Test Booklet No. _____

This booklet consists of 100 questions and __ printed pages.

RGUCET/2025/SL

Series A

RGUCET 2025
Common Entrance Test, 2025
MASTER OF SCIENCE IN PHYSICS

Full Marks: 100 **Time: 2 Hours**

Roll No. | | | | | | | | |

Day and Date of Examination: _____

Signature of Invigilator(s) _____

Signature of Candidate _____

General Instructions:

PLEASE READ ALL THE INSTRUCTIONS CAREFULLY BEFORE MAKING ANY ENTRY.

1. DO NOT OPEN THIS TEST BOOKLET UNTIL YOU ARE TOLD TO DO SO.
2. Candidate must write his/her Roll Number on the space provided.
3. This Test Booklet contains 100 Multiple Choice Questions (MCQs) from the concerned subject. Each question carries 1 mark. There shall be negative marking of 0.25 against each wrong attempt.
4. Please check the Test Booklet to verify that the total pages and total number of questions contained in the test booklet are the same as those printed on the top of the first page. Also check whether the questions are in sequential order or not.
5. Candidates are not permitted to enter into the examination hall after the commencement of the entrance test or leave the examination hall before completion of Examination.
6. Making any identification mark in the OMR Answer Sheet or writing Roll Number anywhere other than the specified places will lead to disqualification of the candidate.
7. Candidates shall maintain silence inside and outside the examination hall. If candidates are found violating the instructions mentioned herein or announced in the examination hall, they will be summarily disqualified from the entrance test.
8. In case of any dispute, the decision of the Entrance Test Committee shall be final and binding.
9. The OMR Answer Sheet consists of two copies, the Original copy and the Student's copy

1	Choose the correct indirect speech form of the sentence: He said, "I will come tomorrow."				He said he would come the next day
	a) He said he would come the next day.	b) He says he will come tomorrow.	c) He said he comes tomorrow.	d) He said he will come the next day.	a
2	Arrange the words to form a meaningful sentence: 1. always 2. early 3. to 4. gets 5. class				She bought a few apples.
	a) 5-1-2-4-3	b) 4-3-5-1-2	c) 4-1-2-3-5	d) 4-1-2-5-3	d
3	Choose the sentence that uses a quantifier correctly:				
	a) He has much friends.	b) She bought a few apples.	c) This is mine pen.	d) We don't have any sugar lefts.	b
4	Change into passive voice: They completed the project on time.				The project was completed on time by them.
	a) The project was completed on time by them.	b) The project completed on time.	c) The project was on time completed.	d) The project has been completed on time.	a
5	Choose the sentences with correct subject-verb agreement: A. The group of students are going on a trip. B. The bouquet of roses smell nice. C. Each of the players has a locker. D. Neither of the boys has done the work.				C & D
	a) A & B	b) C & D	c) A & D	d) B & D	b
6	Which country is the largest producer of coffee in the world?				Brazil
	a) Colombia	b) Vietnam	c) Brazil	d) Ethiopia	c)
7	Match the following sports with the countries from where they originated: A. Judo — 1.USA B. Baseball — 2.India C. Rugby — 3. Japan D. Chess — 4. England				A-3, B-1, C - 4, D - 2
	a) A-4, B-1, C - 3, D - 2	b) A-3, B-1, C - 4, D - 2	c) A-3, B-2, C - 1, D - 4	d) A-1, B-2, C - 3, D - 4	b)
8	Which of the following statements is **true**? A) Albert Einstein discovered the structure of DNA. B) Jonas Salk developed the polio vaccine. C) Rosalind Franklin contributed to the discovery of DNA's double helix structure. D) Galileo Galilei formulated the special theory of relativity.				B & C
	a) B & C	b) A & D	c) A & C	d) B & D	a)
9	Evaluate the Assertion (A) and Justification (J):				Both the assertion and

