(Set–"X")

(DO NOT OPEN THIS QUESTION BOOKLET BEFORE TIME OR UNTIL YOU ARE ASKED TO DO SO)

(M.Phil/Ph.D/URS–EE–2018)

Code **A**

Subject : PHYSICS

Sr. No. 100005

Time : 1¼ Hours   Max. Marks : 100   Total Questions : 100

Roll No. _____ (in figure) _____ (in words)

Name : _____   Father's Name : _____

Mother's Name : _____   Date of Examination : _____

(Signature of the candidate)   (Signature of the Invigilator)

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3. Keeping in view the transparency of the examination system, carbonless OMR Sheet is provided to the candidate so that a copy of OMR Sheet may be kept by the candidate.
4. Question Booklet along with answer key of all the A, B, C, D code will be got uploaded on the University website after the conduct of Entrance Examination. In case there is any discrepancy in the Question Booklet / Answer Key, the same may be brought to the notice of the Controller of Examination in writing / through E.Mail within 24 hours of uploading the same on the University Website. Thereafter, no complaint in any case, will be considered
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6. There will be no Negative marking. Each correct answer will be awarded one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.
7. Use only Black or Blue **BALL POINT PEN** of good quality in the OMR Answer-Sheet.
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Question No.	Questions
1.	The dielectric constant of a material at optical frequency is mainly due to : (1) Ionic polarizability (2) Electronic polarizability (3) Dipolar polarizability (4) Ionic & dipolar polarizability
2.	When a mono-atomic gas is placed in a uniform electric field (E), the displacement of the nucleus is proportional to : (1) E^2 (2) E^3 (3) E (4) Independent of E
3.	In dielectric, the polarization is the function of : (1) Square of applied field (2) Applied field (3) Exponential of applied field (4) Logarithmic of applied field
4.	The electric vector E and magnetic vector H, inside a conductor : (1) Are never in phase (2) Remains in phase (3) Phase depends upon the conductivity of medium (4) None of these

Question No.	Questions
5.	Two plane waves having the same angular frequency, dielectric constant, amplitude (E) and opposite circular polarization is superimposed. The resulting wave is : (1) Linearly polarized with amplitude E (2) Linearly polarized with amplitude 2E (3) Linearly polarized with amplitude 4E (4) Circularly polarized with amplitude E
6.	In the Rayleigh scattering, the amount of scattered light is proportional to : (1) $1/\lambda^4$ (2) $1/\lambda^2$ (3) $1/\lambda^3$ (4) $1/\lambda^2$
7.	A ray of light in a dense medium of refractive index 1.4 approaches the boundary between given medium and air at an angle of $\theta = \sin^{-1}(0.8)$. Then the ray will be : (1) Totally absorbed (2) Internally reflected (3) Showing an arbitrary behavior (4) Emerging at an angle greater than corresponding to $\sin^{-1}(0.8)$
8.	The path of charged particle in a crossed electric and magnetic field is : (1) Parabolic (2) A Cycloid (3) Hyperbolic (4) Circular

Question No.	Questions
9.	According to Dirac's theory, a position is : (1) An occupied state of positive energy (2) An occupied state of negative energy (3) An unoccupied state of negative energy (4) An unoccupied state of positive energy
10.	For a pressure volume system starting from 1st law of thermodynamics according to Mayer's, the relation between C_p and C_v is given as : (1) $C_p - C_v = R$ (2) $C_p - C_v = R$ (3) $C_p - C_v = 2R$ (4) $C_p - C_v = R^2$
11.	In a Carnot cycle, the thermodynamic temperature : (1) Depends on thermodynamics properties (2) Depends on nature of substance (3) Independent on thermodynamics properties or nature of substance (4) None of these
12.	In a refrigerator, the heat exhausted to the outer atmosphere is : (1) More than that absorbed from the contents (2) Same as that absorbed from the contents (3) Less than that absorbed from the contents of the refrigerator (4) None of these

Question No.	Questions
13.	In thermodynamics, the Clausius- Clapeyron Equation is used to : (1) Describe the variation of pressure and volume for a system containing two phases in equilibrium (2) Describe the variation of pressure and temperature for a system containing two phases in equilibrium (3) Describe the variation of pressure, temperature and volume for a system containing two phases in equilibrium (4) Describe the variation of pressure and temperature for a system containing two phases not in equilibrium
14.	Bose-Einstein and Fermi Dirac distribution approaches the Maxwell Boltzmann distribution when value of ratio of sections to no. of particle (g_i/n_i) is : (1) Very Large as compared to unity (2) Zero (3) Small as compared to unity (4) None of these
15.	Consider the Fermi Dirac distribution function f(E) at room temperature, where E refers to energy. If E_f is Fermi energy, which of following is true : (1) F (E_f) has a value of 1/2 (2) State with $E<E_f$ are filled completely (3) F(E) is large and tends to infinity as E decreases much below E_f (4) F(E) is a step function

Question No.	Questions
16.	Hydrogen molecules (mass m) are in thermal equilibrium at a temperature T. Assuming classical distribution of velocity, the most probable speed at RT is : (1) $k_B T/m$ (2) $2k_B T/m$ (3) $(2k_B T)^{1/2}/m$ (4) $m/(2k_B T)^{1/2}$
17.	A system of non-interacting Fermi particles with Fermi energy E_f, has density of states $E^{1/2}$, where E is energy of particle. The average energy per particle at absolute temperature is : (1) $1/6\ E_f$ (2) $1/5\ E_f$ (3) $2/5\ E_f$ (4) $3/5\ E_f$
18.	Consider a radiation cavity of volume V at temperature T. The average number of photon in equilibrium inside the cavity is proportional to : (1) T (2) T^2 (3) T^3 (4) T^4
19.	Planck's formula for black body radiation reduces to Rayleigh and Wien's formula respectively for : (1) Small and large wave length (2) Large and small wave length (3) Complex and large wave length (4) Large and complex wave length

