Test Booklet No. _____

This booklet consists of 150 questions and 22 printed pages.

RGUPET/2024/__/_

RGUPET 2024
Common Entrance Test, 2024
DOCTOR OF PHILOSOPHY IN PHYSICS

Full Marks: 150 **Time: 3 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 150 Multiple Choice Questions (MCQs) from the concerned subject. Each question carries 1 mark.
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 within two hour.
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	Name the organization who will manage all Indian Remote Sensing satellite data and products from May 1, 2024?				b)
	a) Indian Space Research Organisation (ISRO)	b) New Space India Limited (NSIL)	c) Indian Remote Sensing Corporation(IRSC)	d) India n Earth Observation System (IEOS)	New Space India Limited (NSIL)
2	Which is the first Indian missile?				a)
	a) Agni	b) Sagarika	c)Prithvi	d) Dhanush	Agni
3	Green colour in Indian National Flag signifies				c)
	a) Valour	b) Sacrifice	c) Relation to soil and prosperity	d) Truth	Relation to soil and prosperity
4	In which year, the North-East Frontier Agency was renamed as Arunachal Pradesh?				b)
	a) 1970	b) 1972	c) 1976	d) 1980	1972
5	Which city hosted the South Asian Youth Table Tennis championship in 2023 ?				a)
	a) Itanaga r	b) Guwahat i	c) Kolkata	d) Bhub enswar	Itanagar
6	India Gaming Report 2024, recently seen in news, released by which organization?				a
	a) Interactive Entertainment and Innovation Council and WinZO	b) All Indian Gaming Federation and Enigma Gaming	c) Indian Digital Gaming Society and BL4ZE Esports	d) All Indian Gaming Federation and Dream 11	Interactive Entertainme nt and Innovation Council and WinZO
7	What is the theme of ‘World Health Day 2024’?				b
	a) Building a fairer, healthier world	b) My Health, My Right	c) Our planet, our health	d) Support nurses and midwives	My Health, My Right
8	The Indian physicist currently serving as the Principal Scientific Adviser to the Government of India is				c
	a) D. D. Sarma	b) Asutosh Sarmah	c) A. K. Sood	d) Abhay Karandikar	A. K. Sood
9	India recently collaborated with which organization to nurture startups in the EV battery recycling field?				a
	a) European Union	b) World Bank	c) United Nation Environment program	d) World Trade Organization	European Union
10	Swarved Mahamandir, which is World’s Largest Meditation Centre, inaugurated recently is located which city?				b

	a) New Delhi	b) Varanasi	c) Ujjain	d) Jaipur	Varanasi
11	Which of the options is the closest in meaning to the word given below: Primeval				c
	a)modern	b)historic	c)primitive	d)antique	Primitive
12	**Change the following sentence into a positive comparative form: "He is not as tall as his brother."**				a
	a) He is shorter than his brother.	b) He is taller than his brother.	c)He is equally as tall as his brother.	d)He is not tall at all.	He is shorter than his brother.
13	Choose the more appropriate form of indirect speech for the given sentence. She said to me, "Where are you going for the vacation?"				a
	a) She asked me where I was going for the vacation.	b) She said that where I was going for the vacation.	c) She asked me that where I was going for the vacation.	d) She asked where I had been going for the vacation.	She asked me where I was going for the vacation.
14	"I watched the mild scolding with a _____ frown." Complete the sentence by choosing the appropriate non-finite from the following.				c
	a) to worry	b) worry	c) worried	d) worries	worried
15	In which sentence is the adverb of degree linked to an adjective?				b
	a) They ate a lot.	b) The concert was extremely enjoyable.	c) We managed to walk far.	d) The employee barely made any effort to improve.	The concert was extremely enjoyable.
16	Identical balls are tightly arranged in the shape of an equilateral triangle with each side containing n balls. How many balls are there in the arrangement?				b
	a) n^2/2	b) n(n+1)/2	c) n(n-1)/2	d) (n+1)^2/2	n(n+1)/2
17	In a tournament with 8 teams, a win fetches 3 points and a draw, 1. After all teams have played three matches each, total number of points earned by all teams put together must lie between				b
	a) 24 and 36	b) 24 and 32	c) 12 and 24	d) 32 and 48	24 and 32
18	A student is free to choose only Chemistry, only Biology or both. If out of 32 students, Chemistry has been chosen by 16 and Biology by 25, then how many students have chosen Biology but not Chemistry?				b
	a) 9	b) 16	c) 25	d) 7	16

19	A cylindrical road roller having a diameter of 1.5m moves at a speed of 3 km/h while levelling a road. How much length of the road will be leveled in 45 minutes?				b
	a) 2.25 km	b) 0.375*pi km	c) 0.75*pi km	d) 1.5 km	2.25 km
20	A tourist drives 20km towards east, turns right and drives 6km , then drives 6km towards west. He then turns to his left and drives 4km and finally turns right and drives 14km . Where is he from his starting point?				d
	a)6km towards east	b)20km towards west	c)14km towards north	d)10km towards south	10km towards south
21	Which of the following is the primary aim of using a control group in an experimental design?				(b)
	(a) To ensure that the sample size is large enough	(b) To provide a baseline for comparison with the treatment group	(c) To increase the internal validity of the study	(d) To speed up the data collection process	To provide a baseline for comparison with the treatment group
22	Which type of research design is most appropriate for studying the cause-and-effect relationship between variables?				(c)
	(a) Descriptive research design	(b) Correlational research design	(c) Experimental research design	(d) Historical research design	Correlational research design
23	In a research study, what is the term for a variable that is manipulated by the researcher?				(b)
	(a) Dependent variable	(b) Independent variable	(c) Confounding variable	(d) Mediating variable	Independent variable
24	Which of the following is a characteristic of qualitative research design?				(c)
	(a) Use of statistical analysis	(b) Structured data collection methods	(c) Emphasis on understanding and interpretation	(d) Focus on numerical data	Emphasis on understanding and interpretation
25	What is the main purpose of random assignment in an experimental research design?				(b)
	(a) To ensure that the sample is representative of the population	(b) To minimize potential biases and confounding variables	(c) To maximize the sample size for better accuracy	(d) To speed up the experimental process	To minimize potential biases and confounding variables
26	What is the primary purpose of a research design?				(c)
	(a) To collect data	(b) To analyse data	(c) To provide a roadmap for conducting research	(d) To publish research findings	To provide a roadmap for conducting research
	Which of the following is NOT a type of research design?				(b)