	A: The Beatles revolutionized rock music in the 1960s B: The band's experimentation with studio techniques, incorporation of diverse musical genres, and social influence helped shape the modern rock landscape.				reasoning are true, and the reasoning correctly explains the assertion.
	a) Both the assertion and reasoning are true, and the reasoning correctly explains the assertion.	b) Both the assertion and reasoning are true, but the reasoning does not explain the assertion.	c) The assertion is true, but the reasoning is false.	d) The assertion is false, but the reasoning is true.	a)
10	Which of the following films won the **Best Picture** award at the **2025 Academy Awards**?				Oppenheimer
	a) Oppenheimer	b) The Fablemans	c) The Whale	d) Killers of the Flower Moon	a)
11	Which team won the Kalinga Super Cup 2025 by defeating Jamshedpur FC 3-0?				FC Goa
	a) Bengaluru FC	b) FC Goa	c) Kerala Blasters	d) Mohun Bagan	b)
12	What is the primary objective of the Anusandhan National Research Foundation's (ANRF) MAHA-EV initiative launched in May 2025?				Advancing electric vehicle technologies
	a) Advancing electric vehicle technologies	b) Developing advanced nuclear reactors	c) Enhancing satellite communication systems	d) Promoting agricultural biotechnology	a)
13	Which company presented the 48-week results of the REGENT-1 clinical study at Digestive Disease Week 2025?				Endogenex
	a) Medtronic	b) Pfizer	c) GE HealthCare	d) Endogenex	d)
14	What is the goal of the International Maritime Organization's (IMO) Net-Zero Framework set to be implemented in 2027?				Achieving net-zero greenhouse gas emissions in maritime shipping
	a) Eliminating single-use plastics in oceans	b) Achieving net-zero greenhouse gas emissions in maritime shipping	c) Protecting endangered marine species	d) Establishing marine protected areas worldwide	b)

<table>
<tr><td>15</td><td colspan="4">Why did the Indian government intervene to halt the auction of the Piprahwa gems in May 2025?</td><td>They are considered sacred relics associated with the Buddha</td></tr>
<tr><td></td><td>a)They are considered sacred relics associated with the Buddha</td><td>b)The gems were stolen from a national museum</td><td>c)The auction violated international trade laws</td><td>d)The gems were found to be counterfeit</td><td>a)</td></tr>
<tr><td>16</td><td colspan="4">A shopkeeper sells 2 pens for ₹15 and 3 pens for ₹20. What is the cost price of one pen if there's no profit or loss?</td><td>₹6</td></tr>
<tr><td></td><td>a) ₹6</td><td>b) ₹7</td><td>c) ₹5</td><td>d) ₹4</td><td>a)</td></tr>
<tr><td>17</td><td colspan="4">If CAT = 3120, and DOG = 4157 pick up the True statement:</td><td>A BAT is 2120</td></tr>
<tr><td></td><td>a) BAT is 2120</td><td>b) BAT is 2124</td><td>c) BAT is 2123</td><td>d) BAT is 2130</td><td>a)</td></tr>
<tr><td>18</td><td colspan="4">Evaluate the Assertion (A) and Justification (J):

A: Assertion If a person walks 5 km north, turns right, walks 3 km, and turns right again to walk 5 km, he is now 3 km east from his starting point.

B: Justification After two right turns, the person is facing east, and thus 3 km east from his starting point.</td><td>Both Assertion and Justification are True, and Justification is the correct explanation for Assertion</td></tr>
<tr><td></td><td>a) Both Assertion and Justification are True, and Justification is the correct explanation for Assertion</td><td>b) Both Assertion and Justification are True, but Justification is not the correct explanation for Assertion.</td><td>c) Assertion is True, but Justification is False.</td><td>d) Assertion is False, but Justification is True.</td><td>a)</td></tr>
<tr><td>19</td><td colspan="4">Type Questions here for matching pairs:

<table><tr><td>A. Simple Interest</td><td>i. The rate at which an object moves per unit of time.</td></tr><tr><td>B. Speed</td><td>ii. πr^2, where r is the radius</td></tr><tr><td>C. Area of a Circle</td><td>iii. The formula P·R·T/100, where P is principal, R is rate, and T is time.</td></tr><tr><td>D. Probability of rolling an even number on a 6-sided die</td><td>iv. 3/3=1/2, since there are 3 even numbers on a 6-sided die.</td></tr></table></td><td>A-iii, B-i, C-ii, D-iv</td></tr>
<tr><td></td><td>a) A-i, B-iv, C-ii, D-iii</td><td>b) A-iii, B-i, C-ii, D-iv</td><td>c) A-iv, B-i, C-ii, D-iii</td><td>d) A-ii, B-i, C-iv, D-iii</td><td>b)</td></tr>
</table>