Question No.	Questions
20.	Curie temperature of iron is that temperature below which it is : (1) Ferromagnetic (2) Superconducting (3) Radioactive (4) Electrically conducting
21.	In two dimensional electron gas the magnetic susceptibility : (1) Increase with temperature (2) Decrease with temperature (3) Is independent of temperature (4) May increase or decrease with temperature
22.	Bose Einstein condensation temperature T_b refers to the temperature below which : (1) an assembly of Bose gas condenses to liquid state (2) there is a significantly large occupancy of ground state in a system of bosons (3) bosons essentially behave like fermions (4) there is an appreciable occupation of ground state in a electron system
23.	The mean square displacement of a particle undergoing Brownian motion at a temperature T is proportional to : (1) T (2) 1/T (3) $T^{1/2}$ (4) $T^{1/2}$

Question No.	Questions
24.	In semiconducting devices the law of mass action in terms of free electron concentration (n), hole concentration (p) and intrinsic concentration (n_i) is given by : (1) $np = n_i^{1/2}$ (2) $np = n_i^{3/2}$ (3) $np = n_i^2$ (4) $np = n_i^{-1/2}$
25.	Rectification efficiency (η) of a full wave rectifier in terms of R_f and R_L is given by : (1) $\eta = \{81.1/(1 + R_f/R_L)\}\%$ (2) $\eta = \{81.1/(1 - R_f/R_L)\}\%$ (3) $\eta = \{81.1/(1 + R_L/R_f)\}\%$ (4) None of these
26.	In terms of current amplification factor (α) the collector current is given by : (1) $I_c = \alpha . I_B + I_{CBO}$ (2) $I_c = (\alpha/1-\alpha).I_B + I_{CBO}/(1-\alpha)$ (3) $I_c = \alpha . I_E - I_{CBO}$ (4) $I_c = (\alpha/1-\alpha).I_E + I_{CBO}/(1-\alpha)$
27.	In case of common base configuration of a transistor the output characteristics gives : (1) The collector current is very high with small variation in collector base voltage (2) The collector current is very low with large variation in collector base voltage (3) The collector current does not depend upon collector base voltage (4) The collector current is very high with large variation in collector base voltage

Question No.	Questions
28.	The common collector configuration is used : (1) For high frequency applications (2) For audio frequency applications (3) For impedance matching (4) None of these
29.	The voltage gain (A) of a common source Field Effect Transistor amplifier (with output resistance r_d, load resistance R_L and amplification factor μ) is given by : (1) $A = \mu \cdot R_L / (r_d + R_L)^2$ (2) $A = \mu \cdot R_L / (r_d + R_L)^{1/2}$ (3) $A = \mu \cdot R_L / (r_d - R_L)$ (4) $A = \mu \cdot R_L / (r_d + R_L)$
30.	A Zener diode is also a pn junction diode it can be used as : (1) Full wave rectifier (2) Half wave rectifier (3) AC voltage regulator (4) DC voltage regulator
31.	When two identical Zener diodes are connected in series what happens to the breakdown voltage of the combination ? (1) It becomes zero (2) It remains same (3) It is doubled (4) It is halved
32.	The overall gain of a two stage amplifier is 180dB. If the gain of first stage is 100dB, then the voltage gain of second stage is : (1) 20 (2) 80 (3) 100 (4) 8000

Question No.	Questions
33.	A MOSFET differs from JFET mainly because : (1) Of the power rating (2) MOSFET has two gates (3) JFET has a p-n junction (4) MOSFET do not have a physical channel
34.	A certain D-MOSFET is biased at $V_{GS} = 0$ V, its data sheet specifies $I_{Dss} = 20$mA, V_{GS}(off) $= -5$V, the value of drain current is : (1) 0A (2) 20mA (3) 2mA (4) None of these
35.	If the output of logic gates is 0 when all its input are at 1, then the gate is : (1) NAND or Ex-NOR (2) Ex-OR or NOR (3) AND or NOR (4) NOR or OR
36.	A half adder is a digital circuit with : (1) Three inputs one output (2) Three inputs two outputs (3) Two inputs two outputs (4) Two inputs one output
37.	Asynchronous counters are known as : (1) Ripple counters (2) Decade counters (3) Modulus counters (4) Multiple clock counters

Question No.	Questions
38.	The most suitable gates to check whether the number of ones in a digital word is : (1) Ex-OR (2) NAND (3) NOR (4) AND, OR and NOT
39.	The speed of conversion is maximum in : (1) Successive -approximation A/D convertor (2) Parallel- comparator A/D convertor (3) Counter ramp A/D convertor (4) Dual slope A/D convertor
40.	The slowest A/D convertor is : (1) Successive -approximation A/D convertor (2) Parallel- comparator A/D convertor (3) Counter ramp A/D convertor (4) Dual slope A/D convertor
41.	Which of the following is determinates error ? (1) Personal error (2) Erratic error (3) Relative error (4) Absolute error
42.	The Fourier transformation of a function f(t) is given by : (1) $\int_{-\infty}^{\infty} f(t)e^{-st}dt$ (2) $\int_{0}^{\infty} f(t)e^{+st}dt$ (3) $\int_{-\infty}^{\infty} f(t)e^{-jwt}dt$ (4) $\int_{-\infty}^{\infty} f(t)e^{+jwt}dt$

Question No.	Questions
43.	An FM radio receiver is tuned to a 90.6 MHz broadcast station. It will receive an image frequency of : (1) 110 MHz (2) 112 MHz (3) 114 MHz (4) 120 MHz
44.	The signal to noise ratio(S/N) appearing at the output of each channel in Pulse Amplitude Modulation (PAM) is : (1) Three times the input S/N (2) One and half times the input S/N (3) Twice the input S/N (4) Independent of input S/N
45.	The Bohr model gives the value for the ionization potential for the Li^{2+} ion is : (1) 13.6eV (2) 27.2eV (3) 40.8eV (4) 122.4eV
46.	LS coupling occurs often in : (1) All atoms (2) Lighter atoms (3) Heavy atoms (4) None of these
47.	The spectrum of sodium atom can be explained by considering : (1) JJ coupling (2) LS coupling (3) Heitler London theory (4) Relativistic correction

