

This booklet consists of **100** questions and **12** printed pages.

RGUCET/____/____

Series

NIL

RGUCET 2023
M.Sc. in PHYSICS

Full Marks: 100

Time: 2 Hours

Roll No.

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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). 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 15 minutes after the commencement of the entrance test or leave the examination hall before 30 minutes of end 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 candidate(s) is/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, RGU shall be final and binding.
9. The OMR Answer Sheet consists of two copies, the Original copy and the Student's copy.

1	The Chairman is ill and we'll have tothe meeting for few days.				d)	put off
	a) put on	b) put off	c) put away	d) put down		
2	I am alive.....my danger.				c	to
	a) at	b) with	c) to	d) in		
3	What he is telling you.....thinkable.				b	is
	a) are	b) is	c) am	d) were		
4	Choose the word from the options given below that is most nearly opposite in meaning to the given word: Frequency				b	Rarity
	a) Periodicity	b) Rarity	c) Gradualness	d) Persistency		
5	Were you a bird, you _____ in the sky.				a	would fly
	a) would fly	b) shall fly	c) should fly	d) shall have flown		
6	A 650 TFLOPS-Supercomputing facility is set to be installed in which institution?				c)	IIT Guwahati
	a) IIT Mumbai	b) IIT Delhi	c) IIT Guwahati	d) IIT Chennai		
7	Which of the following institute/university is recently set to establish its first international campus in Tanzania?				a	IIT Madras
	a) IIT Madras	b) IIT Mumbai	c) DU	d) IITR		
8	Who will be conferred the 2023 International Prize in Statistics?				d	Calyampudi Radhakrishna Rao
	a) Linda J.S. Allen	b) Terence Tao	c) Manjul Bhargava	d) Calyampudi Radhakrishna Rao		
9	Currently, how many languages are listed in the eight schedule of constitution				c)	22
	a) 24	b) 21	c) 22	d) 20		
10	Name an antiviral medicine used for a clinical trial by Gilead Sciences for COVID-19 treatment?				c)	Remdesivir
	a) Favipiravir	b) Triazavirin	c) Remdesivir	d) None of the above		
11	Diamond city of India is				b	Surat
	a) Ahmedabad	b) Surat	c) Gandhinagar	d) Rajkot		
12	In which city was a large, silent wave of COVID-19 detected in a wastewater study?				b	Bengaluru
	a) Chennai	b) Bengaluru	c) Cuttack	d) Dehradun		
13	Which company collaborated with the Indian Navy to perform a successful trial of the BMD Interceptor launched from a naval platform?				a	DRDO
	a) DRDO	b) NASA	c) ISRO	d) SAARC		
14	Richest source of carbohydrates is				a	Rice
	a) Rice	b) Maize	c) Wheat	d) Barley		

15	There are ten men in a joint family. Each man has one boy and one girl. How many siblings are there in total?				b	30
	a) 25	b) 30	c) 20	d) 10		
16	If A is to 1, Z is to 26, H is 8, then P is to				a	16
	a) 16	b) 12	c) 15	d) 14		
17	Select the word that can be from the word 'MEASUREMENT'				c	MASTER
	a) SUMMIT	b) MANTLE	c) MASTER	d) ASSURE		
18	Find the meaningful order of 1) Pupa 2) Larva 3) Moth 4) Eggs				b	4,2,1,3
	a) 1,4,2,3	b) 4,2,1,3	c) 1,3,4,2	d) 4,1,2,3		
19	In a race five drivers were in the following situation. M was following V, R was just ahead of T and K was the only one between T and V. Who was in the second place at that instant?				c)	T
	a) V	b) R	c) T	d) K		
20	A cyclist covers a certain distance at a constant speed. If a jogger covers half the distance in double the time as the cyclist, the ratio of the speed of the jogger to that of the cyclist is				a)	1: 4
	a) 1: 4	b) 4: 1	c) 1:2	d) 2:1		
21	The value of $1 + 4 * 9 + 6 * 9^2 + 4 * 9^3 + 9^4$ is				c	10^4
	a) 10^2	b) 10^6	c) 10^4	d) 10^5		
22	How many diagonals will be there in a polygon with 10 sides?				d	35
	a) 32	b) 34	c) 36	d) 35		
23	The roots of $ax^2 + bx + c = 0$ are real and positive. Then $ax^2 + b x + c = 0$ has				d	4 real roots
	a) No roots	b) 2 real roots	c) 3 real roots	d) 4 real roots		
24	A multiple choice exam has 4 questions, each with 4 answer choices. Every question has only one correct answer. The probability of getting all answers correct by independent random guesses for each one is				b)	$(1/4)^4$
	a) 14	b) $(1/4)^4$	c) $3/4$	d) $(3/4)^4$		
25	In a college admission where applicants have to choose only one subject, $1/4$ th of the applicants opted for Biology. $1/6$ th for chemistry, $1/8$ th for Physics and $1/12$ th for Maths. 18 applicants did not opt for any of the above four subjects. How many applicants were there?				d)	48
	a) 22	b) 24	c) 36	d) 48		

