No. of Printed Pages : 3 **RPH–001**

Ph. D. (PHYSICS) (PHDPH)

Term-End Examination

June, 2026

RPH-001 : RESEARCH METHODOLOGY

Time : 2 Hours *Maximum Marks : 50*

Note : *(i) Answer any **five** questions.*

(ii) Symbols have their usual meanings.

(iii) You may use a calculator.

1. (a) Discuss the developments in mathematics in the Gupta period of Ancient India. 5

   (b) Discuss the causes which led to the development of modern science in Europe in the post-renaissance period. 5

2. (a) Discuss the impact of the freedom movement on the developments in science in pre-independence India. 5

(b) Discuss the scientific method and each of its operations. 5

3. (a) Elaborate the statement "The falsifiability criterion has to be inbuilt in a scientific theory". 5

(b) Explain the requirements for a question to be a scientific question. 5

4. (a) Explain the three patentability criteria with examples. 5

(b) What are trademarks ? Why trademark protection is important ? 5

5. (a) Describe the procedure to file a patent in India. 5

(b) What actions are to be taken in case of electrical shock in the laboratory ? 5

6. (a) Draw a circuit diagram and discuss a method to obtain mean value, variance and standard deviation of a resistor whose value needs to be determined. 5

(b) (i) What is the central limit theorem ? 1

(ii) Consider a sample distribution with a mean of 2, standard

deviation $\sigma = 0.75$ and size $n = 20$. Obtain the probability that the sample mean is beyond 2.3. Use table below for z values : 4

z	0.00	0.07	0.008	0.009
1.6	0.9452	0.9525	0.9535	0.9545
1.7	0.9552	0.9616	0.9625	0.9633
1.8	0.9641	0.9693	0.9699	0.9706

7. (a) Define propagation of error in the context of experimental measurements. Consider a quantity z which depends on measured variables x and y. If the measurements are subject to random error, show how the error propagates for (a) $z = x + y$, (b) $z = xy$. 5

(b) The observed values are O = [18, 22, 20, 25, 15] and the expected values are E = [20, 20, 20, 20, 20]. Determine the degree of freedom and χ^2. 5

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