27	(a) Experimental design	(b) Descriptive design	(c) Qualitative design	(d) Exploratory design	Descriptive design
28	What type of research design involves manipulating an independent variable to observe its effect on a dependent variable?				(c)
	(a) Descriptive design	(b) Correlational design	(c) Experimental design	(d) Longitudinal design	Experimental design
29	What is the primary characteristic of a longitudinal research design?				(b)
	(a) It studies different groups of participants at the same time.	(b) It studies the same group of participants over an extended period.	(c) It collects data from multiple sources simultaneously.	(d) It involves manipulating variables to observe their effects.	It studies the same group of participants over an extended period.
30	Which of the following is an essential component of an experimental research design in physics?				(b)
	(a) Observing natural phenomena without interference	(b) Manipulating variables and observing their effects	(c) Conducting surveys and interviews	(d) Analyzing existing data sets	Manipulating variables and observing their effects
31	What is the primary advantage of using a controlled experimental design in physics research?				(b)
	(a) It allows for the investigation of natural phenomena in real-world settings.	(b) It enables the manipulation of variables to establish causality.	(c) It provides detailed descriptions of observed phenomena.	(d) It allows for the collection of large-scale data sets.	It enables the manipulation of variables to establish causality.
32	What is the primary purpose of randomization in experimental research design?				(b)
	(a) To ensure that all participants have an equal chance of being selected	(b) To eliminate bias and confounding variables	(c) To increase the generalizability of the results	(d) To control for extraneous variables	To eliminate bias and confounding variables
33	Which research design is commonly used to study the behaviour of astronomical bodies over time?				(d)
	(a) Longitudinal design	(b) Experimental design	(c) Observational design	(d) Correlational design	Correlational design
34	Which research design would be most appropriate for studying the effect of temperature on the conductivity of a material?				(c)
	(a) Descriptive design	(b) Correlational design	(c) Experimental design	(d) Longitudinal design	Experimental design
	What is the difference between internal and external validity?				(b)

35	(a) Internal validity refers to the degree to which the results can be generalized, while external validity refers to the degree to which the study is free from bias	(b) External validity refers to the degree to which the results can be generalized, while internal validity refers to the degree to which the study is free from bias	(c) Internal validity refers to the degree to which the study is free from bias, while external validity refers to the degree to which the results are consistent across different populations	(d) External validity refers to the degree to which the study is free from bias, while internal validity refers to the degree to which the results are consistent across different populations	External validity refers to the degree to which the results can be generalized, while internal validity refers to the degree to which the study is free from bias
36	A research design in which either the investigator or the participant is not aware of the treatment a participant is receiving, refers to				(a)
	(a) Single Blind Study	(b) Half Blind Study	(c) Double Blind Study	(d) Longitudinal Study	Single Blind Study
37	Which of the following studies is used for clinical analysis				(c)
	(a) Correlational Study	(b) Survey Study	(c) Case Study	(d) Trend Study	Case Study
38	If the mean and median of the data: {2,1, a,6,20,10, b,8} are 67/8 and 7 respectively, the values of a and b are respectively				a)
	a) (4, 16)	b) (7,14)	c) (4,7)	d) (6,4)	(4, 16)
39	The variance of the first five natural number is				b)
	a) 2	b) 2.5	c)3	d) 3.5	2.5
40	The relationship between two variables telling how one variable changes in response to changes in the other variable is given by				b)
	a) Correlation	b) Covariance	c) Skewness	d) Regression	Covariance
41	A correlation has distinct values of				c)
	a) 0, 2,1	b) 1,0,1	c) 1,0, -1	d) 2,0, -2	1,0, -1
42	Match the column-I and column-II and choose the correct one from the alternatives: **Column-I** / **column-II** A. skewness / 1. Indicates perfect symmetry B. kurtosis / 2. Measures the degree of asymmetry of distribution C. zero skewness / 3. Indicates perfect normality D. zero kurtosis / 4. Measures the degree of peakedness of a distribution				b)
	a) A-3, B-1, C-4, D-2	b) A-2, B-4, C-1, D-3	c) A-1, B-4, C-2, D-3	d) A-4, B-1, C-2, D-3	A-2, B-4, C-1, D-3
43	Match the column-I and column-II and choose the correct one from the alternatives:				d)

	Column-I		**Column-II**		
	A. Mean is preferred		1. when data include outliers		
	B. Median is preferred		2. when using ratio level data unless distribution includes outliers		
	C. Mode is preferred		3. when using ordinal data		
	D. Median is preferred		4. when using nominal data		
	a) A-1, B-3, C-4, D-2	b) A-2, B-3, C-1, D-4	c) A-3, B-2, C-4, D-1	d) A-2, B-3, C-4, D-1	A-2, B-3, C-4, D-1
44	Identify the true/false statements of the following and choose the correct one from the alternatives: A. The variance is the mean of the sum of the squared deviations between each observation and the median. B. Data measured on a nominal scale can only be classified into categories. C. A frequency distribution for qualitative data has class limits. D. In a bar chart, the heights of the bars represent the frequencies in each class.				b)
	a) A-True, B-True, C-False, D-True	b) A-False, B-True, C-False, D-True	c)A-False, B-False, C-False, D-True	d)A-True, B-True, C-False, D-False	A-False, B-True, C-False, D-True
45	A physicist wants to conduct experiments to study the behavior of particles in various conditions of temperature and pressure. Which sampling method should the physicist use to ensure that all combinations of temperature and pressure are adequately represented in the sample?				b
	a)Convenience sampling	b) Stratified sampling	c) Factorial sampling	d) Random sampling	Stratified sampling
46	In a study measuring the temperature of different stars in a galaxy, which data type would be most appropriate for recording the temperature values?				d
	a) Nominal	b) Ordinal	c) Interval	d) Ratio	Ratio
47	What type of data is used to represent the exact number of protons in an atom?				b
	a) Qualitative data	b)Quantitative data	c) Categorical data	d) Ordinal data	Quantitative data
48	Which among the following does not constitute a step in a sample design? A. Size of sample B. Parameters of interest C. Budgetary constraint D. None of them				d
	a) A only	b) A and C only	c) B and C only	d) D only	D only
49	Choose the correct option that matches each scaling type with its corresponding description. A. Nominal Scaling — i. Assigns numbers to objects to represent the rank order of their attributes. B. Ordinal Scaling — ii. Assigns numbers to objects for identification or categorization without implying any order.				b