Question No.	Questions
48.	The degeneracy of the J states arising from ^3p term with spin orbit interaction are : (1) 1,3,5 (2) 1,2,3 (3) 3,5,7 (4) 2,6,8
49.	The selection rules in JJ coupling for jumping of one electron are : (1) $\Delta l = 0$, $\Delta j = 0, \pm 1$ (2) $\Delta l = \pm 1$, $\Delta j = 0$ (3) $\Delta l = \pm 1$, $\Delta j = 0, \pm 1$ (4) $\Delta l = \pm 1$, $\Delta j = \pm 0$
50.	The number of Zeeman levels for the form $^2P_{3/2}$ in weak magnetic field is : (1) 04 (2) 07 (3) 05 (4) 03
51.	Consider the Zeeman splitting of a single electron system for the $3d \to 3p$ electric dipole transition. The Zeeman spectrum is : (1) Randomly polarized (2) Only π polarized (3) Only σ polarized (4) Both π and σ polarized
52.	Transition rules for vibrational - rotational spectra are : (1) $\Delta n = 0$, $\Delta j = \pm 1$ (2) $\Delta n = \pm 1$, $\Delta j = 0$ (3) $\Delta n = 0$, $\Delta j = 0$ (4) $\Delta n = \pm 1$, $\Delta j = \pm 1$

Question No.	Questions
53.	Resonance (NMR, ESR etc.) studies in solid provide information about (choose incorrect) : (1) The electron structure of single defects (2) The motion of the spin or of the surroundings (3) Collective spin excitations (4) External magnetic field sampled by spin
54.	The population inversion in He-Ne laser is produced by : (1) Photon excitation (2) Electron excitation (3) Inelastic atomic collisions (4) Chemical reaction
55.	A laser wavelength 740nm has coherence time 4×10^{-5} s, the quality factor of the laser beam is : (1) 1.6×10^{-4} (2) 2.6×10^{-10} (3) 1.6×10^{-10} (4) 1.5×10^{-5}
56.	The packing fraction of fcc structure is : (1) 52% (2) 74% (3) 92% (4) 86%
57.	Primitive cell of hcp lattice contains number of basis equal to : (1) 1 (2) 4 (3) 2 (4) 3

Question No.	Questions
58.	The volume of the primitive cell of the reciprocal lattice is : (1) $4 (2\pi/a)^3$ (2) $4 (\pi/a)^3$ (3) $4 (3\pi/a)^3$ (4) $4 (\pi/2a)^3$
59.	A linear diatomic chain consists of two atoms having masses 2 Kg and 16Kg respectively. The extremum frequency of optical branch is : (1) $2^{1/2}$ (2) $1/2^{1/2}$ (3) $1/2$ (4) 2
60.	For a superconductor which of the following is not true : (1) Specific heat is discontinuous at transition temperature (2) The resistivity falls sharply at T_c (3) It is diamagnetic below T_c (4) It is paramagnetic below T_c
61.	If concentration of electrons in a semiconductor is increased the concentration of holes will : (1) remains constant (2) decrease slightly (3) decrease so much that product 'np' will remain constant (4) also increase

Question No.	Questions
62.	The current in a superconductor : (1) are confined to the surface of the superconductor (2) are confined to the middle portion of the superconductor (3) can exist in quantized form (4) give rise to a potential drop
63.	The volume of a nucleus in an atom is proportional to the : (1) Mass number (2) Proton number (3) Neutron number (4) Electron number
64.	The mass of two isobars of Ni and Cu are $_{28}Ni^{64}$ = 63.9280u and $_{29}Cu^{64}$ =63.9298u, the B.E. per nucleon of $_{28}Ni^{64}$: (1) 4.28 MeV (2) 8.77 MeV (3) 3.20 MeV (4) 6.44 MeV
65.	The threshold energy of the increasing projectile for the given reaction is $_9F^{19} + n \rightarrow _8O^{19} + p$ (Q value of reaction is Q= –3.9 MeV) : (1) 4.10 MeV (2) 8.70 MeV (3) 3.20 MeV (4) 6.44 MeV
66.	Which of the following disintegration series of heavy elements will give 209 Bi as stable nucleus : (1) Thorium series (2) Neptunium series (3) Uranium series (4) Actinium series

Question No.	Questions
67.	A neutron passing through a detector is detected because of : (1) The ionization it produces (2) The scintillation light it produces (3) The electron hole pair it produces (4) The secondary particles produced in the nuclear reaction in the detector medium
68.	If B.E. per Nucleon= 1MeV, m_p = 1.00758u and m_n = 1.00898u, then mass of deuterium nucleus in Kg is (1) 1.67×10^{-27} Kg (2) 1.67×10^{-24} Kg (3) 1.752×10^{-27} Kg (4) 3.344×10^{-27} Kg
69.	Which one of the following elementary particles is called baryon : (1) Electron (2) μ-meson (3) π- meason (4) Neutron
70.	Primary cosmic rays are composed of very energetic : (1) Electrons (2) Protons (3) Neutrons (4) Measons
71.	The D' Alembert's Principle is valid only when : (1) work done by force of constraints is zero (2) virtual work done by force of constraints is zero (3) force of constraints are holonomics (4) work done by applied force is zero

Question No.	Questions
72.	In Lagrange's Equation Q_j represents : (1) Generalized force having dimension of force explicitly (2) Quantized force having dimension of force (3) Generalized force may or may not have dimension of force (4) Work done by generalized force
73.	If coordinates are cyclic in nature then : (1) Lagrangian 'L' is independent of velocity (2) Lagrangian 'L' is independent of coordinates (3) Lagrangian 'L' is dependent of velocity (4) Lagrangian 'L' is independent of both velocity and coordinates
74.	If the components of force acting on the particle are conservative and dissipative then Lagrange's Equation is given by : (1) $\frac{d}{dt}(\{\partial L \mid \partial \dot{q}_j\}) - \{\partial L \mid \partial q_j\} + \{\partial G \mid \partial q_j\} = 0$ (2) $\frac{d}{dt}(\{\partial L \mid \partial \dot{q}_j\}) + \{\partial L \mid \partial q_j\} + \{\partial G \mid \partial q_j\} = 0$ (3) $\frac{d}{dt}(\{\partial L \mid \partial \dot{q}_j\}) - \{\partial L \mid \partial q_j\} - \{\partial G \mid \partial q_j\} = 0$ (4) $\frac{d}{dt}(\{\partial L \mid \partial \dot{q}_j\}) + \{\partial L \mid \partial q_j\} - \{\partial G \mid \partial q_j\} = 0$