20	**Which bone protects the brain?**				Cranium
	a) Femur	b) Cranium	c) Tibia	d) Clavicle	b)
21	Which of the following statements is true regarding an inertial frame of reference?				It obeys Newton's laws of motion
	a)It rotates with constant angular velocity	b)It accelerates uniformly	c)It obeys Newton's laws of motion	d)It has zero mass	c)
22	The second postulate of special theory relativity states that:				The speed of light is constant in all inertial frames
	a) Time is absolute in all inertial frames	b) The speed of light is constant in all inertial frames	c) All forces act instantaneously	d) Mass is invariant	b)
23	The photoelectric effect demonstrates:				The particle nature of light
	a) The particle nature of light	b) The wave nature of electrons	c) Nuclear decay	d) Thermal equilibrium	a)
24	The Pauli Exclusion Principle states that:				No two identical fermions can occupy the same quantum state
	a) Two fermions can occupy the same quantum state	b) Electrons have zero spin	c) No two identical fermions can occupy the same quantum state	d) Bosons repel each other	c)
25	Type Questions here for matching pairs: A Photoelectric effect — i Energy quantization B Compton effect — ii Mass-energy equivalence C Blackbody radiation — iii Particle nature of light D Special Relativity — iv Photon momentum				A-iii, B-iv, C-i, D-ii

	a)A-iii, B-iv, C-i, D-ii	b)A-ii, B-iii, C-iv, D-i	c)A-i, B-ii, C-iii, D-iv	d)A-iv, B-i, C-ii, D-iii	a)
26	Match the physical quantities with their units: A Energy — i meter B Time — ii joule C Length — iii second D Frequency — iv hertz				A-ii, B-iii, C-i, D-iv
	a) A-iii, B-iv, C-ii, D-i	b) A-i, B-ii, C-iv, D-iii	c) A-ii, B-iii, C-i, D-iv	d) A-iv, B-i, C-iii, D-ii	c)
27	Match the nuclear process with its application: A Alpha decay — i Cancer treatment B Gamma rays — ii Fire alarms C Radioactive dating — iii Archaeology D Beta decay — iv High-energy imaging				A-ii, B-iv, C-iii, D-i
	a) A-iii, B-i, C-ii, D-iv	b) A-ii, B-iv, C-iii, D-i	c) A-i, B-ii, C-iv, D-iii	d) A-iv, B-i, C-ii, D-iii	b)
28	State whether the following statements are True (T) or False (F): A. Time dilation implies moving clocks run slower relative to a stationary observer. B. Lorentz transformations reduce to Galilean transformations at low velocities. C. The speed of light depends on the motion of the light source. D. Length contraction occurs perpendicular to the direction of motion.				T, T, F, F
	a) T, T, F, F	b) T, F, F, T	c) F, T, T, F	d) F, T, T, F	a)
29	Which option correctly represents the truth values of the following statements? A. Increasing the intensity of incident light increases the kinetic energy of ejected electrons. B. There is a threshold frequency below which photoemission does not occur. C. The number of photoelectrons emitted increases with light intensity (above threshold). D. Photoelectric emission occurs without measurable time delay.				F, T, T, T
	a) T, T, T, T	b) F, T, T, T	c) F, F, T, F	d) T, F, F, F	b)
30	Choose the correct sequence of True (T) and False (F) for the following statements: A. Energy levels of a particle in a 1D infinite potential well are quantized. B. The Schrödinger equation is a first-order differential equation. C. A physically acceptable wavefunction must be normalizable. D. The square of the wavefunction modulus gives the probability density.				T, F, T, T

