
Written Test for the Recruitment of Technical Superintendents

Department of Physics, Indian Institute of Technology Bombay

(Admin-II/EXT101/2025, Job Ref. No. – 50873902)



Date: 01.07.2026

Total marks: 85

Time: 10:00 am to 1:00 pm

Application ID:

Signature of the Invigilator:

Application ID:

SECTION-1

Questions 1 to 10 carry 2 marks each

[-0.5 marks for each incorrectly marked answer]

CIRCLE THE ONLY CORRECT OPTION

USEFUL CONSTANTS ARE LISTED AT THE END OF THE PAPER

Q-1. Calculate the photon energy in eV for light having a wavelength of 400 nm in vacuum.

(A) 6.2 eV

(B) 1.6 eV

(C) 2.5 eV

(D) 3.1 eV

Answer:

Q-2. Two thin lenses are pressed tightly together such that their optic axes coincide. Under these circumstances which of the following statements is correct?

(A) The power (expressed in diopter) of the combination is equal to the sum of the powers of the individual lenses

(B) The power (expressed in diopter) of the combination is equal to the product of the powers of the individual lenses

(C) The focal length of the combination will be the sum of the focal lengths of the individual lenses

(D) The focal length combination is equal to the geometric mean of the focal lengths of the individual lenses

Answer:

Q-3. What is the common name of the type of cable shown in the picture below?



(A) UTP cable

(B) SMA cable

(C) Digital audio cable

(D) BNC cable

Answer:

Q-4. The time light takes to reach earth from the surface of the sun is closest to

- (A) 10 seconds
- (B) 8 minutes
- (C) 18 minutes
- (D) 53 seconds

Answer:

Q-5. Which of the following file-extension is commonly used for CAD (Computer assisted drawing) files?

- (A) .DWG and .DXF
- (B) .DOCX and .PPT
- (C) .DAT and .ASC
- (D) .JPG and .BMP

Answer:

Q-6. A mobile phone's battery is rated as 3.7 V, 3000 mA-hour. The energy stored in this battery, when fully charged is approximately

- (A) 40×10^3 Joule
- (B) 19×10^3 Joule
- (C) 8×10^3 Joule
- (D) 27×10^3 Joule

Answer:

Q-7. The instrument used for measuring air pressure is called?

- (A) Thermometer
- (B) Hygrometer
- (C) Barometer
- (D) Refractometer

Answer:

Q-8: At normal temperature, due to a puncture, the compressed air inside the tube of a car tire starts coming out. Then the air inside

- (A) Starts becoming cooler
- (B) Starts becoming hotter
- (C) Temperature does not change
- (D) Becomes cooler or hotter depending on the size of the tire

Answer:

Q-9. What happens to the orbital velocity of a satellite when the radius of orbit is decreased?

- (A) Orbital velocity increases
- (B) Orbital velocity decreases
- (C) Orbital velocity remains unchanged
- (D) Orbital velocity increases or decreases depending on the size of the satellite

Answer:

Q-10. Which process governs the flow of heat within a solid?

- (A) Heat does not flow
(C) Convection

- (B) Radiation
(D) Conduction

Answer:

Questions 11 to 15: 2 Marks each, no negative marking

Q-11. Correct the sentence "Though the Head of the Department solves the numerical problems during the lectures held last week, still the students perform very badly in the examination held today".

Correct Sentence: solves → solved
 perform → performed

Q-12: A student measures pressure of the same sample of a gas 5 times in atmospheres and obtains the readings as 24, 23, 22, 26, 25. Prepare a Table reporting these measurements and a final result to be reported with standard deviation.

data	average	$(x_i - \mu)^2$	$\sqrt{\frac{\sum (x_i - \mu)^2}{N}}$
24	$\mu = 24$	0	$\sqrt{\frac{10}{5}}$ $= \sqrt{2} = 1.414$
23		1	
22		4	
26		4	
25		1	

Q-13: What is the full form of CSIR-NPL and CSIR-NCL?

Council of Scientific and Industrial Research
National Physical Laboratory
National Chemical Laboratory

Q-14: Which fire extinguishers are suitable for extinguishing fire resulting from (i) electrical short-circuit, and (ii) gas

- i) CO_2 for electrical fire
- ii) Powder for gas fire

Question-15: What is cloud computing? Name any two cloud storage services.