	C. Interval Scaling	iii. Assigns numbers to objects with equal intervals between them, but without a true zero point.			
	D. Ratio Scaling	iv. Assigns numbers to objects with equal intervals between them and a true zero point.			
	a) A-iii, B-iv, C-i, D-ii	b) A-iv, B-iii, C-ii, D-i	c) A-i, B-ii, C-iii, D-iv	d) A-ii, B-i, C-iv, D-iii	A-iv, B-iii, C-ii, D-i
50	What does the term "scaling" refer to in the context of physical sciences research? A. The process of removing scale from chemical apparatus B. The procedure of measuring and representing physical quantities by numbers C. The technique of cleaning experimental data for analysis D. The method of increasing the size of experimental apparatus proportionally				b
	a) A only	b) B only	c) A and B only	d) B and D only	B only
51	The spectrum of radiation emitted by a black body at temperature $1000K$ peaks in the				(b)
	(a) Visible range of frequencies	(b) Infrared range of frequencies	(c) Ultraviolet range of frequencies	(d) Microwave rage of frequencies	Infrared range of frequencies
52	The Lande g-factor for the $^3p_1$ level of an atom is				(b)
	(a) $\frac{1}{2}$	(b) $\frac{3}{2}$	(c) $\frac{5}{2}$	(d) $\frac{7}{2}$	$\frac{3}{2}$
53	A three-level system of atoms has N_1 atoms in lis evel E_1 , N_2 in level E_2 and N_3 in level E_3 . Again, $N_1 > N_2 > N_3$ and $E_1 < E_2 < E_3$. Laser emission is possible between the levels				(b)
	(a) $E_3 \rightarrow E_1$	(b) $E_2 \rightarrow E_1$	(c) $E_3 \rightarrow E_2$	(d) $E_2 \rightarrow E_3$	$E_2 \rightarrow E_1$
54	The principal series of spectral lines of lithium is obtained by transitions between				
	(a) ns and $2p$, $n > 2$	(b) nd and $2p$, $n > 2$	(c) np and $2s$, $n > 2$	(d) nf and 3d , $n > 3$	(c)
55	An atom with one outer electron having orbital angular momentum l is placed in a weak magnetic field. The number of energy levels into which the higher total angular momentum state splits is				and $2s$, $n > 2$
	(a) $2l + 2$	(b) $2l + 1$	(c) $2l$	(d) $2l - 1$	(b)
56	In $He - Ne$ laser, the laser transition takes place in				$2l + 1$
	(a) He only	(b) Ne only	(c) Ne first, then in He	(d) He first and then in Ne	
57	Match the following				(d)
	A. Franck-Hertz experiment	i. Electronic excitation of molecules			
	B. Hartree-Fock method	ii. Wave function of atoms			
	C. Stern-Gerlach experiment	iii. Spin angular momentum of atoms			
	D. Franck-Condon principle	iv. Energy levels of atoms			

<table>
<tr><td></td><td>a) A-iv, B-i, C-ii, D-iii</td><td>b) A-iii, B-i, C-ii, D-iv</td><td>c) A-iii, B-iv, C-ii, D-i</td><td>d) A-i, B-iv, C-iii, D-ii</td><td>A-i, B-iv, C-iii, D-ii</td></tr>
<tr><td>58</td><td colspan="4">Which is correctly matched?<table><tr><td>A. Infra-red region</td><td>i. electronic transitions involving valence electrons</td></tr><tr><td>B. Ultraviolet-visible region</td><td>ii. nuclear transitions</td></tr><tr><td>C. X-ray region</td><td>iii. vibrational transitions of molecules</td></tr><tr><td>D. γ-ray region</td><td>iv. transitions involving inner shell electrons</td></tr></table></td><td>(c)</td></tr>
<tr><td></td><td>a) A-iv, B-iii, C-ii, D-i</td><td>b) A-i, B-ii, C-iv, D-iii</td><td>c) A-iii, B-i, C-iv, D-ii</td><td>d) A-iii, B-iv, C-i, D-ii</td><td>A-iii, B-i, C-iv, D-ii</td></tr>
<tr><td>59</td><td colspan="4">Which of the following statements is not correct about rotational spectra?
(i) Rotational spectra occur when molecules undergo transitions between rotational energy levels.
(ii) Rotational spectra are only observed in solid-state materials.
(iii) Rotational spectra involve transitions between electronic energy levels within a molecule.
(iv) Rotational spectra are independent of the moment of inertia of the molecule.</td><td>(c)</td></tr>
<tr><td></td><td>a) (i), (ii) and (iii)</td><td>b) (ii), (iii) only</td><td>c) (iii), (iii) and (iv)</td><td>d) (i), and (iv)</td><td>(iii), (iii) and (iv)</td></tr>
<tr><td>60</td><td colspan="4">Which of the following statements is true about magnetic moments of atoms of different elements
(i) All have a magnetic moment
(ii) None has a magnetic moment
(iii) None of the above statements are accurate
(iv) All acquire a magnetic moment under external magnetic field and in same direction as the filed.</td><td>(c)</td></tr>
<tr><td></td><td>a) (i) and (ii)</td><td>b) (iii) and (iv) only</td><td>c) (iv) only</td><td>d) (i) only</td><td>(iii) only</td></tr>
<tr><td>61</td><td colspan="4">Assertion: The Stark effect is the splitting of spectral lines observed in the presence of an electric field.
Reason: The Stark effect arises from changes in the electron configuration within the atom.
In the light of the above statements, choose the correct answer</td><td>(c)</td></tr>
<tr><td></td><td>(a) Both the Assertion and the Reason are true, and the reason is the correct explanation of the assertion.</td><td>(b) Both the Assertion and the Reason are true, but the reason is not the correct explanation of the assertion.</td><td>(c) The Assertion is true, but the Reason is false.</td><td>(d) The Assertion is false, but the Reason is true.</td><td>The Assertion is true, but the Reason is false.</td></tr>
<tr><td>62</td><td colspan="4">Which type of molecular spectroscopy is primarily used to study vibrations within molecules?</td><td>(a)</td></tr>
<tr><td></td><td>(a) Microwave spectroscopy</td><td>(b) UV-Vis spectroscopy</td><td>(c) Raman spectroscopy</td><td>(d) Infrared spectroscopy</td><td>Microwave spectroscopy</td></tr>
<tr><td>63</td><td colspan="4">Which of the following types of molecular motion does Raman spectroscopy primarily detect?</td><td>(d)</td></tr>
</table>