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75.	If equation of a conic with one focus at origin is given by $1/r = C[1 + \varepsilon \cos (\theta - \theta_0)]$ then nature of the orbit is ellipse when : (1) $0 < \varepsilon < 1$ and $E > 0$ (2) $0 < \varepsilon < 1$ and $E < 0$ (3) $\varepsilon > 1$ and $E > 0$ (4) $\varepsilon = 1$ and $E = 0$
76.	A particle moves in a circular orbit under a central force. Suddenly the force constant 'k' becomes half without change in velocity, the orbit becomes : (1) elliptical (2) parabolic (3) straight (4) not change
77.	The Hamiltonian, $H = T + V$ gives total energy : (1) when Cartesian and generalized coordinates do not depend on time explicitly (2) when only generalized coordinates do depend on time explicitly (3) when only Cartesian coordinates do not depend on time explicitly (4) when cartesian and generalized coordinates depend on time explicitly
78.	If (q,p) set obeys Hamilton' equations then new (Q,P) set obey canonical transformation when : (1) Generalized coordinates and momentum are independent variables (2) Generalized coordinates are independent variables (3) Cartesian coordinates are independent variables (4) Generalized coordinates and momentum are not independent variables

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79.	The quantized energy of Harmonic oscillator is given by : (1) $En = \left(n + \dfrac{1}{2}\right) hv$ (2) $En = \left(n - \dfrac{1}{2}\right) hv$ (3) $En = \left(n^2 + \dfrac{1}{2}\right) hv$ (4) $En = (n + 1) hv$
80.	Write the value of Eigen function and Eigen value in a given equation $-\dfrac{d^2}{dx^2} (\sin 3x) = 9 \sin 3x$: (1) $\sin x, 9$ (2) $3, \sin 3x$ (3) $\sin 3x, 9$ (4) $-\sin 3x, 9$
81.	In case of a particle in a potential well of finite depth, the number of anti symmetric states depends : (1) value of applied potential, V_0 (2) mass of particle (3) depth of potential well (4) none of these
82.	In case of a particle in a 3D box, number of states for a particle having ½ spin are given by : (1) two (2) zero (3) one (4) none of these

Question No.	Questions
83.	The value of commutator $[L_x, L_y, L_z]$ is given by : (1) $i\hbar \left(L_x^2 - L_y^2\right)$ (2) $i\hbar \left(L_z^2 - L_x^2\right)$ (3) $i\hbar \left(L_y^2 - L_z^2\right)$ (4) None of these
84.	Eigen vectors of product $A\hat{}B\hat{}$ are : (1) Orthogonal (2) Non-orthogonal (3) Orthogonal as well as non orthogonal (4) None of these
85.	Pauli exclusion principle is applicable only for : (1) bosons (2) fermions (3) boson as well as fermions (4) none of these
86.	The necessary and sufficient condition for $A \times (B \times C) = (A \times B) \times C$ is given by : (1) $(A \times C) \times B = 0$ (2) $A \times (B \times C) = 0$ (3) $C \times (A \times B) = 0$ (4) None of these
87.	If $\nabla u = 2r^4 \, \vec{r}$ then r is given by : (1) $(1/2)r^5 + $ constant (2) $r^6 + $ constant (3) $(1/5)r^6 + $ constant (4) $(1/3)r^6 + $ constant

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88.	If vector $V = r/r^3$ the surface integral of r over the surface of a cube of size a and centered at the origin is given by : (1) 2π (2) 4π (3) $2\pi a^3$ (4) zero
89.	The Eigen Value of a matrix are 1, $-2i$ and $3i$. The matrix is : (1) Unitary (2) Anti-unitary (3) Hermitian (4) Anti-Hermitian
90.	The generating function of Legendre's polynomial $P_n(x)$ is given by : (1) $(1 + 2xu - u^2)^{1/2}$ (2) $1/(1 - 2xu + u^2)^{1/2}$ (3) $(x^2 - 1)n$ (4) $1/(1 - 2xu - u^2)$
91.	Fourier sine transform for a function $f(x) = e^{-ax}$ is given by : (1) $s/(a^2 + s^2)$ (2) $a/(a^2 + s^2)$ (3) $s/(a^2 - s^2)$ (4) $a/(a^2 - s^2)$
92.	The solution of the Laplace equation in cylindrical coordinates when it has no dependence on the Z coordinate involves : (1) Legendre's polynomial (2) Bessel Function (3) Associated Legendre's Function (4) Trigonometric Function

Question No.	Questions
93.	The equation $\sin x = (x-1)^2 + 0.5$ has : (1) Two real root (2) No real roots (3) One real root (4) None of these
94.	If tensor $A_{ij} = A_{ji}$ and $B_{ij} = -B_{ji}$, then : (1) A_{ij} is symmetric and B_{ij} is anti symmetric (2) A_{ij} is anti symmetric and B_{ij} is symmetric (3) A_{ij} is symmetric and B_{ij} is asymmetric (4) A_{ij} is symmetric and B_{ij} is not anti symmetric
95.	An electron annihilates with positron, the order of wave length of radiation emitted is : (1) In nano meter (2) In Pico meter (3) In fento meter (4) In micro meter
96.	A particle is subjected to a constant force. The displacement versus time plot for relativistic motion will be : (1) Straight Line (2) Parabolic (3) Hyperbolic (4) Circular
97.	In a good conductor the phase difference electric and magnetic field is given by : (1) $\pi/4$ (2) $\pi/6$ (3) $\pi/8$ (4) π

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98.	If an electromagnetic wave is propagated in a medium of permittivity ε and permeability μ then ratio $(\mu/\varepsilon)^{1/2}$ is : (1) Intrinsic impedance of the medium (2) Square of R.I. of the medium (3) R.I. of the medium (4) Energy density of the medium
99.	An electron is accelerated from rest by 10.2 mV. The percentage increase in its mass is : (1) 200 (2) 2000 (3) 20000 (4) 20
100.	Electromagnetic waves are propagating along a hollow, metallic wave guide whose cross section is a square of side, W. The minimum frequency of the e.m. waves is : (1) c/W (2) 2c/W (3) π c/W² (4) π c/W

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(M.Phil/Ph.D/URS–EE–2018)