Computation and data storage is not local but happens in a remote server connected through internet.

cloud service : Google, Microsoft

SECTION-2: Questions 1 to 10 carry 3 marks each [TOTAL 30 marks]

WRITE THE FINAL ANSWER ONLY IN THE SPACE PROVIDED.

NO NEGATIVE MARKING

1. Two sides of a triangle are 3 cm and 4 cm in length respectively. If the included angle between the two sides is 45° . Calculate the length of the third side, correct to one decimal place in cm.

ANSWER	2.83 cm
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2. A voltage signal varies with time as

$$V(t) = |\sin \pi t| \text{ for } 0 \leq t \leq 2$$

(The bars denote absolute value.) Calculate the average value of the signal over time, correct to one decimal place.

ANSWER	$\frac{2}{\pi} \approx 0.637$
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3. On a metric vernier calliper, 49 divisions on the main scale correspond to 50 divisions on the vernier scale. Determine the least count for this instrument. Give your answer correct to two decimal places.

ANSWER	0.02 mm
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4. A 9 Volt battery has an internal resistance of $r = 0.5 \Omega$. A resistance $R_L = 50 \Omega$ is connected across the output terminals of the battery. Calculate the voltage that will be measured across its output correct to two decimal places.

ANSWER	8.91 V
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5. What happens to the speed, wavelength and frequency of green colour light when it enters from air into a block of glass (refractive index 1.5)? Describe in one line.

ANSWER	Speed and wavelength decrease. Frequency remains same.
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6. What happens to the kinetic energy and linear momentum in a perfectly inelastic collision between two particles? Describe in one line.

ANSWER	Momentum conserved. K.E. not conserved.
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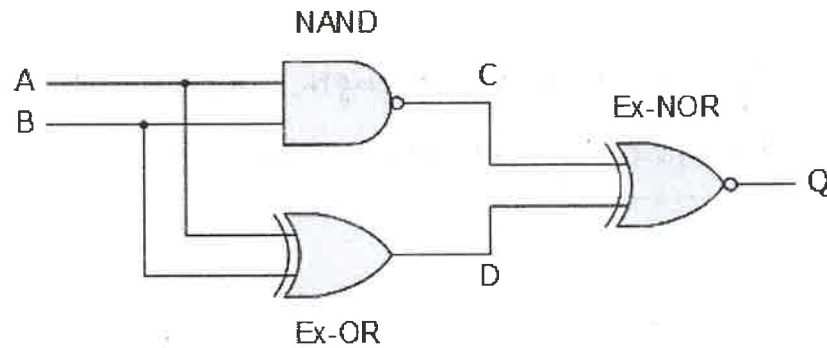
7. Determine the dimensions of mechanical work done in terms of MLTQ (mass, length, time, charge).

ANSWER	$M L^2 T^{-2}$
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8. What are the approximate percentages of Oxygen & Nitrogen in ambient air?

ANSWER	Oxygen $\approx 21\%$ Nitrogen $\approx 78\%$
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9. Construct the truth table of the digital circuit shown below.
(T denotes TRUE or 1 logical state & F denotes FALSE or 0 logical state)