	(a) Rotational motion	(b) Vibrational motion	(c) Translational motion	(d) Electronic motion	Vibrational motion
64	Vibrational spectroscopy involves the transitions falling in the spectral range of _____				(c)
	(a) 100-1000 cm	(b) 300-3000 cm	(c) 400-4000 cm	(d) 500-5000 cm	400-4000 cm
65	In an open circuited *p-n* junction diode, the barrier voltage at the junction is generated due to-				c)
	a) Minority carrier in the p and n side.	b) Majority carrier in the p and n side	c) Immobile negative charge in the p side and positive charge in the n side.	d) Immobile positive charge in the p side and negative charge in the n side.	Immobile negative charge in the p side and positive charge in the n side.
66	The semiconductor material not used in LED is-				d)
	a) Silicon Carbide	b) GaAsP	c) GaAs	d) Si	Si
67	Identify the correct sequence of operation in a microprocessor.				c)
	a) I/O read, Opcode fetch, memory write, memory read, I/O write.	b) Opcode fetch, memory write, memory read, I/O read, I/O write.	c) Opcode fetch, memory read, memory write, I/O read, I/O write.	d) I/O read, Opcode fetch, memory read, memory write, I/O write.	Opcode fetch, memory read, memory write, I/O read, I/O write.
68	Identify the correct matching from Column-I and Column-II using the codes given below Column-I (Inventor) / Column-II (Invention) (a) John Ambrose Fleming — (i) LED (b) Nick Holonyak — (ii) Transistor (c) William Shockley — (iii) Thermionic diode (d) Clarence Melvin Zener — (iv) Zener diode				b)
	a) A-iv, B-i, C-ii, D-iii	b) A-iii, B-ii, C-i, D-iv	c) A-iii, B-iv, C-ii, D-i	d) A-i, B-iv, C-iii, D-ii	A-iii, B-ii, C-i, D-iv
69	Identify the correct matching from Column-I and Column-II using the codes given below Column-I / Column-II (a) Temporary storage unit inside a computer — (i) Counter (b) A device that stores the number of times a particular event in relation to a clock signal. — (ii) Resister (c) An electronic decision making circuit that use a high gain OPAMP — (iii) Latch				c)

		(d) A device that changes its output immediately on the basis of applied input	(iv) Compartator		
	a) A-iv, B-i, C-ii, D-iii	b) A-iii, B-ii, C-i, D-iv	c) A-ii, B-i, C-iv, D-iii	d) A-i, B-iv, C-iii, D-ii	A-ii, B-i, C-iv, D-iii
70	Convert $(E5B)_{16}$ to binary equivalent number.				a)
	a) $(111001011011)_2$	b) $(101101011110)_2$	c) $(110110100111)_2$	d) $(101001011001)_2$	$(111001011011)_2$
71	In a half adder circuit.				a)
	a) XOR gate gives the sum and AND gate gives the carry.	b) OR gate gives the sum and AND gate gives the carry.	c) OR gate gives the carry and AND gate gives the sum.	d) XOR gate gives the carry and AND gate gives the sum.	XOR gate gives the sum and AND gate gives the carry
72	If the input of a comparator is a sine wave, the output will be- (A)				c)
	a) Ramp voltage	b) Sine wave	c) Rectangular wave	d) Saw tooth wave.	Rectangular wave
73	Which of the following file extension that is loaded in a microcontroller for executing any instruction?				c)
	a) .c	b) .txt	c) .hex	d) .doc	.hex
74	A PIN diode is frequently used as				a)
	a) Switching diode for frequencies up to GHz range	b) Peak clipper	c) Voltage regulator	d) Harmonic generator	Switching diode for frequencies up to GHz
75	If f(z) is analytic throughout a simply connected bounded domain, then for every counter integral in the domain is zero. This is the statement of				c)
	a) Taylor's theorem	b) Laurent's theorem	c) Cauchy's integral theorem	d) Cauchy's integral formula	Cauchy's integral theorem
76	The Stoke's theorem is				c)
	a) $\iint_s \vec{A}\cdot d\vec{s} = \oint_c \vec{A}\cdot d\vec{r}$	b) $\iint_s \vec{\nabla}\times\vec{A}\cdot d\vec{s} = \oint_c \vec{A}\cdot d\vec{r}$	c) $\iint_s \vec{A}\cdot d\vec{s} = \oint_v \vec{\nabla}\cdot\vec{A}dV$	d) $\iint_s \vec{A}\cdot d\vec{s} = \iint_s \vec{\nabla}\vec{A}dV$	$\iint_s \vec{A}\cdot d\vec{s} = \oint_v \vec{\nabla}\cdot\vec{A}dV$
77	The line integral per unit area along the boundary of small area around a point in a vector field $\vec{A}$ is known as				c)
	a) Grad $\vec{A}$	b) Div $\vec{A}$	c) Curl $\vec{A}$	d) Line integral $\vec{A}$	Curl $\vec{A}$
78	Identify the true/false statements of the following and choose the correct one from the alternatives: 1. Hermite polynomials appear in harmonic oscillator problems. 2. Legendre polynomials appear in electrostatics. 3. Laguerre polynomials appear in hydrogen problems. Bessel polynomials appear in circular membrane problems.				a)

	a) True-True - True - True	b) True-False-True-False	c) True-True-True-False	d) True-False -True-True	True-True-True-True
79	Identify the true/false statements of the following and choose the correct one from the alternatives: 1. Eigen values are the diagonal elements of the given matrices. 2. Sum of the eigen values of the given matrix equals to the sum of the diagonal elements of the matrix. 3. Determinant of the matrix equals to the product of the eigen values of the matrix. 4. The inverse of the eigen values of a matrix is not equal to the eigen values of the inverse matrix.				d)
	a) True-True-True-True	b) True-False-True-False	c) True-True-True-False	d) False-True -True-False	False-True - True-False
80	Identify the true/false statements of the following and choose the correct one from the alternatives: 1. Newton-Raphson method is used for root finding. 2. Runge-Kutta method is applied for finding the solution of ordinary differential equation. 3. Gauss-Seidel method is used for finding numerical integration. 4. Simpson's-Rule is used for finding the solution of system of linear equations.				b)
	a) False-True-False-False	b) True-True-False-False	c) True-False-False-False	d) True-True-True-False	True-True-False-False
81	The complex variable function $f(z)=\|z\|^2$ is differentiable at				a)
	a) $z=0$	b) $z\neq 0$	c) $z=1$	d) any point of z.	$z=0$
82	If $f(s)$ is the Laplace transform of $F(t)$, then the Laplace transform of $e^{at}F(t)$ will be				b)
	a) $f(s+a)$	b) $f(s-a)$	c) $\frac{f(s)}{a}$	d) $af(s)$	$f(s-a)$
83	If A is a Skew-symmetric matrix of odd order, then the determinant of A is				c)
	a) -1	b) 1	c) 0	d) a real number	0
84	The continuous random variable X lies only inside the interval (0,2) and its density function is f(x)=kx(2-x). The expected value is				a)
	a) 1	b)1.5	c) 0.5	d) 0	1
85	**Assertion (A)**: A periodic function defined over a regular interval can be expressed as the sum of sine and cosine series over the same interval. **Reason (R)**: The limit of the Fourier transform of a function is from zero to infinity only.				c)
	a) Assertion is correct, reason is correct; reason is a correct explanation for assertion.	b) Assertion is correct, reason is correct; reason is not a correct explanation for assertion.	c) Assertion is correct, reason is incorrect.	d) Assertion is incorrect, reason is correct.	Assertion is correct, reason is incorrect.
86	Identify the true /false statements and choose the correct alternatives.				b)