Code **B**

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Sr. No. 100006

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2.	In Lagrange's Equation Q_j represents : (1) Generalized force having dimension of force explicitly (2) Quantized force having dimension of force (3) Generalized force may or may not have dimension of force (4) Work done by generalized force
3.	If coordinates are cyclic in nature then : (1) Lagrangian 'L' is independent of velocity (2) Lagrangian 'L' is independent of coordinates (3) Lagrangian 'L' is dependent of velocity (4) Lagrangian 'L' is independent of both velocity and coordinates
4.	If the components of force acting on the particle are conservative and dissipative then Lagrange's Equation is given by : (1) $\frac{d}{dt}(\{\partial L\|\partial \dot{q}_j\}) - \{\partial L\|\partial q_j\} + \{\partial G\|\partial q_j\} = 0$ (2) $\frac{d}{dt}(\{\partial L\|\partial \dot{q}_j\}) + \{\partial L\|\partial q_j\} + \{\partial G\|\partial q_j\} = 0$ (3) $\frac{d}{dt}(\{\partial L\|\partial \dot{q}_j\}) - \{\partial L\|\partial q_j\} - \{\partial G\|\partial q_j\} = 0$ (4) $\frac{d}{dt}(\{\partial L\|\partial \dot{q}_j\}) + \{\partial L\|\partial q_j\} - \{\partial G\|\partial q_j\} = 0$

Question No.	Questions
5.	If equation of a conic with one focus at origin is given by $1/r = C[1 + \varepsilon \cos(\theta - \theta_0)]$ then nature of the orbit is ellipse when : (1) $0 < \varepsilon < 1$ and $E > 0$ (2) $0 < \varepsilon < 1$ and $E < 0$ (3) $\varepsilon > 1$ and $E > 0$ (4) $\varepsilon = 1$ and $E = 0$
6.	A particle moves in a circular orbit under a central force. Suddenly the force constant 'k' becomes half without change in velocity, the orbit becomes : (1) elliptical (2) parabolic (3) straight (4) not change
7.	The Hamiltonian, $H = T + V$ gives total energy : (1) when Cartesian and generalized coordinates do not depend on time explicitly (2) when only generalized coordinates do depend on time explicitly (3) when only Cartesian coordinates do not depend on time explicitly (4) when cartesian and generalized coordinates depend on time explicitly
8.	If (q,p) set obeys Hamilton' equations then new (Q,P) set obey canonical transformation when : (1) Generalized coordinates and momentum are independent variables (2) Generalized coordinates are independent variables (3) Cartesian coordinates are independent variables (4) Generalized coordinates and momentum are not independent variables

Question No.	Questions
9.	The quantized energy of Harmonic oscillator is given by : (1) $En = \left(n + \dfrac{1}{2}\right) hv$ (2) $En = \left(n - \dfrac{1}{2}\right) hv$ (3) $En = \left(n^2 + \dfrac{1}{2}\right) hv$ (4) $En = (n + 1) hv$
10.	Write the value of Eigen function and Eigen value in given equation $-\dfrac{d^2}{dx^2} (\sin 3x) = 9 \sin 3x$: (1) $\sin x, 9$ (2) $3, \sin 3 x$ (3) $\sin 3 x, 9$ (4) $-\sin 3 x, 9$
11.	Consider the Zeeman splitting of a single electron system for the $3d \to 3p$ electric dipole transition. The Zeeman spectrum is : (1) Randomly polarized (2) Only π polarized (3) Only σ polarized (4) Both π and σ polarized
12.	Transition rules for vibrational - rotational spectra are : (1) $\Delta n = 0, \Delta j = \pm 1$ (2) $\Delta n = \pm 1, \Delta j = 0$ (3) $\Delta n = 0, \Delta j = 0$ (4) $\Delta n = \pm 1, \Delta j = \pm 1$
13.	Resonance (NMR, ESR etc.) studies in solid provide information about (choose incorrect) : (1) The electron structure of single defects (2) The motion of the spin or of the surroundings (3) Collective spin excitations (4) External magnetic field sampled by spin

Question No.	Questions
14.	The population inversion in He-Ne laser is produced by : (1) Photon excitation (2) Electron excitation (3) Inelastic atomic collisions (4) Chemical reaction
15.	A laser wavelength 740nm has coherence time 4×10^{-5} s, the quality factor of the laser beam is : (1) 1.6×10^{-4} (2) 2.6×10^{-10} (3) 1.6×10^{-10} (4) 1.5×10^{-5}
16.	The packing fraction of fcc structure is : (1) 52% (2) 74% (3) 92% (4) 86%
17.	Primitive cell of hcp lattice contains number of basis equal to : (1) 1 (2) 4 (3) 2 (4) 3
18.	The volume of the primitive cell of the reciprocal lattice is : (1) $4 (2\pi/a)^3$ (2) $4 (\pi/a)^3$ (3) $4 (3\pi/a)^3$ (4) $4 (\pi/2a)^3$
19.	A linear diatomic chain consists of two atoms having masses 2 Kg and 16Kg respectively. The extremum frequency of optical branch is : (1) $2^{1/2}$ (2) $1/2^{1/2}$ (3) $1/2$ (4) 2

Question No.	Questions
20.	For a superconductor which of the following is not true : (1) Specific heat is discontinuous at transition temperature (2) The resistivity falls sharply at T_c (3) It is diamagnetic below T_c (4) It is paramagnetic below T_c
21.	When two identical Zener diodes are connected in series what happens to the breakdown voltage of the combination ? (1) It becomes zero (2) It remains same (3) It is doubled (4) It is halved
22.	The overall gain of a two stage amplifier is 180dB. If the gain of first stage is 100dB, then the voltage gain of second stage is : (1) 20 (2) 80 (3) 100 (4) 8000
23.	A MOSFET differs from JFET mainly because : (1) Of the power rating (2) MOSFET has two gates (3) JFET has a p-n junction (4) MOSFET do not have a physical channel

Question No.	Questions
24.	A certain D-MOSFET is biased at $V_{GS} = 0$ V, its data sheet specifies $I_{Dss} = 20$mA, V_{GS}(off) = –5V, the value of drain current is : (1) 0A (2) 20mA (3) 2mA (4) None of these
25.	If the output of logic gates is 0 when all its input are at 1, then the gate is : (1) NAND or Ex-NOR (2) Ex-OR or NOR (3) AND or NOR (4) NOR or OR
26.	A half adder is a digital circuit with : (1) Three inputs one output (2) Three inputs two outputs (3) Two inputs two outputs (4) Two inputs one output
27.	Asynchronous counters are known as : (1) Ripple counters (2) Decade counters (3) Modulus counters (4) Multiple clock counters
28.	The most suitable gates to check whether the number of ones in a digital word is : (1) Ex-OR (2) NAND (3) NOR (4) AND, OR and NOT