	a) T, F, T, T	b) T, T, F, F	c) F, F, T, T	d) T, F, F, T,	a)
31	Mark the correct combination of truth values for the following statements: A. Binding energy is the energy released when a nucleus is formed from nucleons. B. Alpha decay reduces both the atomic number and mass number of a nucleus. C. Radioactive decay follows a logarithmic law. D. After two half-lives, 25% of the original sample remains.				T, T, F, T
	a) T, T, T, T	b) T, F, T, F	c) F, T, T, F	d) T, T, F, T	d)
32	A (Assertion): The Bohr model explains hydrogen spectral lines accurately. B (Justification): It quantizes angular momentum and introduces discrete energy levels.				Both A and B are true, and B is the correct
	a) Both A and B are true, and B is the correct explanation of A	b) Both A and B are true, but B is not the correct explanation of A	c) A is true, B is false	d) A is false, B is true	a)
33	Type Questions here for assertion and justification A: The Schrödinger equation can be applied to macroscopic bodies. B: Quantum effects dominate at all scales.				A is false, B is false
	a) Both A and B are true, and B is the correct explanation of A	b) Both A and B are true, but B is not the correct explanation of A	c) A is false, B is false	d) A is false, B is true	c)
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	explanation of A	explanation of A			
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	a)A-iii, B-iv, C-i, D-ii	b)A-ii, B-iii, C-iv, D-i	c)A-i, B-ii, C-iii, D-iv	d)A-iv, B-i, C-ii, D-iii	a)
38	Match the physical quantities with their units: A Energy — i meter B Time — ii joule C Length — iii second D Frequency — iv hertz				A-ii, B-iii, C-i, D-iv
	a) A-iii, B-iv, C-ii, D-i	b) A-i, B-ii, C-iv, D-iii	c) A-ii, B-iii, C-i, D-iv	d) A-iv, B-i, C-iii, D-ii	c)
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	a) A-T, B-T, C-F, D-F	b)A-T, B-F, C-F, D-T	c) A-F, B-T, C-T, D-F	d) A-F, B-T, C-T, D-F	a)
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	a) Both A and B are true, and B is the correct explanation of A	b) Both A and B are true, but B is not the correct explanation of A	c) A is true, B is false	d) A is false, B is true	a)
45	A rod of length 2 m moves at 0.8c with respect to an observer. What is its observed length due to length contraction?				1.2 m
	a) 2.0 m	b) 1.2 m	c) 1.6 m	d) 0.6 m	b)
46	What is the de Broglie wavelength of a 1 keV electron?				0.388 Å
	a) 0.038 Å	b) 1.23 nm	c) 12.3 Å	d) 0.388 Å	d)
47	The energy difference between the first and second level of a particle in a 1D box is				$\frac{3h^2}{8ml^2}$
	a) $\frac{3h^2}{8ml^2}$	b) $\frac{5h^2}{8ml^2}$	c) $\frac{4h^2}{8ml^2}$	d) $\frac{8h^2}{8ml^2}$	a)
48	If the half-life of a radioactive isotope is 10 hours, what fraction remains after 30 hours?				1/8
	a) 1/2	b) 1/4	c) 1/8	d) 1/16	c)
49	The coordination number of an atom in a face-centered cubic (FCC) lattice is:				12
	a) 4	b) 6	c) 8	d) 12	d)
50	Which of the following statements is true for *conductors*? A The conduction band is completely empty B There is a large energy gap between valence and conduction bands C The valence and conduction bands overlap D Electrons cannot move freely				The valence and conduction bands overlap
	a) A	b) B	c) C	d) D	c)
51	In an insulator, the energy band gap is typically:				Greater than 5 eV
	a) Less than 1 eV	b) Between 1 and 3 eV	c) Greater than 5 eV	d) Zero	c)

52	Match the terms with their correct descriptions in related to **X-ray Diffraction (XRD)**. A Bragg's Law — i The technique used to analyze the crystal structure of materials. B Diffraction Peak — ii The condition that describes the relationship between the wavelength of X-rays and the crystal spacing. C Unit Cell — iii The point at which constructive interference occurs, resulting in diffraction maxima. D X-ray Source — iv The periodic arrangement of atoms in a crystalline solid.	A-ii, B-iii, C-iv, D-i
	a) A-ii, B-iii, C-iv, D-i / b) A-i, B-ii, C-iv, D-iii / c) A-ii, B-i, C-iii, D-iv / d) A-iii, B-ii, C-i, D-iv	a)
53	The *Brillouin zone* is associated with:	Reciprocal lattice
	a) Reciprocal lattice / b) Real space lattice / c) Electron spin / d) Magnetic susceptibility	a)

54	In a perfectly elastic collision between two particles, which of the following is **not** conserved?	Internal energy
	a) Total energy / b) Total kinetic energy / c) Total linear momentum / d) Internal energy	d)
55	A uniform solid cylinder of mass 5 kg and radius 0.2 m rotates about its central axis. The moment of inertia of the cylinder about this axis is:	0.1 kg·m²
	a) 0.05 kg·m² / b) 0.1 kg·m² / c) 0.2 kg·m² / d) 0.4 kg·m²	b)
56	The orbital radius of a satellite around Earth is doubled. What happens to the orbital period TTT of the satellite?	T becomes $2^{3/2}$ times the original
	a) T becomes $\sqrt{2}$ times the original / b) T becomes 2 times the original / c) T becomes 4 times the original / d) T becomes $2^{3/2}$ times the original	d)
57	A particle is at a distance of 0.5 m from the axis of a uniformly rotating frame spinning at 10 rad/s. What is the magnitude of the centrifugal acceleration acting on the particle?	50 m/s²