	1. Force between two charges is dependent on the product of the charges. 2. Coulomb law is valid for moving charges. 3. Coulomb law is applied for regular shapes. 4. Coulomb law is valid for point charge only.				
	a) True-True – True-True	b) True-False-True-True	c) False-True-False-True	d) False-False-True-True	True-False-True- True
87	Identify the true /false statements and choose the correct alternatives. 1. The temperature at which conductivity of a material becomes infinite is called critical temperature. 2. In superconductors, the Fermi energy level is midway between the ground state and first excited state. 3. The superconducting state is perfectly diamagnetic in nature. 4. The shifting of electrons in super conductors is prevented by classical effect.				c)
	a) True-True-True-False	b) True-False-True-False	c) True-True-True-False	d) False-False-True-True	True-True-True-False
88	Identify the true /false statements and choose the correct alternatives. 1. Magnetic susceptibility χ equals magnetisation per unit magnetic field intensity. 2. Magnetic susceptibility has the dimensions of Amp/metre. 3. In a solid, the sum of the magnetic moment in unit volume constitutes the field strength. 4. Bohr magneton is defined as magnetic moment of an electron spin.				d)
	a) True-True-True-False	b) True-False-True-False	c) True-True-True-False	d) True-False -True-True	True-False - True-True
89	Assertion (A): Twinkling of stars is due to the fact that refractive index of the earth's atmosphere fluctuates. Reason (R): Dispersion is due to Tyndall effect.				c)
	a) Assertion is correct, reason is correct; reason is a correct explanation for assertion.	b) Assertion is correct, reason is correct; reason is not a correct explanation for assertion.	c) Assertion is correct, reason is incorrect.	d) Assertion is incorrect, reason is correct.	Assertion is correct, reason is incorrect
90	In a Lorentz frame of reference, the electric field vector is given by $\vec{E} = \hat{i} + \hat{k}$ whereas the magnetic field vector is given by $\vec{B} = 2\hat{i} + \hat{j}$. If in another Lorentz frame of reference, the transformed electric field vector is parallel to the magnetic field vector, then their magnitudes will be				c)
	a) $\left\|\vec{E}\right\| = 2$ and $\left\|\vec{B}\right\| = 1$	b) $\left\|\vec{E}\right\| = \sqrt{5}$ and $\left\|\vec{B}\right\| = \sqrt{2}$	c) $\left\|\vec{E}\right\| = 1$ and $\left\|\vec{B}\right\| = 2$	d) $\left\|\vec{E}\right\| = \sqrt{2}$ and $\left\|\vec{B}\right\| = \sqrt{5}$	$\left\|\vec{E}\right\| = 1$ and $\left\|\vec{B}\right\| = 2$
91	The Poynting vectors for velocity and acceleration fields are given by				a)

	a) $S_v \alpha \frac{1}{R^4}$ and $S_a \alpha \frac{1}{R^2}$	b) $S_v \alpha \frac{1}{R^2}$ and $S_v \alpha \frac{1}{R^4}$	c) $S_v \alpha \frac{1}{R}$ and $S_a \alpha \frac{1}{R^2}$	d) $S_v \alpha \frac{1}{R^4}$ and $S_a \alpha \frac{1}{R}$	$S_v \alpha \frac{1}{R^4}$ and $S_a \alpha \frac{1}{R^2}$
92	The orientational polarizability per molecule in a polyatomic gas is proportional to temperature (T) as				c)
	a) T	b) T^2	c) $\frac{1}{T}$	d) $\frac{1}{T}$	$\frac{1}{T}$
93	The electric field of a plane wave is given by $\vec{E} = E_0 \hat{j} \sin(kx + \omega t)$. The magnetic field is given by				c)
	a) $\vec{B} = \hat{i} B_0 \sin(kz + \omega t)$	b) $\vec{B} = -\hat{i} B_0 \sin(kz + \omega t)$	c) $\vec{B} = \hat{k} B_0 \sin(kz + \omega t)$	d) $\vec{B} = -\hat{k} B_0 \sin(kz + \omega t)$	$\vec{B} = \hat{k} B_0 \sin(kz + \omega t)$
94	If the electric field of an electromagnetic wave is given by $\vec{E} = (\hat{i} E_1 + \hat{j} E_2) e^{i(\vec{k} \cdot \vec{r} - \omega t)}$, where $\hat{i}$ and $\hat{j}$ are mutually unit vectors both being perpendicular to $\hat{k}$ and E_1 and E_2 are two real numbers, then the electromagnetic wave is				a)
	a) Plane polarised	b) Circularly polarised	c) Elliptically polarised	d) unpolarised	Plane polarised
95	X-rays are electromagnetic radiations which can be deflected by				a)
	a) Electric and magnetic fields together	b) Electric fields only	c) Magnetic fields only	d) Neither electric nor magnetic fields	Electric and magnetic fields together
96	The statement that the time rate of change of electromagnetic energy within a certain volume plus time rate of the energy flowing out through the boundary surface is equal to the power transferred into the electromagnetic fields is				a)
	a) Poynting theorem	b) Ampere's circuital law	c) Conservation of momentum in electrodynamics	d) Larmor's radiation	Poynting theorem
97	The surface integral of an electric field over a closed surface enclosing a charge in free space equals $\frac{1}{\varepsilon_0}$ times the total charge enclosed by the surface. This is the statement of				b)
	a) Coulomb's law	b) Gauss's law	c) Ampere's law	d) Faraday's law	Gauss's law
98	Match the column-I and column-II and choose the correct one from the alternatives:				a)

column-I	column-II
A. Linear charge density	1. Charge volume
B. Surface charge density	2. Charge length
C. Volume charge density	3. Charge area
D. Discrete charge	4. System consisting of distribution ultimate individual charges