DOMAIN

26	When a pure semiconductor is heated, its resistance				d)	Goes down
	a) Goes up	b) Goes down	c) Remains the same	d) None of the above		
27	Addition of trivalent impurity to a semiconductor creates many				a)	Holes
	a) Holes	b) Free electrons	c) Valence electrons	d) Bound electrons		
28	A hole in a semiconductor is defined as				b)	The incomplete part of an electron pair bond
	a) A free electron	b) The incomplete part of an electron pair bond	c) A free neutron	d) A free proton		
29	In a semiconductor, current conduction is due to				c)	Holes and free electrons
	a) Only holes	b) Only free electrons	c) Holes and free electrons	d) None of the above		
30	The barrier voltage at a pn junction for germanium is about				d)	0.3 V
	a) 5 V	b) 3 V	c) Zero	d) 0.3 V		
31	In the depletion region of a pn junction, there is a shortage of				b)	Holes and electrons
	a) Acceptor ions	b) Holes and electrons	c) Donor ions	d) None of the above		
32	The leakage current across a pn junction is due to				b)	minority carriers
	a) minority carriers	b) majority carriers	c) Junction capacitance	d) None of the above		
33	For operation of a bipolar junction transistor as an amplifier, the transistor operates in				c)	Active region
	a) Cut off region	b) Saturation region	c) Active region	d) Deep in saturation		
34	The dc load line of a transistor				b)	Has a negative
	a) Has a	b) Has a negative	c) Is a plot of	d) None of the above		

	positive slope	slope	I_C vs I_B			slope
35	The biasing method which is considered independent of transistor β_{dc} is				c)	Voltage divider bias
	a) Fixed biasing	b) Collector feedback bias	c) Voltage divider bias	d) Base bias with collector feedback		
36	For transistor, the h_{fe} parameter is same as				b)	β_{ac}
	a) β_{dc}	b) β_{ac}	c) α_{dc}	d) r_e		
37	The JFET is				c)	Voltage controlled device
	a) A bipolar device	b) Current controlled device	c) Voltage controlled device	d) None of the above		
38	For low values of V_{DS} , the JFET behaves like a				a)	Resistance
	a) Resistance	b) Constant voltage device	c) Constant current device	d) Negative resistor		
39	In electronic communication, modulation process is done in					Transmitter
	a) Transmitter	b) Receiver	c) Both in transmitter and receiver	d) None of the above		
40	The representation of octal number $(532.2)_8$ in decimal is _____				a)	$(346.25)_{10}$
	a) $(346.25)_{10}$	b) $(532.864)_{10}$	c) $(340.67)_{10}$	d) $(531.668)_{10}$		
41	The decimal equivalent of the binary number $(1011.011)_2$ is _____				a)	$(11.375)_{10}$
	a) $(11.375)_{10}$	b) $(10.123)_{10}$	c) $(11.175)_{10}$	d) $(9.23)_{10}$		
42	The potential difference required to store $24 \mu C$ of charge on a $6 \mu F$ capacitor is				a)	4V
	a) 4V	b) 0.25V	c) 40V	d) 144 V		
43	For a black body radiation in a cavity, photons are created and annihilated freely as a result of emission and absorption by the walls of					