	a) 50 m/s²	b) 100 m/s²	c) 50 m/s²	d) 10 m/s²	a)
58	The orbital velocity v of a planet in a circular orbit of radius rrr around the Sun is given by $v = \sqrt{\frac{GM}{r}}$. If the orbital radius is reduced to one-fourth, what happens to the orbital velocity?				Doubles
	a) Doubles	b) Quadruples	c) Halves	d) Becomes four times the original	a)

59	In the kinetic theory of gases, which assumption is *not* made about the molecules of an ideal gas?				Molecules move with same speed.
	a) Elastic molecular collisions	b) Negligible volume of molecules compared to container.	c) Significant Intermolecular forces during collisions.	d) Molecules move with same speed.	d)
60	Which of the following conditions resembles *adiabatic process*?				No heat is exchanged between the system and surroundings.
	a) No work is done by or on the system.	b) No heat is exchanged between the system and surroundings.	c) A process that occurs at constant pressure.	d) A process in which temperature remains constant.	b)
61	According to the zeroth law of thermodynamics: "If two systems are each in thermal equilibrium with a third system, then…"				they must have the same temperature.
	a) they must have the same volume.	b) they must have the same pressure.	c) they must have the same temperature.	d) no heat flows between them if placed in contact.	c)
62	The root-mean-square speed v_{rms} of molecules in an ideal gas is given by $v_{rms} = \sqrt{\frac{3k_B T}{m}}$, Which statement correctly describes its dependence?				v_{rms} increases as the square root of the absolute temperature.

	a) v_{rms} is directly proportional to the gas density.	b) v_{rms} increases with the square of the absolute temperature.	c) v_{rms} is independent of the molecular mass.	d) v_{rms} increases as the square root of the absolute temperature.	d)
63	Type Questions here for matching pairs: A. Zeroth law of thermodynamics — i. State in which no net heat flows between bodies in contact B.Thermal equilibrium — ii. If A is in equilibrium with C, and B is in equilibrium with C, then A and B are in equilibrium with each other." C.Thermal contact — iii. Physical connection allowing heat exchange D.Thermal reservoir — iv. Body so large that its temperature remains essentially constant when exchanging heat				A–ii B–i C–iii D–iv
	a) A–ii B–i C–iii D–iv	b) A–i B–ii C–iii D–iv	c) A–ii B–i C–iv D–iii	d) A–ii B–iii C–i D–iv	a)
64	Type Questions here for matching pairs: A. ΔU (change in internal energy) — i. Energy added to the system as heat B. Q (heat added) — ii. Work done by the system (on surroundings) C. W (work done) — iii. ΔU = Q − W D. First law statement — iv. Energy is conserved: change in internal energy equals heat added minus work done."				A–iii B–i C–ii D–iv
	a) A–i B–iii C–ii D–iv	b) A–iii B–ii C–i D–iv	c) A–iii B–i C–ii D–iv	d) A–ii B–iii C–i D–iv	c)
65	Which of the following statements about statistical ensembles is **True?:** A. The Clausius-Clapeyron equation is used to calculate the change in internal energy during a phase transition. B. It describes the slope of the coexistence curve between two phases in a pressure-temperature diagram. C. It can be applied only to solid-liquid transitions. D. It is independent of latent heat.				Only B
	a) A & B	b) B & C	c) Only B	d) Only D	c)