	a) A-2, B-3, C-1, D-4	b) A-1, B-3, C-1, D-4	c) A-3, B-1, C-2, D-4	d) A-3, B-2, C-1, D-4	A-2, B-3, C-1, D-4
99	Match the two columns regarding magnetic quantities and dimensional formulae and choose the correct one from the alternatives: **column-I** / **column-II** A. Magnetic flux — 1. $\left[M^1L^2T^{-3}A^{-1}\right]$ B. Magnetic flux density — 2. $\left[M^1L^2T^{-2}A^{-1}\right]$ C. Magnetic permeability — 3. $\left[M^1L^{-1}T^0A^1\right]$ D. Magnetic intensity — 4. $\left[M^1L\,T^{-2}A^{-1}\right]$				d)
	a) A-2, B-3, C-1, D-4	b) A-1, B-3, C-1, D-4	c) A-4, B-3, C-2, D-1	d) A-2, B-4, C-1, D-3	A-2, B-4, C-1, D-3
100	Consider the transition of liquid water to steam as water boils at a temperature of 100 °C under a pressure of 1 atmosphere. Which one of the following quantities does not change discontinuously at the transition?				b
	a) The internal energy	b) The Gibbs free energy	c) The entropy	d) The specific volume	The Gibbs free energy
101	Consider an ideal Bose gas in three dimensions with the energy-momentum relation $\varepsilon \propto p^s$ with $s > 0$. The range of s for which this system may undergo a Bose-Einstein condensation at a non-zero temperature is				c
	a) $0 < s < 1$	b) $0 < s < 3$	c) $1 < s < 3$	d) $0 < s < 3$	$1 < s < 3$
102	What is the contribution of the conduction electrons in the molar entropy of a metal with electronic coefficient of specific heat?				a
	a) γT	b) γT^2	c) γT^3	d) γT^4	γT
103	Which is correctly matched: A. Phase Space — i.Mathematical function representing the statistical properties of a system. B. Micro-states — i.Mathematical space representing all possible states of a system. C. Macro-states — i.Describes the distribution of particles in terms of their positions and momenta. D. Partition Function — v.Represents the number of ways a system can distribute its energy among its particles.				b
	a) A-iii, B-ii, C-iv, D-i	b) A-iv, B-i, C-iii, D-ii	c) A-i, B-iv, C-ii, D-iii	d) A-ii, B-iii, C-i, D-iv	A-iv, B-i, C-iii, D-ii
104	Match the following concepts with their corresponding descriptions: E. Ideal Bose Gas — v.Applies to particles with integer spin, such as photons or helium-4 nuclei. F. Ideal Bose Gas — i.Describes the distribution of particles that obey Bose-Einstein statistics.				a

	G. Principle of Detailed Balance	i.Fundamental principle ensuring equilibrium in systems with reversible processes.			
	H. Blackbody Radiation and Planck's Distribution Law	i.Describes the distribution of particles that obey Fermi-Dirac statistics.			
	a) A-ii, B-iii, C-i, D-iv	b) A-iv, B-i, C-iii, D-ii	c) A-i, B-iv, C-ii, D-iii	d) A-iii, B-ii, C-iv, D-i	A-ii, B-iii, C-i, D-iv
105	Which of the following statement(*s*) is (are) correct? A. Random walk is a mathematical model describing the trajectory of a particle undergoing a series of independent steps. B. In a random walk, the displacement of the particle after each step is correlated with its previous displacements. C. Brownian motion results from the random collisions of particles with a solvent, leading to erratic movement. D. Brownian motion is a deterministic process governed by Newton's laws of motion.				b
	a) A and B only	b) A and C only	c) B and D only	d) C and D only	A and C only
106	Which one of the following statement(s) is/are correct? A. In diamagnetic materials, the magnetic moments of individual atoms or ions align in the direction of an applied magnetic field. B. Paramagnetic materials exhibit permanent magnetization even in the absence of an external magnetic field. C. Ferromagnetic materials have a positive magnetic susceptibility. D. Diamagnetic materials experience attraction toward regions of stronger magnetic field.				c
	a) A, B and C	b) A, B and D	c) A, C and D	d) B, C and D	A, C and D
107	Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R): A. The principle of detailed balance ensures that a system in equilibrium has equal probabilities for all possible transitions between states. R. Detailed balance ensures that the rates of forward and backward processes in a reversible reaction are equal, maintaining equilibrium. In the light of the above statements, choose the correct answer from the options given below:				b
	a) A is true, but the R is false.	b) Both A and R are true, and the R is the correct explanation for the A.	c) Both A and R are true, but the R is not the correct explanation for the A	d) Both A and R are false.	Both A and R are true, and the R is the correct
108	Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R): A. Classical statistics adequately describe the behavior of particles at low temperatures and high densities. R. At such conditions, the quantum effects become negligible, and classical statistics provide accurate predictions of the system's behavior.				a

	In the light of the above statements, choose the correct answer from the options given below:				
	a) A is true, but the R is false.	b) Both A and R are true, and the R is the correct explanation for the A.	c) Both A and R are true, but the R is not the correct explanation for the A	d) Both A and R are false.	A is true, but the R is false.
109	Consider an ideal Fermi gas in a grand canonical ensemble at a constant chemical potential. The variance of the occupation number of the single particle energy level with mean occupation number $\bar{n}$ is				b
	a) $\sqrt{\bar{n}}$	b) $\bar{n}\,(1-\bar{n}\,)$	c) $\bar{n}$	d) $\frac{1}{\sqrt{\bar{n}}}$	b) $\bar{n}\,(1-\bar{n}\,)$
110	The vibrational motion of a diatomic molecule may be considered to be that of a simple harmonic oscillator with angular frequency ω. If a gas of these molecules is at temperature T, what is the probability that a randomly picked molecule will be found in its lowest vibrational state?				a
	a)$1-e^{-\frac{\hbar\omega}{k_BT}}$	b) $e^{-\frac{\hbar\omega}{2k_BT}}$	c) $\tanh\frac{\hbar\omega}{k_BT}$	d) $\operatorname{cosech}\frac{\hbar\omega}{2k_BT}$	a)$1-e^{-\frac{\hbar\omega}{k_BT}}$
111	A cavity contains blackbody radiation in equilibrium at temperature T. The specific heat per unit volume of the photon gas in the cavity is of the form $C_V=\gamma T^3$, where γ is a constant. The cavity is expanded to twice its original volume and then allowed to equilibrate at the same temperature T. The new internal energy per unit volume is				d
	a) $4\gamma T^4$	b) $2\gamma T^4$	c) γT^4	d) $\frac{\gamma T^4}{4}$	d) $\frac{\gamma T^4}{4}$
112	The relation between the internal energy U, entropy S, temperature T, pressure P, volume V, chemical potential μ and number of particles N of a thermodynamic system is $dU = TdS - PdV + \mu dN$. That U is an exact differential implies that				a
	a) $-\frac{\partial P}{\partial S}\Big\vert_{V,N}=\frac{\partial T}{\partial V}\Big\vert_{S,N}$	b) $P\frac{\partial U}{\partial T}\Big\vert_{V,N}=-S\frac{\partial U}{\partial V}\Big\vert_{S,\mu}$	c) $P\frac{\partial U}{\partial T}\Big\vert_{V,N}=-\frac{1}{T}\frac{\partial U}{\partial V}\Big\vert_{S,\mu}$	d) $\frac{\partial P}{\partial S}\Big\vert_{V,N}=\frac{\partial T}{\partial V}\Big\vert_{S,N}$	a) $-\frac{\partial P}{\partial S}\Big\vert_{V,N}=\frac{\partial T}{\partial V}\Big\vert_{S,N}$
113	The Hamiltonian for three Ising spins S_0, S_1 and S_2, taking values ± 1, is $H = JS_0\,(S_1+S_2)$. If the system is in equilibrium at temperature T , the average energy of the system, in terms of $\beta=(k_BT)^{-1}$, is				d
	a) $-\frac{1+\cosh(2\beta J)}{2\beta\sinh(2\beta J)}$	b) $-2J[1+\cosh(2\beta J)]$	c) $-2/\beta$	d) $-2J\frac{\sinh(2\beta J)}{1+\cosh(2\beta J)}$	d) $-2J\frac{\sinh(2\beta J)}{1+\cosh(2\beta J)}$
114	The type of crystal having lowest cohesive energy in				d
	a) Ionic crystal	b) Covalent crystal	c) Metals	d) Molecular crystal	Molecular crystal
115	A two dimensional square lattice has n-fold rotational symmetry. The value of n is				d
	a) 1	b) 2	c) 3	d) 4	4
116	In Debye's theory, the energy distribution of atomic oscillators follow				a
	a) Maxwell-Boltzmann distribution	b) Bose-Einstein distribution	c) Fermi-Dirac distribution	d) Kelvin-Stokes distribution	Maxwell-Boltzmann distribution
	Which is correctly matched?				b