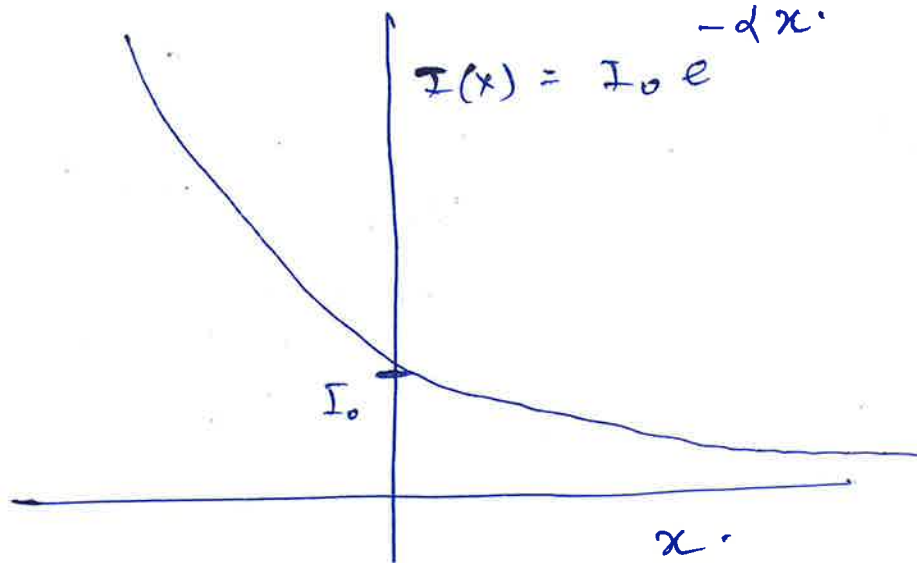
A	B	Q
T	T	T
T	F	T
F	T	T
F	F	F

10. The r.m.s. (root mean square) value of the single phase sinusoidal alternating voltage that we get in our a.c. mains is 230 Volts. Calculate the amplitude of this voltage.

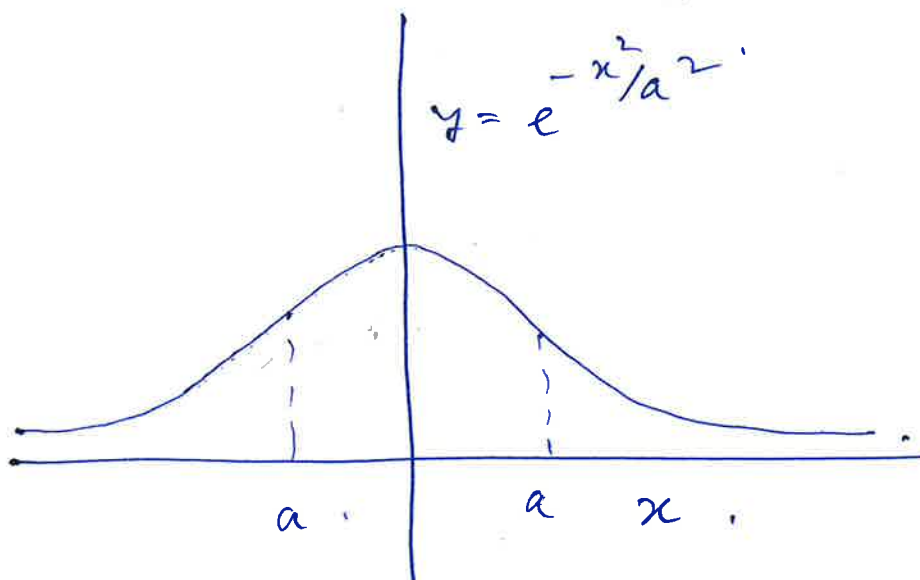
≈ 325 Volts

SECTION-3: Questions 1 to 5 carry 5 marks each [TOTAL 25 marks]
SHOW YOUR CALCULATION / PLOT / SKETCH IN THE SPACE PROVIDED.
NO NEGATIVE MARKING

