

MIZORAM PUBLIC SERVICE COMMISSION

GENERAL COMPETITIVE EXAMINATIONS FOR RECRUITMENT TO THE POST OF JUNIOR GRADE OF MIZORAM FOREST SERVICE i.e. ASSISTANT CONSERVATION OF FOREST (ACF) UNDER ENVIRONMENT, FOREST & CLIMATE CHANGE DEPARTMENT, GOVERNMENT OF MIZORAM, 2018

PHYSICS

Time Allowed : 3 hours

Full Marks : 100

The figures in the margin indicate full marks for the questions.

Answer any 10 (ten) questions taking 5 (five) questions from each section.

SECTION - A

1. Define Coriolis force and derive an expression for it. Through suitable examples, explain the way this force varies in different parts of the earth's surface and for different velocities of the concerned particles. (10)
2. Describe Michelson-Morley experiment and discuss its significance. (10)
3. (a) A double slit arrangement produces an interference pattern of fringewidth 0.4 mm at a distance 1 m from the plane of the slits, the wavelength of light used being 6000 \AA . Find the distance between the slits. If the whole arrangement is immersed in water (r.i. $4/3$) by how much must the distance between the slits be increased or decreased to have the same interference pattern? (5)
(b) Explain the principle of holography. (5)
4. Derive the potential and field due to an electric dipole. (10)
5. (a) State the distinction between conduction current and displacement current. (4)
(b) Show that the electric field \mathbf{E} and magnetic field \mathbf{B} in electromagnetic wave are perpendicular to each other and to the direction of propagation. (6)
6. (a) Classify the basic difference in the formulation point of view of Wien's law, Rayleigh-Jeans law and Planck's law of black body radiation. (5)
(b) Write a short essay on neutron stars. (5)
7. (a) State and derive Poynting's theorem. Discuss the physical significance of each term in the resulting equation. (1+3+1=5)
(b) What is gauge transformation? Explain Lorentz and Coulomb gauges. (1+4=5)

SECTION - B

8. (a) Show that the de-Broglie wavelength of a particle of rest mass m_0 and kinetic energy K is given

$$\text{by } \lambda = \frac{hc}{\sqrt{K(K + 2m_0c^2)}}. \quad (5)$$

- (b) Establish the Uncertainty relation $\Delta E \Delta t \geq \hbar/2$. (5)

9. Prove the identities $[J_x^2, J_y^2] = [J_y^2, J_z^2] = [J_z^2, J_x^2]$ where the brackets represent commutators. (10)

10. What do you mean by the term fine structure? Discuss the Sommerfeld relativistic variation of mass to account for fine structure components of H_∞ line of hydrogen spectrum. (10)

11. What are the mass parabolas? Describe the method of analyzing the beta ray energies in nuclear transition from such parabolas. (3+7=10)

12. What are hadrons? Give the elementary theory of structure of hadrons on the basis of quark model. (2+8=10)

13. What is superconductivity? In what kinds of materials is it found to occur? Name some parameters which characterise a superconductor. Cite any two major uses if we succeed in making superconduction with T not far below the room temperature. (10)

14. Write the truth tables and circuit symbols of the following logic gates: (10)

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|---------|---------|
| (a) OR | (b) AND |
| (c) NOT | (d) NOR |
| (e) XOR | |

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