20. What is Hall Effect?

Part B (4 marks each)

Answer any five of the following.

21. What are matter waves? How does de Broglie wavelength of an electron change if its velocity increases?

22. State the postulates of Special theory of relativity.

23. Explain Bragg's law.

24. Explain Stefan's law.

25. Calculate the potential energy of an electric dipole placed in a uniform electric field.

26. State and explain Gauss' theorem.

27.Explain Maxwell's equations.

28. Total energy of a particle is exactly twice of its rest mass energy. Find its speed.

Part C   (12 marks each)

Answer any **five** of the following.

29.   (i) State the law of radioactive disintegration. Obtain an expression for the number of
         radioactive atoms remaining after time t seconds.
        (ii) The half life of a radioactive nuclide is 20 hrs. What fractions of original activity will
         remain after 40 hrs.?

30.   (i) Obtain the resonant frequency of a series LCR circuit with L=2H, C= 32 µF and
          R=10 Ω. What is the Q value of this circuit?
        (ii) Why is a choke coil needed in the use of fluorescent tubes with AC mains? Why can
          we not use an ordinary resistor instead of the choke coil?

31.   (i) Three particles of masses 1 kg, 2 kg and 3 kg are placed at the corners   A, B & C
          respectively of equilateral triangle ABC of edge 1m. Locate the centre of mass of the
          system.
        (ii) Discuss the theory of interference from thin films.

32.   (i) Explain weightlessness in a satellite
        (ii) Find the amount of work done to move a satellite of mass 100 kg from temporary
          orbit at 800 km above earth's surface to permanent orbit at 2000 km above earth's
          surface.   (Radius of earth is 6400 km.)

33.   Describe with relevant theory Stern-Gerlach experiment. What is the significance of the
         results of this experiment.

34.   (i) Obtain an expression for the de Broglie wavelength of matter waves.
        (ii)The position and momentum of 2 keV electron are simultaneously determined. If its
          position is located within 0.5nm, what is the percentage uncertainty in its
          momentum.($h = 6.625 \times 10^{-34}$ J-S, $e = 1.6 \times 10^{-19}$C, $m_e = 9.1 \times 10^{-31}$kg.)

35.   (i) Obtain an expression for the Lorentz contraction of a moving rod.
        (ii) Define proper time and explain the concept of time dilation.