	the cavity. This is because					
	a) the chemical potential of the photons is zero	b) photons obey Pauli exclusion principle	c) photons are spin-1 particles	d) the entropy of the photons is very large	a)	the chemical potential of the photons is zero
44	<p>The energy levels of a particle of mass m in a potential of the form</p> $V(x) = \infty, \quad x \leq 0$ $V(x) = \frac{1}{2} m \omega^2 x^2, \quad x > 0$ <p>Are given, in terms of quantum number $n = 0, 1, 2, 3, \dots$ by</p>					
	a) $(n + \frac{1}{2}) \hbar \omega$	b) $(2n + \frac{1}{2}) \hbar \omega$	c) $(2n + \frac{3}{2}) \hbar \omega$	d) $(n + \frac{3}{2}) \hbar \omega$	a)	$(n + \frac{1}{2}) \hbar \omega$
45	The motion of wave packet is similar to					
	a) Photons	b) Waves	c) Classical Particle	d) Quantum Particle	d)	Quantum Particle
46	The wavelength λ associated with a particle of mass m moving with velocity v is given by					
	a) $\lambda = \frac{h}{mv}$	b) $\lambda = \frac{m}{hv}$	c) $\lambda = \frac{hv}{m}$	d) $\lambda = \frac{mv}{h}$	a)	$\lambda = \frac{h}{mv}$
47	De-Broglie wavelength of a material particle having a kinetic energy, E is proportional to					
	a) \sqrt{E}	b) $\frac{1}{\sqrt{E}}$	c) E	d) $\frac{1}{E}$	b)	$\frac{1}{\sqrt{E}}$
48	If the momentum of a particle is increased to four times, then the de-Broglie wavelength will become:					
	a) two times	b) four times	c) half times	d) one-fourth times	d)	one-fourth times
49	de- Broglie wavelength of an electron which has been accelerated from rest through a potential difference of 100 V is					

	a) 12.27 \AA	b) 1.227 \AA	c) 15 \AA	d) 1.5 \AA	d)	1.5 \AA
50	Davisson and Germer experiment relate to:				c)	diffraction
	a) interference	b) polarization	c) diffraction	d) None of these		
51	A spherical shell of radius R has a charge $+q$ units. The electric field at a point				c)	inside the shell is zero and varies as $1/R^2$ outside it
	a) inside the shell is zero and varies as $1/R$ outside it	b) inside the shell is constant and varies as $1/R^2$ outside it	c) inside the shell is zero and varies as $1/R^2$ outside it	d) inside the shell is constant and varies as $1/R$ outside it		
52	The divergence of the curl of a vector field is				c)	zero
	a) a scalar	b) a vector	c) zero	d) infinity		
53	The charge build up in the capacitor is due to which quantity?				a)	Conduction current
	a) Conduction current	b) Displacement current	c) Convection current	d) Direct current		
54	A circuit containing resistor R_1 , inductor L_1 and capacitor C_1 connected in series gives resonance at the same frequency f as the second similar combination R_2 , L_2 and C_2 . If the two circuits are connected in series, the whole circuit will resonate at the frequency				c)	f
	a) $2f$	b) $f/2$	c) f	d) $f/4$		
55	A capacitor of 250 pF is connected in parallel with a coil having inductance of 16 mH and effective resistance 20 ohm . The circuit impedance at resonance is				d)	$3.2 \times 10^6 \text{ ohm}$
	a) $3.2 \times 10^4 \text{ ohm}$	b) $3.2 \times 10^3 \text{ ohm}$	c) $3.2 \times 10^2 \text{ ohm}$	d) $3.2 \times 10^6 \text{ ohm}$		
56	Parallel wires carrying currents in the same direction				d)	attract each other.
	a) have no action on each other.	b) repel each other.	c) exert torque on each other.	d) attract each other.		

57	Two conducting coils are placed near each other. If a time varying current is passed through one coil				a)	an emf is induced in both the coils
	a) an emf is induced in both the coils	b) an emf is induced in the other coil	c) an emf is induced in the same coil	d) no net emf is induced in any coil		
58	A purely capacitive load is driven by a sinusoidal voltage source. If the frequency of the input voltage is increased the corresponding current amplitude in the circuit				a)	increases linearly
	a) increases linearly	b) decreases linearly	c) increases quadratically	d) decreases quadratically		
59	Which of the following quantities cannot be measured by Hall Effect ?				d)	Diffusion constant
	a) Mobility of charge carriers	b) Carrier concentration	c) Sign of the charge carriers	d) Diffusion constant		
60	In any collision, the parameter that is conserved is				c)	linear momentum
	a) kinetic energy	b) angular momentum	c) linear momentum	d) potential energy		
61	Energy required to move a body of mass m from an orbit of radius $2R$ to $3R$ is (symbols in the options have usual meanings) ?				d)	$GMm / 6R$
	a) $GMm / (12R^2)$	b) $GMm / (3R^2)$	c) $GMm / 8R$	d) $GMm / 6R$		
62	A simple pendulum is attached to the roof of a lift. If T denote the time-period oscillation of this pendulum while the lift is stationary, then what will be the frequency of oscillation of the pendulum when the lift is freely falling under earth's gravity ?				a)	zero
	a) zero	b) T	c) $1/T$	d) infinite		
63	The transverse nature of light is shown by				c)	polarization
	a) interference	b) refraction	c) polarization	d) dispersion		
64	In the phenomenon of diffraction of light, when blue light is used in the experiment instead of red light, then					