66	Which of the following statements about statistical ensembles is **True**? A. In a microcanonical ensemble, the energy of the system is allowed to fluctuate. B. In a canonical ensemble, both energy and number of particles remain constant. C. In a grand canonical ensemble, the temperature, volume, and chemical potential are fixed. D. A canonical ensemble describes an isolated system.				Only C
	a) A & B	b) Only C	c) Only B	d) C & D	b)
67	Select the right option on basis of following assertion and justification **A: Assertion** The pressure exerted by an ideal gas is due to the elastic collisions of gas molecules with the walls of the container. **B: Justification** According to the kinetic theory of gases, gas molecules attract each other when they come close.				**A** is true, but **B** is false
	a) Both **A** and **B** are true, and **B** is the correct explanation of **A**	b) Both **A** and **B** are true, but B is not the correct explanation of **A**	c) **A** is true, but **B** is false	d) **A** is false, but **B** is true	c)
68	Select the right option on basis of following assertion and justification **A: Assertion** According to Maxwell's velocity distribution, most gas molecules in a container move with the same velocity at a given temperature. **B: Justification** The Maxwell-Boltzmann distribution curve is symmetric about the most probable speed.				**A** is false, but **B** is true
	a) Both **A** and **B** are true, and **B** is the correct explanation of **A**	b) Both **A** and **B** are true, but B is not the correct explanation of **A**	c) **A** is true, but **B** is false	d) **A** is false, but **B** is true	d)

69	What is the average kinetic energy per molecule of an ideal gas at a temperature of **300 K**? (Take k_B=1.38×10^{-23} J/K)				3.12×10^{-21} J
	a) 6.21×10^{-21} J	b) 4.14×10^{-21} J	c) 3.12×10^{-21} J	d) 2.07×10^{-21} J	c)
70	The root-mean-square (r.m.s.) speed of oxygen molecules at 300 K is approximately 480 m/s. What will be its r.m.s. speed at 1200 K?				960 m/s
	a) 960 m/s	b) 680 m/s	c) 240 m/s	d) 1200 m/s	a)
71	In an adiabatic expansion, a gas does **150 J of work** on its surroundings. What is the change in internal energy (ΔU) of the system?				-150 J
	a) +150 J	b) 0 J	c) -150 J	d) +300 J	c)
72	At absolute zero temperature (T = 0 K), what is the value of the Fermi-Dirac distribution function $f(E)$ for a state with energy E less than the Fermi energy E_F ?				1
	a) 0	b) 0.5	c) 2	d) 1	d)

73	The Jacobian of a transformation from variables (x, y) to (u, v) is:				The determinant of the matrix of partial derivatives
	a) The cross product of u and v	b) The determinant of the matrix of partial derivatives	c) The product of all partial derivatives	d) The inverse of the determinant of the transformation matrix	b)
74	A differential df is said to be perfect if:				The differential is exact
	a) The mixed partial derivatives are not equal	b) df depends only on time	c) The differential is exact	d) f is a function of more than one variable	c)
75	The Fourier series of an even function contains:				Only cosine terms
	a) Only sine terms	b) Only cosine terms	c) Both sine and cosine terms	d) Exponential terms only	b)

76	The divergence of a vector field gives:				Scalar measure of source/sink strength
	a) Circulation	b) Area under the curve	c) Scalar measure of source/sink strength	d) Direction of flow	c)
77	Each of these questions contains two statements: Assertion (A) and Reason (R). Each of these questions also has four alternative choices, only one of which is the correct answer. You have to select one of the codes (a), (b), (c) and (d) given below. Assertion (A): The Jacobian of a transformation being zero implies the transformation is not invertible. Reason (R): A zero Jacobian determinant indicates that the mapping collapses dimensions.				Both A and R are true, and R is the correct explanation of A.
	a) Both A and R are true, and R is the correct explanation of A.	b) Both A and R are true, but R is not the correct explanation of A	c) A is true but R is false	d) A is false but R is true	a)
78	Each of these questions contains two statements: Assertion (A) and Reason (R). Each of these questions also has four alternative choices, only one of which is the correct answer. You have to select one of the codes (a), (b), (c) and (d) given below. Assertion (A): The curl of a gradient of any scalar field is always zero. Reason (R): Gradient fields are irrotational in nature.				Both A and R are true, and R is the correct explanation of A
	a) Both A and R are true, and R is the correct explanation of A	b) Both A and R are true, but R is not the correct explanation of A	c) A is true, but R is false	d) A is false, but R is true	a)
79	Each of these questions contains two statements: Assertion (A) and Reason (R). Each of these questions also has four alternative choices, only one of which is the correct answer. You have to select one of the codes (a), (b), (c) and (d) given below. Assertion (A): The Laplace equation $\nabla^2\phi=0$ has solutions that are harmonic functions. Reason (R): Harmonic functions satisfy the condition that their gradient is zero.				A is true, but R is false
	a) a) Both A and R are true,	b) Both A and R are true,	c) A is true, but R is false	d) A is false, but R is true	c)