117	A Schottky defect — i hole trapped in positive ion vacancy B Frankel defect — ii electron trapped in negative ion vacancy C F-centre — iii vacancy and interstitial D V-centre — iv pair of ionic vacancies of opposite charge				
	a) A-iii, B-iv, C-ii, D-i	b) A-iv, B-iii, C-ii, D-i	c) A-ii, B-iv, C-i, D-iii	d) A-iv, B-i, C-ii, D-iii	A-iv, B-iii, C-ii, D-i
118	In band theory of solids, the extent of freedom of depends on (i) the effective mass (ii) the gravitational mass (iii) curvature of the band (iv) the band gap of the material The true option/s is/are				a
	a) (i) and (iii)	b) (i) only	c) (ii) only	d) (ii) and (iv)	(i) and (iii)
119	5-fold rotational symmetry is (i) not possible in any crystal system (ii) possible in C_{60} (iii) possible in a hexagonal crystal system (iv) possible in Si The true option/s is/are				b
	a) (i) only	b) (ii) only	c) (ii) and (iv)	d) (iii) only	(ii) only
120	Hall effect can be used to find (i) carrier concentration (ii) carrier type (iii) mobility (iv) magnetic flux density The true option/s is/are				d
	a) (i) and (ii)	b) (i), (iii) and (iv)	c) (i), (ii) and (iv)	d) (i), (ii), (iii) and (iv)	(i), (ii), (iii) and (iv)
121	Assertion (A): One dimensional array of identical atoms behaves as continuous string for all frequency regime. Reason (R): Angular frequency is proportional to wavevector only when wavelength is much smaller than interatomic spacing. In the light of the above statements, choose the correct answer				d
	a) Both A and R are true	b) A is false but R is true	c) A is true but R is false	d) Both A and R are false	Both A and R are false
122	Assertion (A): Electron mobility decreases with increase in temperature. Reason (R): Relaxation time increases with increase in temperature.				c
	a) Both A and R are true	b) A is false but R is true	c) A is true but R is false	d) Both A and R are false	A is true but R is false
123	If energy required to create a vacancy in the crystal is 1 eV at temperature 1000 K, then the ratio of vacancies to total atoms is				c
	a) 0.1	b) 0.01	c) 0.001	d) 0.0001	0.001
124	An n-type Ge strip, 1 mm wide and 1 mm thick, has a Hall coefficient of 10^{-2} m^3/coulomb. If for a current of 1 mA the Hall voltage produced inside the strip is 1 mV, the strength of the magnetic field is				b
	a) 1 T	b) 0.1 T	c) 0.001T	d) 0.0001 T	0.1 T
125	The velocities of longitudinal and transverse waves in aluminium are 6374 and 3111 ms^{-1}, respectively. The Debye temperature for aluminium is				a

	a) 407.6 K	b) 706.4 K	c) 606.4 K	d) 340 K	407.6 K
126	For lead, the critical field at 0K is 6.39×10^4 A/m and the critical temperature for zero magnetic field is 7.18K. The critical field for lead at 4K is				c
	a) 2 x 10^{-2} A/m	b) 20 A/m	c) 4×10^4 A/m	d) 40 A/m	4×10^4 A/m
127	Cs metal (atomic weight 130) has a cubic unit cell of side 6Å. If the density of Cs is 2 g/cm^3, the number of atoms per unit volume is				b
	a) 1	b) 2	c) 4	d) 6	2
128	Choose the correct statement for magnitude of threshold energy of an endoergic nuclear reaction between stationary nucleus and a moving projectile.				a
	a) It is greater than |Q| of nuclear reaction.	b) It has to be more than kinetic energy of a projectile.	c) It is less than |Q| of nuclear reaction.	d) It has to be equal to kinetic energy of a projectile.	It is greater than |Q| of nuclear reaction.
129	The quarks are supposed to exist in following number of flavours:				c
	a) Two	b) Four	c) Six	d) Sixteen	Six
130	According to shell model of the nucleus which is incorrect?				b
	a) Magic numbers exist	b) Nucleons interact with their nearest neighbours only	c) Nucleons in a nucleus interact with a general force field	d) Large electronic quadrupole moment exists for certain nuclei	Nucleons interact with their nearest neighbours only
131	In the semi-empirical formulae the observed parity of odd Z and odd N nuclei in nature is taken care of by the				c
	a) Surface energy term	b) Coulombs energy term	c)δ - term	d) Asymmetry term	δ - term
132	Consider Fermi theory of β-decay. The number of final states of electrons corresponding to momenta between p and p + dp is				c
	a) Independent of p	b) Proportional to pdp	c) Proportional to p^2dp	d) Proportional to p^3dp	Proportional to p^2dp
133	If a U-238 nucleus splits into two identical parts, the two nuclei so produced will be				b
	a) radioactive	b) stable	c) isotope	d) isobar	Answer stable
134	Which is correct from the following statements: A. Neutron interacts through electromagnetic interaction. B. Electron does not interact through weak interaction. C. Neutrino interacts through weak and electromagnetic interaction. D. Quark interacts through strong interaction but not through weak interaction.				d)
	a) A and C	b) B and C	c) A and D	d) only A	only A