Question No.	Questions
29.	The speed of conversion is maximum in : (1) Successive -approximation A/D convertor (2) Parallel- comparator A/D convertor (3) Counter ramp A/D convertor (4) Dual slope A/D convertor
30.	The slowest A/D convertor is : (1) Successive -approximation A/D convertor (2) Parallel- comparator A/D convertor (3) Counter ramp A/D convertor (4) Dual slope A/D convertor
31.	In a Carnot cycle, the thermodynamic temperature : (1) Depends on thermodynamics properties (2) Depends on nature of substance (3) Independent on thermodynamics properties or nature of substance (4) None of these
32.	In a refrigerator, the heat exhausted to the outer atmosphere is : (1) More than that absorbed from the contents (2) Same as that absorbed from the contents (3) Less than that absorbed from the contents of the refrigerator (4) None of these

Question No.	Questions
33.	In thermodynamics, the Clausius- Clapeyron Equation is used to : (1) Describe the variation of pressure and volume for a system containing two phases in equilibrium (2) Describe the variation of pressure and temperature for a system containing two phases in equilibrium (3) Describe the variation of pressure, temperature and volume for a system containing two phases in equilibrium (4) Describe the variation of pressure and temperature for a system containing two phases not in equilibrium
34.	Bose-Einstein and Fermi Dirac distribution approaches the Maxwell Boltzmann distribution when value of ratio of sections to no. of particle (g_i/n_i) is : (1) Very Large as compared to unity (2) Zero (3) Small as compared to unity (4) None of these
35.	Consider the Fermi Dirac distribution function f(E) at room temperature, where E refers to energy. If E_f is Fermi energy, which of following is true : (1) F (E_f) has a value of 1/2 (2) State with $E<E_f$ are filled completely (3) F(E) is large and tends to infinity as E decreases much below E_f (4) F(E) is a step function

Question No.	Questions
36.	Hydrogen molecules (mass m) are in thermal equilibrium at a temperature T. Assuming classical distribution of velocity, the most probable speed at RT is : (1) $k_B T/ m$ (2) $2k_B T/m$ (3) $(2k_B T)^{1/2}/m$ (4) $m / (2k_B T)^{1/2}$
37.	A system of non-interacting Fermi particles with Fermi energy E_f, has density of states $E^{1/2}$, where E is energy of particle. The average energy per particle at absolute temperature is : (1) $1/6 \, E_f$ (2) $1/5 \, E_f$ (3) $2/5 \, E_f$ (4) $3/5 \, E_f$
38.	Consider a radiation cavity of volume V at temperature T. The average number of photon in equilibrium inside the cavity is proportional to : (1) T (2) T^2 (3) T^3 (4) T^4
39.	Planck's formula for black body radiation reduces to Rayleigh and Wien's formula respectively for : (1) Small and large wave length (2) Large and small wave length (3) Complex and large wave length (4) Large and complex wave length

Question No.	Questions
40.	Curie temperature of iron is that temperature below which it is :
	(1) Ferromagnetic (2) Superconducting
	(3) Radioactive (4) Electrically conducting
41.	Fourier sine transform for a function $f(x) = e^{-ax}$ is given by :
	(1) $s/(a^2 + s^2)$ (2) $a/(a^2 + s^2)$
	(3) $s/(a^2 - s^2)$ (4) $a/(a^2 - s^2)$
42.	The solution of the Laplace equation in cylindrical coordinates when it has no dependence on the Z coordinate involves :
	(1) Legendre's polynomial
	(2) Bessel Function
	(3) Associated Legendre's Function
	(4) Trigonometric Function
43.	The equation $\sin x = (x-1)^2 + 0.5$ has :
	(1) Two real root (2) No real roots
	(3) One real root (4) None of these
44.	If tensor $A_{ij} = A_{ji}$ and $B_{ij} = -B_{ji}$, then :
	(1) A_{ij} is symmetric and B_{ij} is anti symmetric
	(2) A_{ij} is anti symmetric and B_{ij} is symmetric
	(3) A_{ij} is symmetric and B_{ij} is asymmetric
	(4) A_{ij} is symmetric and B_{ij} is not anti symmetric

Question No.	Questions
45.	An electron annihilates with positron, the order of wave length of radiation emitted is : (1) In nano meter (2) In Pico meter (3) In fento meter (4) In micro meter
46.	A particle is subjected to a constant force. The displacement versus time plot for relativistic motion will be : (1) Straight Line (2) Parabolic (3) Hyperbolic (4) Circular
47.	In a good conductor the phase difference electric and magnetic field is given by : (1) $\pi/4$ (2) $\pi/6$ (3) $\pi/8$ (4) π
48.	If an electromagnetic wave is propagated in a medium of permittivity ε and permeability μ then ratio $(\mu/\varepsilon)^{1/2}$ is : (1) Intrinsic impedance of the medium (2) Square of R.I. of the medium (3) R.I. of the medium (4) Energy density of the medium

Question No.	Questions
49.	An electron is accelerated from rest by 10.2 mV. The percentage increase in its mass is : (1) 200 (2) 2000 (3) 20000 (4) 20
50.	Electromagnetic waves are propagating along a hollow, metallic wave guide whose cross section is a square of side, W. The minimum frequency of the e.m. waves is : (1) c/W (2) 2c/W (3) π c/W^2 (4) π c/W.
51.	If concentration of electrons in a semiconductor is increased the concentration of holes will : (1) remains constant (2) decrease slightly (3) decrease so much that product 'np' will remain constant (4) also increase
52.	The current in a superconductor : (1) are confined to the surface of the superconductor (2) are confined to the middle portion of the superconductor (3) can exist in quantized form (4) give rise to a potential drop