	a) fringes will become narrower	b) fringes will become broader	c) no change in fringe width	d) none of the above	a)	fringes will become narrower
65	When exposed to sunlight, thin films of oil on water often exhibit brilliant colours due to the phenomenon of				a)	interference
	a) interference	b) diffraction	c) dispersion	d) polarization		
66	In Young's double slit experiment, 12 fringes are observed to be formed in a certain segment of the screen, when light of wavelength 600 nm is used. If the wavelength of light is changed to 400 nm, number of fringes observed in the same segment of the screen is				b)	18
	a) 12	b) 18	c) 24	d) 30		
67	A source of sound of frequency 600 Hz is placed inside water. The speed of sound in water is 1500 m/s and in air it is 300 m/s. The frequency of sound recorded by an observer who is standing in air, is				d)	600 Hz
	a) 200 Hz	b) 3000 Hz	c) 120 Hz	d) 600 Hz		
68	A travelling wave in a stretched string is described by the equation $y = A \sin(kx - \omega t)$. The maximum particle speed is				a)	$A\omega$
	a) $A\omega$	b) ω/k	c) $d\omega/dk$	d) x/t		
69	A whistle giving out sound of frequency 450 Hz approaches a stationary observer at a speed of 30 m/s. What is the frequency heard by the observer? (Assume speed of sound 330 m/s)				d)	495 Hz
	a) 409 Hz	b) 429 Hz	c) 517 Hz	d) 495 Hz		
70	The solution of $\frac{d^2x}{dt^2} + \omega^2x = 0$ is				d)	$e^{\pm i\omega t}$
	a) $e^{\pm i\omega t}$	b) $\sin x$	c) $\cos x$	d) $e^{\pm i\omega t}$		
71	The integrating factor of $\frac{dy}{dx} + 2xy = e^{-x^2}$ is				b)	e^{x^2}
	a) e^{2x}	b) e^{x^2}	c) e^{-x^2}	d) e^x		
72	The average value of the function $f(x) = x$ in the interval 1 to 2 is					

	a) 1.2	b) 1.4	c) 1.5	d) 0.5	c	1.5
73	Periodic function of half-wave symmetry is necessarily				d	neither odd or even
	a) an odd	b) an even	c) both odd and even	d) neither odd or even		
74	If $A = \begin{pmatrix} 0 & 1 & 1 \\ -1 & 0 & 1 \\ -1 & -1 & 0 \end{pmatrix}$, then A is				b	Skew-symmetric
	a) Hermitian	b) Skew-symmetric	c) Symmetric	d) Skew Hermitian		
75	The unit normal vector to the surface $\phi = x^2 - 3xy$ at P(-1,1,-1) is				b	(-5,3)
	a) (-5,2)	b) (-5,3)	c) (1,3)	d) (4,3)		
76	The differential equation of the form $\frac{d}{dx} \left(\frac{dy}{dx} (1-x^2) \right) + n(n+1)y = 0$ where n is a constant, is				a	Legendre differential equation
	a) Legendre differential equation	b) Bessel differential equation	c) Laguerre differential equation	d) Bessel differential equation		
77	The value of the integral $\int_{-\infty}^{\infty} e^{-x^2} dx$ is				c	$\sqrt{\pi}$
	a) π	b) $\pi/2$	c) $\sqrt{\pi}$	d) $\sqrt{\pi}/2$		
78	The Hermite polynomial appears in the problem of				c	Harmonic oscillator problem
	a) Hydrogen atom problem	b) Drum vibration problem	c) Harmonic oscillator problem	d) Electrostatic problem		
79	The phase of the complex function $f(z) = e^z$ where $z=x+iy$, is				a	y/x
	a) y/x	b) x/y	c) x	d) y		
80	The degree of the polynomial obtained as a solution from the differential					

