

निरीक्षक, वैद्यमापनशास्त्र गट-ब मुख्य परीक्षा - २०२३
दि. ४ फेब्रुवारी, २०२४ पेपर - I



2023

S18

BOOKLET NO.

500576

**Legal Metrology
Paper – I**

Time Allowed : Three Hours

Maximum Marks : 200

Medium : English

Type of Paper : Conventional

Question Paper Specific Instructions

Please read each of the following instructions carefully before attempting questions :

1. There are **EIGHT** questions divided in two sections, out of which **FIVE** are to be attempted.
2. Questions no. 1 and 5 are compulsory. Out of the remaining questions, **THREE** are to be attempted choosing at least **ONE** question from each Sections.
3. The number of marks carried by a question/sub question is indicated against it.
4. Keep in mind the word limit indicated in the question if any.
5. Wherever option has been given, only the required number of responses in the serial order attempted shall be assessed. Unless struck off, attempt of a question shall be counted even if attempted partly. Excess responses shall not be assessed and shall be ignored.
6. Candidates are expected to answer all the sub-questions of a question together. If sub-question of a question is attempted elsewhere (after leaving a few page or after attempting another question) the later sub-question shall be overlooked.
7. Any page or portion of the page left blank in the Answer Booklet must be clearly struck off.
8. Unless otherwise mentioned, symbol and notation have their usual standard meanings. Assume suitable data, if necessary and indicate the same clearly.
9. Neat sketches may be drawn, wherever required.
10. The medium of answer should be mentioned on the answer book as claimed in the application and printed on admission card. The answers written in medium other than the authorized medium will not be assessed and no marks will be assigned to them.

Note – 1. Candidates will be allowed to use Scientific (Non-programmable type) calculators.

P.T.O.

SEAL



SECTION – A

- Q1.** Write short notes on **any five** of the following.
- (a) What is the difference between an AC bridge and a DC bridge? 8
 - (b) Describe in short 'piezoelectric effect' with block diagram. 8
 - (c) Explain in brief fundamental forces in nature. 8
 - (d) The surface area of a cylinder is $2\pi rh$. For a cylinder of height 5 cm and radius 1 cm, find the percentage error in the measurement of surface area with an instrument of least count 0.1 mm. 8
 - (e) What is the importance of statistics in analysing data? Write brief note on mean and standard deviation. 8
 - (f) Explain in short basic concepts of Algebra and basic concepts of Geometry. 8
 - (g) What are the main functions of the international organisation of legal metrology? 8
-
- Q2.**
- (a) Obtain the condition of balance in the basic circuit of a wheatstone bridge. Draw suitable circuit diagram. 15
 - (b) What is piezoelectric material and piezoelectric transducer? With neat circuit diagram explain the working of a piezoelectric oscillator to generate ultrasound. 15
 - (c) The initial velocity of an object is $\vec{u} = 5\hat{i} + 10\hat{j}$ m/s. Its constant acceleration is $\vec{a} = 2\hat{i} + 3\hat{j}$ m/s². Find the magnitude of final velocity and linear displacement of an object after 5 seconds. 10
-
- Q3.**
- (a) What is static characteristic of the instruments? Explain the factors affecting static characteristic. 15
 - (b) What are Lissajous Figures? What are their uses? Explain the use of cathode ray oscillograph for producing Lissajous Figures. 15
 - (c) What is trigonometry? Prove that $(\sin^4\theta - \cos^4\theta) \cdot \operatorname{Cosec}^2\theta = 2$. 10
-
- Q4.**
- (a) What is the role of International Bureau of Weights and Measures (BIPM)? Explain the terms :
 - i) Dealer
 - ii) Label
 - iii) Manufacturer
 - iv) Pre-packaged commodity
 - v) Packer, in relation to any weight and measure. 15
 - (b) What do you mean by variable inductance type transducer? Explain how displacement is measured with change in number of turns in inductive transducer. 15
 - (c) Draw basic Q-meter circuit diagram. Describe its working to measure quality factor of the circuit. 10



SECTION – B

Q5. Write short notes on **any five** of the following.

- (a) What is digital multimeter ? With neat labeling, draw block diagram of the digital multimeter. 8
- (b) Differentiate between active transducer and passive transducer. 8
- (c) Write principle and construction of pH measurement electrode. 8
- (d) What is standards of measurement ? Write in short internal standards of length, mass and time. 8
- (e) Define Doppler effect. State its applications in signal recording instruments. 8
- (f) The gravitational force between two bodies of masses M_1 and M_2 is 1N. If distance between them is doubled, what will be the gravitational force between them ? 8
- (g) What are main objectives of the National Physical Laboratory work ? 8

-
- Q6.** (a) What is transformer and its function in electrical device ? Describe the working of ideal transformer. 15
- (b) What is a strain gauge ? How does it work ? Describe working of bridge strain gauge circuit. 15
- (c) Explain how to determine viscosity of a liquid by Ostwald's viscometer. Obtain necessary formula. 10
-



- Q7.** (a) What do you mean by errors in physical measurements ? Explain with illustration random errors and systematic errors. How they minimise in measurements ? **15**
- (b) How is electricity and magnetism related ? Define electromagnetic waves. Briefly describe any three types of electromagnetic waves. **15**
- (c) Calculate the energy density and intensity of a wave of frequency 100 Hz, wavelength 32 cm and amplitude 0.1 cm when propagated in air of density $1.29 \times 10^{-3} \text{ gm/cm}^3$. **10**
-
- Q8.** (a) What is the gravitational potential energy ? Obtain an expression for gravitational potential energy of the system of object of mass m and earth of mass M . **15**
- (b) What is International Standards Organisation and its certification ? Describe how are ISO standards developed. **15**
- (c) What are the types of sound ? Write note on :
- i) Intensity of sound and
 - ii) Loudness of sound. **10**
-
- _____
-
-