<table>
<tr><td>135</td><td colspan="4">With reference to nuclear forces which of the following statements is not true?
The nuclear forces are
A. Short range
B. Charge independent
C. Velocity dependent
D. Spin independent</td><td>C</td></tr>
<tr><td></td><td>a) A and D</td><td>b) B and D</td><td>c) Only D</td><td>d) Only C</td><td>Only D</td></tr>
<tr><td>136</td><td colspan="4">In case of a Geiger – Muller (GM) counter, which is correct from the following statements:
A. Multiplication factor of the detector is of the order of 10^{10}
B. Type of the particles detected can be identified
C. Energy of the particles detected can be distinguished
D. Operating voltage of the detector is few tens of Volts</td><td>a</td></tr>
<tr><td></td><td>a) Only A</td><td>b) A and B</td><td>c) Only D</td><td>d) B and D</td><td>Only A</td></tr>
<tr><td>137</td><td colspan="4">Given below are two statements: one labelled as Assertion (A) and other labelled as Reason (R):
Assertion (A) :
The binding energy of the nucleus increases with the increase in atomic number.
Reason (R):
Heavier elements have a greater number of non-radioactive isotopes than radioactive isotopes.
Select your answer:</td><td>c</td></tr>
<tr><td></td><td>a) Both Assertion and Reason are correct and Reason is the correct explanation for Assertion.</td><td>b) Both Assertion and Reason are correct and Assertion is the correct explanation for Reason.</td><td>c) Assertion is correct but Reason is incorrect.</td><td>d)Both Assertion and Reason are incorrect</td><td>Assertion is correct but Reason is incorrect.</td></tr>
<tr><td>138</td><td colspan="4">A one-dimensional rigid rod is constrained to move inside a sphere such that its two ends are always in contact with the surface. The number of constraints on the Cartesian coordinates of the endpoints of the rod is</td><td>a)</td></tr>
<tr><td></td><td>a)3</td><td>b)5</td><td>c)2</td><td>d)4</td><td>a)3</td></tr>
<tr><td>139</td><td colspan="4">Match List-I with List-II:
<table><tr><td>A Poisson bracket</td><td>i Motion in a central potential</td></tr><tr><td>B Quantum harmonic oscillator</td><td>ii Fourier Transform</td></tr><tr><td>C Hydrogen atom</td><td>iii Commutator</td></tr><tr><td>D Wave function in position and momentum representations</td><td>iv Uniform energy level spacing</td></tr></table></td><td>a)</td></tr>
<tr><td></td><td>a) A – iii , B – iv, C – i, D -- ii</td><td>b) A – ii, B – iv, C – i, D -- iii</td><td>c) A – iii , B – i, C – iv, D -- ii</td><td>d) a) A – iv , B – iii, C – ii, D -- i</td><td>a) A – iii , B – iv, C – i, D -- ii</td></tr>
</table>

140	For a particle moving in a central potential A. Acceleration is constant B. Total energy is constant C. Velocity is constant D. Angular Momentum is constant				d)
	a) A & B are True	b) A & C are true	c) B, D and C are true	d) B & D are true	d) B & D are true
141	A: $\psi(x,t) = \frac{a}{x^2} e^{i\omega t}$ is a valid wave-function. B: $\psi(x,t)$ is well-defined at $x = 0$.				c
	a) Both A and R are true and R is the correct explanation of A	b) Both A and R are true and R is NOT the correct explanation of A	c) Both A and R are false	d)A is false B is true	c) Both A and R are false
142	Two particles each of rest mass m collide head-on and stick together. Before collision, the speed of each mass was 0.6 times the speed of light in free space. The mass of the final entity is				c
	a) 5m / 4	b) 2m	c) 5m / 2	d) 25m / 8	c) 5m / 2
143	The energy levels available to each electron in a system of N non-interacting electrons are $E_n = nE_0$, n = 0,1, 2,... . A magnetic field, which does not affect the energy spectrum, but completely polarizes the electron spins, is applied to the system. The change in the ground state energy of the system is				d
	a) $\frac{n^2E_0}{2}$	b) n^2E_0	c) $\frac{n^2E_0}{8}$	d) $\frac{n^2E_0}{4}$	d) $\frac{n^2E_0}{4}$
144	Match List-I with List-II: A Wave nature of electrons — i Michelson-Morley experiment B Speed of light is constant — ii Compton effect C Particle nature of light — iii Stern-Gerlach Experiment D Quantization of Angular momentum — iv Davisson-Germer Experiment				d
	a) A -ii, B- i, C – iv, D - iii	b) A -i, B- iv, C – ii, D - iii	c) A -iii, B- i, C – ii, D - iv	d) A -iv, B- i, C – ii, D - iii	d) A -iv, B- i, C – ii, D - iii
145	Two angular momenta with quantum numbers j1 = 3/2 and j2 = 5/2 are added. The possible values of j, the resultant angular momentum states are A 4, 3, 2, 1 B 4, 1 C 4, 3, 2, 1, 0 D +4, -4, +1, -1				c
	a) B is True	b) D is True	c) A is True	d) C is True	c) A is True

146	Match List-I with List-II A Continuous symmetry – i least Action B Hamilton's principle – ii conserved quantity C Hamiltonian mechanics – iii configuration space D Lagrangian mechanics – iv phase space				b
	a) A – i, B – ii, C – iii, D -- iv	b) A – ii, B – i, C – iv, D -- iii	c) A – iii, B – i, C – iv, D -- ii	d) A – ii, B – i, C – iii, D -- iv	b) A – ii, B – i, C – iv, D -- iii
147	A particle, thrown with a speed v from the earth's surface, attains a maximum height h (measured from the surface of the earth). If v is half the escape velocity and R denotes the radius of earth, then h / R is				b
	a)2/3	b)1/3	c)1/4	d)1/2	b)1/3
148	Consider a Hamiltonian $H = AI + B\sigma_x + C\sigma_y$, where A, B and C are positive constants, I is the 2 × 2 identity matrix and $\sigma_x, \sigma_y$are Pauli matrices. If the normalized eigenvector corresponding to its largest energy eigenvalue is $\frac{1}{\sqrt{2}}(1y)$then y is				Answer option (a,b,c or d)
	a)$\frac{B+iC}{\sqrt{B^2+C^2}}$	b)$\frac{A-iB}{\sqrt{A^2+B^2}}$	c)$\frac{A-iC}{\sqrt{A^2+C^2}}$	d)$\frac{B-iC}{\sqrt{B^2+C^2}}$	a)$\frac{B+iC}{\sqrt{B^2+C^2}}$
149	If the expectation value of the momentum of a particle in one dimension is zero, then its (box-normalizable) wave function may be of the form				Answer option (a,b,c or d)
	a) sin kx	b)e^{ikx} sin kx	c)e^{ikx}cos kx	d) sin kx + e^{ikx} cos kx	a) sin kx
150	If the Lagrangian of a particle moving in one dimensions is given by $L = \frac{\dot{x}^2}{2x} - V(x)$the Hamiltonian is				a)
	a) $\frac{1}{2}xp^2 + V(x)$	b) $\frac{\dot{x}^2}{2x} + V(x)$	c) $\frac{1}{2}\dot{x}^2 + V(x)$	d) $\frac{p^2}{2x} + V(x)$	a) $\frac{1}{2}xp^2 + V(x)$