Question No.	Questions
53.	The volume of a nucleus in an atom is proportional to the : (1) Mass number (2) Proton number (3) Neutron number (4) Electron number
54.	The mass of two isobars of Ni and Cu are $_{28}Ni^{64} = 63.9280u$ and $_{29}Cu^{64} = 63.9298u$, the B.E. per nucleon of $_{28}Ni^{64}$: (1) 4.28 MeV (2) 8.77 MeV (3) 3.20 MeV (4) 6.44 MeV
55.	The threshold energy of the increasing projectile for the given reaction is $_9F^{19} + n \rightarrow _8O^{19} + p$ (Q value of reaction is Q= –3.9 MeV) : (1) 4.10 MeV (2) 8.70 MeV (3) 3.20 MeV (4) 6.44 MeV
56.	Which of the following disintegration series of heavy elements will give 209 Bi as stable nucleus : (1) Thorium series (2) Neptunium series (3) Uranium series (4) Actinium series
57.	A neutron passing through a detector is detected because of : (1) The ionization it produces (2) The scintillation light it produces (3) The electron hole pair it produces (4) The secondary particles produced in the nuclear reaction in the detector medium

Question No.	Questions
58.	If B.E. per Nucleon= 1MeV, m_p = 1.00758u and m_n = 1.00898u, then mass of deuterium nucleus in Kg is : (1) 1.67×10^{-27} Kg (2) 1.67×10^{-24} Kg (3) 1.752×10^{-27} Kg (4) 3.344×10^{-27} Kg
59.	Which one of the following elementary particles is called baryon : (1) Electron (2) μ-meson (3) π- meason (4) Neutron
60.	Primary cosmic rays are composed of very energetic : (1) Electrons (2) Protons (3) Neutrons (4) Measons
61.	In case of a particle in a potential well of finite depth, the number of anti symmetric states depends : (1) value of applied potential, V_0 (2) mass of particle (3) depth of potential well (4) none of these
62.	In case of a particle in a 3D box, number of states for a particle having ½ spin are given by : (1) two (2) zero (3) one (4) none of these

Question No.	Questions
63.	The value of commutator $[L_x, L_y, L_z]$ is given by : (1) $i\hbar\left(L_x^2 - L_y^2\right)$ (2) $i\hbar\left(L_z^2 - L_x^2\right)$ (3) $i\hbar\left(L_y^2 - L_z^2\right)$ (4) None of these
64.	Eigen vectors of product $A^\wedge B^\wedge$ are : (1) Orthogonal (2) Non-orthogonal (3) Orthogonal as well as non orthogonal (4) None of these
65.	Pauli exclusion principle is applicable only for : (1) bosons (2) fermions (3) boson as well as fermions (4) none of these
66.	The necessary and sufficient condition for $A \times (B \times C) = (A \times B) \times C$ is given by : (1) $(A \times C) \times B = 0$ (2) $A \times (B \times C) = 0$ (3) $C \times (A \times B) = 0$ (4) None of these
67.	If $\nabla u = 2r^4\, \vec{r}$ then r is given by : (1) $(1/2)r^5$ + constant (2) r^6 + constant (3) $(1/5)r^6$ + constant (4) $(1/3)r^6$ + constant

Question No.	Questions
68.	If vector V=r/r³ the surface integral of r over the surface of a cube of size a and centered at the origin is given by : (1) 2π (2) 4π (3) $2\pi a^3$ (4) zero
69.	The Eigen Value of a matrix are 1, –2i and 3i. The matrix is : (1) Unitary (2) Anti-unitary (3) Hermitian (4) Anti-Hermitian
70.	The generating function of Legendre's polynomial $P_n(x)$ is given by : (1) $(1 + 2xu - u^2)^{1/2}$ (2) $1/(1 - 2xu + u^2)^{1/2}$ (3) $(x^2 - 1)n$ (4) $1/(1 - 2xu - u^2)$
71.	Which of the following is determinates error ? (1) Personal error (2) Erratic error (3) Relative error (4) Absolute error
72.	The Fourier transformation of a function f(t) is given by : (1) $\int_{-\infty}^{\infty} f(t)\,e^{-st}dt$ (2) $\int_{0}^{\infty} f(t)\,e^{+st}dt$ (3) $\int_{-\infty}^{\infty} f(t)\,e^{-jwt}dt$ (4) $\int_{-\infty}^{\infty} f(t)\,e^{+jwt}dt$

Question No.	Questions
73.	An FM radio receiver is tuned to a 90.6 MHz broadcast station. It will receive an image frequency of : (1) 110 MHz (2) 112 MHz (3) 114 MHz (4) 120 MHz
74.	The signal to noise ratio(S/N) appearing at the output of each channel in Pulse Amplitude Modulation (PAM) is : (1) Three times the input S/N (2) One and half times the input S/N (3) Twice the input S/N (4) Independent of input S/N
75.	The Bohr model gives the value for the ionization potential for the Li^{2+} ion is : (1) 13.6eV (2) 27.2eV (3) 40.8eV (4) 122.4eV
76.	LS coupling occurs often in : (1) All atoms (2) Lighter atoms (3) Heavy atoms (4) None of these
77.	The spectrum of sodium atom can be explained by considering : (1) JJ coupling (2) LS coupling (3) Heitler London theory (4) Relativistic correction

Question No.	Questions
78.	The degeneracy of the J states arising from ^3p term with spin orbit interaction are : (1) 1,3,5 (2) 1,2,3 (3) 3,5,7 (4) 2,6,8
79.	The selection rules in JJ coupling for jumping of one electron are : (1) $\Delta l = 0, \Delta j = 0, \pm 1$ (2) $\Delta l = \pm 1, \Delta j = 0$ (3) $\Delta l = \pm 1, \Delta j = 0, \pm 1$ (4) $\Delta l = \pm 1, \Delta j = \pm 0$
80.	The number of Zeeman levels for the form $^2P_{3/2}$ in weak magnetic field is : (1) 04 (2) 07 (3) 05 (4) 03
81.	In two dimensional electron gas the magnetic susceptibility : (1) Increase with temperature (2) Decrease with temperature (3) Is independent of temperature (4) May increase or decrease with temperature