	and R is the correct explanation of A	but R is not the correct explanation of A			
80	The complex number z=3+4i has a modulus of:				5
	e) 5	f) 7	g) $\sqrt{7}$	h) $\sqrt{13}$	a)
81	The surface integral $\iint_s \vec{F}.\hat{n}dS$ using the divergence theorem for $\vec{F} = x\hat{i} + y\hat{j} + z\hat{k}$ over the surface of the unit cube 0≤x, y, z≤10 is:				3
	a) 0	b) 3	c) 1	d) 2	b)
82	For the matrix $A = \begin{bmatrix} 2 & 1 \\ 0 & 3 \end{bmatrix}$, the eigenvalues are:				2 and 3
	a) 2 and 1	b) 1 and 3	c) 2 and 3	d) 3 and 0	c)
83	The locus represented by $\|z-3\|+\|z+3\|=10$ is				Ellipse
	e) circle	f) parabola	g) Ellipse	h) Hyperbola	c)
84	The value of the integral $\int_C (x^2 ydx + xy^2 dy)$ where C is the boundary of the unit square 0≤x,y≤1 is				2/3
	b) 1/3	b) 1	c) 2/3	d) 0	c)
85	In a square matrix, each diagonal element is real and $a_{ij} = \overline{a}_{ij}$. The matrix will be				Symmetric
	a) Symmetric	b) Skew symmetric	c) Hermitian	d) Skew Hermitian	a)
86	The Jacobian of the transformation x=r cosθ, y=r sinθ is:				r
	a) r	b) r^2	c) 1	d) 0	a)

<table>
<tr><td>87</td><td colspan="4">Which of the following quantities in Simple Harmonic Motion (SHM) is constant during the motion?</td><td>Total Mechanical Energy</td></tr>
<tr><td></td><td>a) Speed</td><td>b) Displacement</td><td>c) Kinetic Energy</td><td>d) Total Mechanical Energy</td><td>d)</td></tr>
<tr><td>88</td><td colspan="4">Which of the following statements are true?

A. Lissajous figures are only generated when both input signals have zero phase difference.

B. Lissajous figures can only be seen on a cathode ray oscilloscope when the signals are identical.

C. The shape of a Lissajous figure depends on the frequency ratio and phase difference between two signals.

D. Lissajous figures do not change with variations in signal frequency.</td><td>C The shape of a Lissajous figure depends on the frequency ratio and phase difference between two signals.</td></tr>
<tr><td></td><td>a)A & B</td><td>b) A & D</td><td>c)D</td><td>d)C</td><td>d)</td></tr>
<tr><td>89</td><td colspan="4">Which of the following options is correct about the statements A and B ?

A: In forced oscillation, resonance occurs when the driving frequency equals the natural frequency of the system.

B: At resonance, the amplitude of oscillation becomes minimum due to destructive interference.</td><td>A is true, but R is false.</td></tr>
<tr><td></td><td>a) Both A and R are true, and R is the correct explanation of A.</td><td>b) Both A and R are true, but R is not the correct explanation of A.</td><td>c) A is true, but R is false.</td><td>d) A is false, but R is true.</td><td>c)</td></tr>
<tr><td>90</td><td colspan="4">Match the following situations in the columns given below:

<table><tr><td>A Underdamping</td><td>I Oscillations die out very slowly over time</td></tr><tr><td>B Critical damping</td><td>IINo oscillations; system returns to equilibrium slowly</td></tr><tr><td>C Overdamping</td><td>III No oscillations; system returns to equilibrium fastest</td></tr><tr><td>D No damping (ideal case)</td><td>IV Oscillations continue with constant amplitude</td></tr></table></td><td>A-I, B-III, C-II, D-IV</td></tr>
<tr><td></td><td>a)A-I, B-II, C-III, D-IV</td><td>b)A-I, B-III, C-II, D-IV</td><td>c)A-II, B-I, C-III, D-IV</td><td>d)A-IV, B-III, C-II, D-I</td><td>b)</td></tr>
</table>

<table>
<tr><td>91</td><td colspan="4">A police car with a siren emitting a constant frequency is moving towards a stationary observer. Which of the following best explains what the observer hears as the car approaches?</td><td>The siren's frequency appears higher than its actual frequency.</td></tr>
<tr><td></td><td>a) The siren's frequency appears lower than its actual frequency.</td><td>b) The siren's frequency appears unchanged.</td><td>c) The siren's frequency appears higher than its actual frequency.</td><td>d) The siren becomes completely inaudible.</td><td>c)</td></tr>
<tr><td>92</td><td colspan="4">Match the following situations in the columns given below:

