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End Semester Examination, December 2024
B.Sc. (H) Forensic Science – IIIrd Semester
Physics-III (BSFS209A)

Time: 2.5 hrs.

Max Marks: **50**

Note: **All Questions are compulsory.** Marks are indicated against each question.

PART-A

Q.1 Attempt any five questions:

- (a) Derive relationship between the focal length and radius of curvature of convex mirror. [CO-1] [L-1] **2**
- (b) Explain why white light disperses into a spectrum when passed through a prism. [CO-1] [L-2] **2**
- (c) What causes the formation of a rainbow? [CO-1] [L-1] **2**
- (d) How does Huygen's Principle help in understanding the refraction of light at the interface of two media? [CO-1] [L-3] **2**
- (e) How does the image formed by a concave mirror change when an object is moved from infinity to a position between the focus and the mirror? [CO-1] [L-1] **2**
- (f) What is meant by plane-polarized light, and how can it be achieved using a Polaroid filter? [CO-1] [L-1] **2**
- (g) Why does a rainbow appear in the sky as a circular arc and not as a straight line? [CO-1] [L-2] **2**
- 2x5**

PART-B

Q.2 What is the communication system? Draw and explain the block diagram of a communication system. Provide an example of how this system works in a real-world scenario. [CO-2] [L-2] **10**

OR

What is modulation? Discuss its need and different types of modulation techniques used in communication systems. [CO-2] [L-2] **10**

Q.3 (i) Based on Lorentz transformations derive an expression for length contraction and time dilation.
(ii) With what velocity should a rocket move so that every year spent on it corresponds to 4 years on earth? [CO-3] [L-3] **10**

OR

- i. What are Inertial and Non-Inertial frames of reference? Explain giving an example of each.
- ii. State the postulates of special theory of relativity.
- iii. A spaceship is moving at a speed of $0.9c$ relative to an observer on Earth. The proper length of the spaceship (its length in its rest frame) is 500 meters. Calculate the contracted length of the spaceship as observed from Earth.

[CO3] [L-3]

Q.4 Explain the Young's double-slit experiment and derive the expression for the fringe width. How can the experiment be used to determine the wavelength of light. Discuss the significance of this experiment in the study of wave optics. [CO-4] [L-2] **10**

OR

- (i) With the help of a ray diagram, explain the construction and working of Newtonian reflecting telescope.
- (ii) A telescope objective has a focal length of 100 cm. When the final image is formed at the least distance of distinct vision, the distance between the lenses is 105 cm. Calculate the focal length of the eyepiece and the magnifying power of telescope. [CO- 4] [L-2] **10**

Q.5 (i) Derive the mirror equation and explain the significance of the focal length in determining the position and nature of the image formed by a convex mirror.

(ii) If you sit in parked car, you glance in the rear-view mirror of radius of curvature 2 m and notice a jogger approaching. If the jogger is running at a speed of 5 m/s, how fast is the image of the jogger moving when the jogger is 40 m away. [CO-1] [L-3] **10**

OR

- (i) Explain how a rainbow is formed due to the refraction, internal reflection, and dispersion of light inside water droplets. Why does a rainbow appear as a circular arc?
- (ii) A prism has an apex angle $A=60^\circ$ and a refractive index $n=1.5$. Calculate the minimum angle of deviation for the prism. [CO- 1] [L-3] **10**