*Total number of printed pages–5*

**63 (FY)SEM–2/SEC2/PHYSEC1023**

**2024**

# PHYSICS

Paper : PHYSEC1023

***(Instrumentation Skills in Physics–II)***

*Full Marks : 40*

*Pass Marks : 16*

Time : Two hours

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

1. Choose the correct answer : 1×5=5

   *(a)* The critical angle for water of refractive index 1·35 is

   *(i)* 45°

   *(ii)* 48°

   *(iii)* 40°

   *(iv)* 50°

*Contd.*

(b) An experiment measures quantities $a$, $b$, $c$ and $X$ is calculated from the formula $X = ab^2/c^3$. What is the percentage error in $X$?

(i) $\frac{\Delta X}{X} = \frac{\Delta a}{a} + 2\frac{\Delta b}{b} + 3\frac{\Delta c}{c}$

(ii) $\frac{\Delta X}{X} = \frac{\Delta a}{a} + \frac{\Delta b}{b} + \frac{\Delta c}{c}$

(iii) $\frac{\Delta X}{X} = \frac{\Delta a}{a} + 2\frac{\Delta b}{b} - 3\frac{\Delta c}{c}$

(iv) $\frac{\Delta X}{X} = \frac{\Delta a}{a} - 2\Delta b/b + 3\Delta c/c$

(c) S.I. unit of solid angle is

(i) radian

(ii) steradian

(iii) degree

(iv) radian/$s^2$

(d) The lens formula for convex lens is

(i) $\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$



(ii) $\frac{1}{u} - \frac{1}{v} = \frac{1}{f}$

(iii) $\frac{1}{u} + \frac{1}{f} = \frac{1}{v}$

(iv) $\frac{1}{v} + \frac{1}{f} = \frac{1}{u}$

(e) The working principle of photodiode is based on

(i) Photoelectric effect

(ii) Compton effect

(iii) Stark effect

(iv) Raman effect

2. Answer the following questions ***(any five)***: 2×5=10

(a) The time period of oscillation of a simple pendulum in an experiment is recorded as 2·56 s, 2·62 s, 2·70 s and 2·45 s. Find the absolute error in each observation and the percentage error in the measurement of time period.

(b) What are the rules of image formation in geometrical optics ?

(c) What is dispersion ? Explain with *one* example.

(d) What are the common issues in instrument operation ?

(e) What are the applications of optics in metrology ?

(f) What is the meaning of traceability ? Mention its role.

(g) In an experiment of simple pendulum, a student measures length and time period as $l = 92{\cdot}95 \pm 0{\cdot}2$ and $t = 1{\cdot}936 \pm 0{\cdot}003$ s. Find the error in calculation of acceleration due to gravity $g$.

3. Answer the following questions ***(any three)*** : 5×3=15

(a) Write about interferometry and spectroscopy.

(b) Mention the similarities and differences among reflection, refraction and dispersion.

(c) Explain the different types of errors in measurement system.



(d) Explain the working principle of photodiode.

(e) Explain the safety consideration in instrumentation system.

4. Answer the following questions ***(any one)*** : 10×1=10

(a) (i) What is standard error ? Write the various steps to find standard error. 5

(ii) The height of five persons are 22·8, 23·1, 22·7, 22·6, 23·0 *cm* respectively. Find the standard error in the measurement of height. 5

(b) (i) Explain the working principle of fibre optics sensor with diagram. 5

(ii) Mention different troubleshooting techniques in instrument maintenance. 5