1. Sketch the function $I(x) = I_0 e^{-\alpha x}$ for $\alpha > 0$

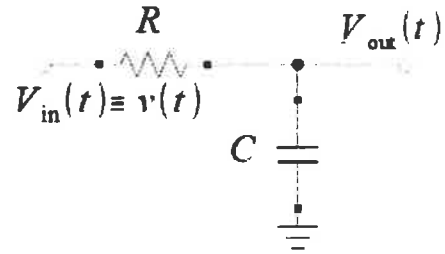


2. Sketch the function $y = e^{-\frac{x^2}{a^2}}$. What is the value of the function for $x = \pm a$?

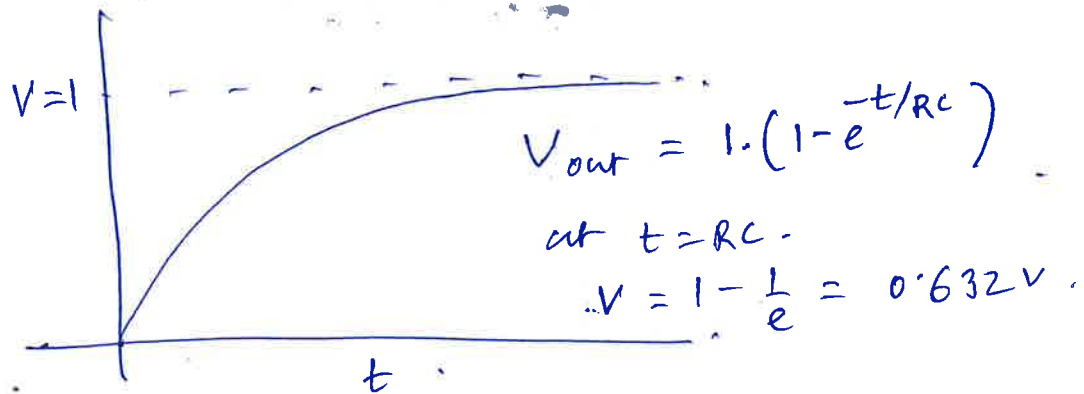


$$x = \pm a, \quad y = \frac{1}{e}$$

3. In the circuit shown, at time $t = 0$ the capacitor C has no charge. A constant input voltage $v(t) = 1 \text{ Volt}$ is then applied at the input terminal.



- Sketch the expected voltage at the output $V_{out}(t)$ as a function of time starting from $t = 0$.
- What will the output voltage at time $t = RC$?



4. Draw the standard circuit symbols for the following components:

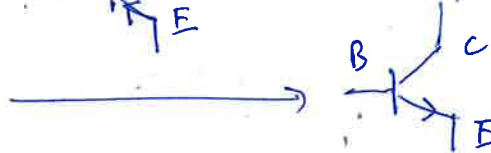
- a. Zener diode



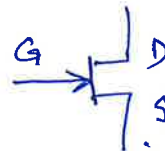
- b. PNP transistor



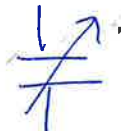
- c. NPN transistor



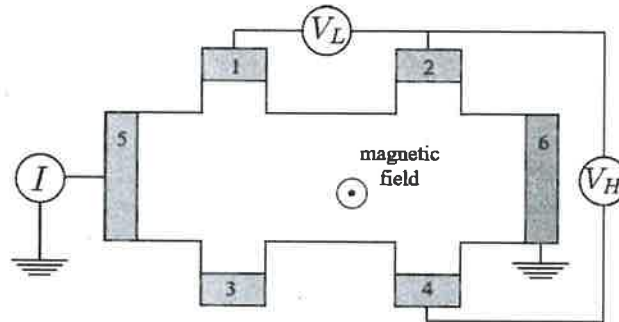
- d. N-channel Field effect transistor (FET)



- e. Variable capacitor



5. Consider the schematic of a Hall voltage sensor shown in the figure below. The current through the sensor is $I = 10 \text{ mA}$, the carrier density and thickness of the material used are $n = 2 \times 10^{22} \text{ m}^{-3}$ and $t = 1 \mu\text{m}$ respectively. Calculate the Hall voltage (V_H) that you expect when the sensor is subjected to the earth's magnetic field $B = 50 \mu\text{Tesla}$ perpendicular to the plane of the film.



$$\begin{aligned}
 V_H &= \frac{I B}{n e t} \\
 &= \frac{10 \cdot 10^{-3} \cdot 50 \cdot 10^{-6}}{2 \times 10^{22} \times 1.6 \times 10^{-19} \times 10^{-6}} \\
 &= \frac{500}{3.2} \times 10^{-6} \text{ volts} \approx 156 \mu\text{V}
 \end{aligned}$$

*****Paper Ends*****

Constant name	symbol	Value	Unit
Speed of Light in vacuum	c	2.99×10^8	m. s^{-1}
Elementary unit of charge	e	1.602×10^{-19}	Coulomb
Plank's constant	h	6.626×10^{-34}	Joule. sec^{-1}
Vacuum permeability	μ_0	$4\pi \times 10^{-7}$	Henry. m^{-1}
Vacuum permittivity	ϵ_0	8.85×10^{-12}	Farad. m^{-1}