<table><tr><td>A Light travels from air to water</td><td>ILight bends away from normal to minimize time</td></tr><tr><td>B Light reflects off a plane mirror</td><td>II The angle of incidence equals the angle of reflection</td></tr><tr><td>C Light travels from water to air</td><td>IIILight bends toward the normal to minimize travel time</td></tr><tr><td>D Light travels in a vacuum.</td><td>IVLight travels in a straight line, since the medium is uniform</td></tr></table></td><td>A-III, B-II, C-I, D-IV</td></tr>
<tr><td></td><td>a)A – I, B- II, C-III, D- IV</td><td>b)A-III, B-II, C-I, D-IV</td><td>c)A-I, B-II, C-III, D-IV</td><td>d)A-IV, B- III, C-II, D-I</td><td>b)</td></tr>
<tr><td>93</td><td colspan="4">An object is placed beyond the center of curvature of a concave mirror. Which of the following statements correctly describes the image formed?</td><td>The image is real, inverted, and diminished.</td></tr>
<tr><td></td><td>a) The image is virtual, erect, and magnified.</td><td>b) The image is real, inverted, and diminished.</td><td>c) The image is real, inverted, and the same size as the object.</td><td>d) The image is real, inverted, and magnified.</td><td>b)</td></tr>
<tr><td>94</td><td colspan="4">Which of the following options is correct about the statements A and B ?

A: Sound waves can be polarized just like light waves.

B: Only transverse waves can be polarized because their vibrations are perpendicular to the direction of propagation.</td><td>A is false, but R is true.</td></tr>
<tr><td></td><td>a) Both A and R are true, and R is the correct</td><td>b) Both A and R are true, but R is not the correct</td><td>c) A is true, but R is false.</td><td>d) A is false, but R is true.</td><td>d)</td></tr>
</table>

	explanation of A.	explanation of A.			
95	Identify which of the following statements are **true ?** A Polarization can occur in all types of mechanical waves. B Unpolarized light means the electric field oscillates in the direction of wave propagation. C A polarizing filter converts polarized light into unpolarized light. D Polarization of light cannot be explained by wave theory.				None of the statements are true
	a) None of the statements are true	b) Only statements B and D are true	c) Only statement C is true	d) None of the statements are true All statements are true	a)
96	Which of the following statements about interference of light are **true**? A Constructive interference occurs when the path difference between two light waves is an odd B Interference patterns can be observed with light from incoherent sources if they have the same frequency. C The principle of superposition states that when two light waves meet, their displacements add D In the interference of light, the intensity of the resulting wave is greater than the sum of the individual intensities when destructive interference occurs.				C The principle of superposition states that when two light waves meet, their displacements add
	a)B & C	b) C	c) D	d)B & D	b)
97	Which of the following options is correct about the statements A and B ? A: Diffraction is more pronounced when light passes through a narrow slit. B: The amount of diffraction increases as the slit width approaches the wavelength of light.				Both A and R are true, and R is the correct explanation of A
	a) Both A and R are true, and R is the correct explanation of A.	b) Both A and R are true, but R is not the correct explanation of A.	c) A is true, but R is false.	d) A is false, but R is true.	a).

98	Two simple harmonic motions (SHMs) along the same line are given by: $x1(t)=A\cos(\omega t)$, $x2(t)=A\cos(\omega t+\phi)$. The resultant amplitude of their superposition is given by:				$2A\cos(\phi/2)$
	a) $2A\cos(\phi/2)$	b) $A\cos(\phi)$	c) $2A\cos(\omega t+\phi/2)$	d)$2A\cos(\phi)$	a)
99	A car is moving towards a stationary observer at a speed of 30 m/s. The frequency of the sound emitted by the car's horn is 1000 Hz. If the speed of sound in air is 343 m/s, what frequency does the observer hear?				1100 Hz
	a) 1000 Hz	b) 1030 Hz	c) 1100 Hz	d) 1060 Hz	c)
100	In the double-slit experiment, when the separation between the slits is reduced, what happens to the interference pattern?				The fringe width increases.
	a) The fringe width increases.	b) The fringe width decreases.	c) The interference pattern disappears.	d) The fringe width remains unchanged.	a)