	equation $x \frac{d^2 y}{dx^2} + (1-x) \frac{dy}{dx} + ny = 0$ is				a	n
	a) n	b) n+1	c) n-1	d) n+2		
81	Suppose for all z in the entire complex plane, f(z) is analytic and bounded. Then the function must be a constant. This the statement of				d	Liouville's theorem
	a) Gauss' mean value theorem	b) Rouché's theorem	c) Cauchy Riemann theorem	d) Liouville's theorem		
82	A vector field is $\vec{F} = 2x\hat{i} + y\hat{j}$ newtons. The work done from the origin to a point (1,1) will be				b	1.5
	a) 1	b) 1.5	c) 2	d) 2.5		
83	The rotational vector whose magnitude is the maximum circulation of a vector per unit area as the area tends to zero and whose direction is the normal direction of the area is				a	the curl of the vector
	a) the curl of the vector	b) the divergence of the vector	c) the gradient of the vector	d) Green's theorem		
84	$\nabla^2(\ln(r))$ equals				d	$\frac{1}{r^2}$
	a) $\frac{\vec{r}}{r^2}$	b) r	c) $\frac{\vec{r}}{r^3}$	d) $\frac{1}{r^2}$		
85	The amount of flux diverging from a point source per unit time is called				b	the divergence of the vector
	a) the curl of the vector	b) the divergence of the vector	c) the gradient of the vector	d) Green's theorem		
86	Surface integral to volume integral involves in				a	Gauss's divergence theorem
	a) Gauss's divergence theorem	b) Stroke's theorem	c) Green's theorem	d) Green's identity relation		

87	The semi-empirical mass formula for the binding energy of nucleus contains a surface correction term. This term depends on the mass number A of the nucleus as				c	$A^{2/3}$
	a) $A^{-1/3}$	b) $A^{1/3}$	c) $A^{2/3}$	d) A		
88	Two gases separated by an impermeable but movable partition are allowed to freely exchange energy. At equilibrium, the two sides will have the same				a	Pressure and temperature
	a) Pressure and temperature	b) Volume and temperature	c) Pressure and volume	d) Volume and energy		
89	The ratio of two specific heats of a diatomic gas is				c	1.40
	a) 1.66	b) 1.33	c) 1.40	d) 1.52		
90	The Gibb's potential is defined as				d	$G = U + PV - TS$
	a) $G = U - PV + TS$	b) $G = U + PV + TS$	c) $G = U - PV - TS$	d) $G = U + PV - TS$		
91	When applied to solar radiation, Planck's law reduces to Wien's law in the				a	Ultraviolet region
	a) Ultraviolet region	b) Microwave region	c) Infrared region	d) Visible region		
92	A second order phase transition is characterized by				b	A discontinuous change in its specific heat
	a) A latent heat	b) A discontinuous change in its specific heat	c) A change in volume	d) Irreversible behaviour during warming and cooling		
93	The melting point a solid is lowered by increase in pressure when the solid melts, its volume				b	Decreases

	a) Increases	b) Decreases	c) Does not change	d) None of these		
94	The uncertainty relation cannot hold for the following pairs				c	Linear momentum and angle
	a) Position and momentum	b) Energy and time	c) Linear momentum and angle	d) Angular momentum and angle		
95	Which of the following is not a Fermion?				d	Photon
	a) Electron	b) Muons	c) Neutrons	d) Photon		
96	The angular momentum of an atomic electron is				b	Quantized in magnitude and direction both
	a) Not quantized	b) Quantized in magnitude and direction both	c) Quantized in magnitude only	d) Quantized in direction only		
97	In case more than one linearly independent wave function belong to the same energy E the level is said to be				a	Degenerate
	a) Degenerate	b) Non-degenerate	c) Orthogonal	d) Orthonormal		
98	What is the possible number of different types of Bravais lattices in 3D?				C	14
	a) 4	b) 7	c) 14	d) 18		
99	At normal magnetic field strengths and ordinary temperature, Langevin's theory lead to				a	Curie's law
	a) Curie's law	b) Domain theory	c) Diamagnetic theory	d) Weber's law		
100	Fermi level is the top most energy level of the electrons at				b	0 K
	a) room temperature	b) 0 K	c) NTP	d) 273 K		

SPACE FOR ROUGH WORK