Question No.	Questions
82.	Bose Einstein condensation temperature T_b refers to the temperature below which : (1) an assembly of Bose gas condenses to liquid state (2) there is a significantly large occupancy of ground state in a system of bosons (3) bosons essentially behave like fermions (4) there is an appreciable occupation of ground state in a electron system
83.	The mean square displacement of a particle undergoing Brownian motion at a temperature T is proportional to : (1) T (2) 1/T (3) $T^{1/2}$ (4) $T^{1/2}$
84.	In semiconducting devices the law of mass action in terms of free electron concentration (n), hole concentration (p) and intrinsic concentration (n_i) is given by : (1) $np=n_i^{1/2}$ (2) $np=n_i^{3/2}$ (3) $np=n_i^2$ (4) $np=n_i^{-1/2}$
85.	Rectification efficiency (η) of a full wave rectifier in terms of R_f and R_L is given by : (1) $\eta=\{81.1/(1+R_f/R_L)\}\%$ (2) $\eta=\{81.1/(1-R_f/R_L)\}\%$ (3) $\eta=\{81.1/(1+R_L/R_f)\}\%$ (4) None of these

Question No.	Questions
86.	In terms of current amplification factor(α) the collector current is given by : (1) $I_c = \alpha.I_B + I_{CBO}$ (2) $I_c = (\alpha/1-\alpha).I_B + I_{CBO}/(1-\alpha)$ (3) $I_c = \alpha.I_E - I_{CBO}$ (4) $I_c = (\alpha/1-\alpha).I_E + I_{CBO}/(1-\alpha)$
87.	In case of common base configuration of a transistor the output characteristics gives : (1) The collector current is very high with small variation in collector base voltage (2) The collector current is very low with large variation in collector base voltage (3) The collector current does not depend upon collector base voltage (4) The collector current is very high with large variation in collector base voltage
88.	The common collector configuration is used : (1) For high frequency applications (2) For audio frequency applications (3) For impedance matching (4) None of these

Question No.	Questions
89.	The voltage gain (A) of a common source Field Effect Transistor amplifier (with output resistance r_d, load resistance R_L and amplification factor μ) is given by : (1) $A = \mu.R_L/(r_d + R_L)^2$ (2) $A = \mu.R_L/(r_d + R_L)^{1/2}$ (3) $A = \mu.R_L/(r_d - R_L)$ (4) $A = \mu.R_L/(r_d + R_L)$
90.	A Zener diode is also a pn junction diode it can be used as : (1) Full wave rectifier (2) Half wave rectifier (3) AC voltage regulator (4) DC voltage regulator
91.	The dielectric constant of a material at optical frequency is mainly due to : (1) Ionic polarizability (2) Electronic polarizability (3) Dipolar polarizability (4) Ionic & dipolar polarizability
92.	When a mono-atomic gas is placed in a uniform electric field (E), the displacement of the nucleus is proportional to : (1) E^2 (2) E^3 (3) E (4) Independent of E
93.	In dielectric, the polarization is the function of : (1) Square of applied field (2) Applied field (3) Exponential of applied field (4) Logarithmic of applied field

Question No.	Questions
94.	The electric vector E and magnetic vector H, inside a conductor : (1) Are never in phase (2) Remains in phase (3) Phase depends upon the conductivity of medium (4) None of these
95.	Two plane waves having the same angular frequency, dielectric constant, amplitude (E) and opposite circular polarization is superimposed. The resulting wave is : (1) Linearly polarized with amplitude E (2) Linearly polarized with amplitude 2E (3) Linearly polarized with amplitude 4E (4) Circularly polarized with amplitude E
96.	In the Rayleigh scattering, the amount of scattered light is proportional to : (1) $1/\lambda^4$ (2) $1/\lambda^2$ (3) $1/\lambda^3$ (4) $1/\lambda^2$
97.	A ray of light in a dense medium of refractive index 1.4 approaches the boundary between given medium and air at an angle of $\theta = \sin^{-1}(0.8)$. Then the ray will be : (1) Totally absorbed (2) Internally reflected (3) Showing an arbitrary behavior (4) Emerging at an angle greater than corresponding to $\sin^{-1}(0.8)$

Question No.	Questions
98.	The path of charged particle in a crossed electric and magnetic field is : (1) Parabolic (2) A Cycloid (3) Hyperbolic (4) Circular
99.	According to Dirac's theory, a position is : (1) An occupied state of positive energy (2) An occupied state of negative energy (3) An unoccupied state of negative energy (4) An unoccupied state of positive energy
100.	For a pressure volume system starting from 1st law of thermodynamics according to Mayer's, the relation between C_p and C_v is given as : (1) $C_p - C_v = R$ (2) $C_p - C_v = R$ (3) $C_p - C_v = 2R$ (4) $C_p - C_v = R^2$

(Set–"X")

(DO NOT OPEN THIS QUESTION BOOKLET BEFORE TIME OR UNTIL YOU ARE ASKED TO DO SO)

(M.Phil/Ph.D/URS–EE–2018)

Code C   Subject : PHYSICS   Sr. No. 100003

Time : 1¼ Hours   Max. Marks : 100   Total Questions : 100

Roll No. _____ (in figure) _____ (in words)

Name : _____   Father's Name : _____

Mother's Name : _____   Date of Examination : _____

(Signature of the candidate)   (Signature of the Invigilator)

CANDIDATES MUST READ THE FOLLOWING INFORMATION/ INSTRUCTIONS BEFORE STARTING THE QUESTION PAPER.

1. All questions are compulsory.
2. The candidates must return the Question book-let as well as OMR answer-sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means / mis-behaviour will be registered against him / her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.
3. Keeping in view the transparency of the examination system, carbonless OMR Sheet is provided to the candidate so that a copy of OMR Sheet may be kept by the candidate.
4. Question Booklet along with answer key of all the A, B, C, D code will be got uploaded on the University website after the conduct of Entrance Examination. In case there is any discrepancy in the Question Booklet / Answer Key, the same may be brought to the notice of the Controller of Examination in writing / through E.Mail within 24 hours of uploading the same on the University Website. Thereafter, no complaint in any case, will be considered
5. The candidate MUST NOT do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question book-let itself. Answers MUST NOT be ticked in the Question book-let.
6. There will be no Negative marking. Each correct answer will be awarded one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.
7. Use only Black or Blue **BALL POINT PEN** of good quality in the OMR Answer-Sheet.
8. BEFORE ANSWERING THE QUESTIONS, THE CANDIDATES SHOULD ENSURE THAT THEY HAVE BEEN SUPPLIED CORRECT AND COMPLETE BOOK-LET. COMPLAINTS, IF ANY, REGARDING MISPRINTING ETC. WILL NOT BE ENTERTAINED 30 MINUTES AFTER STARTING OF THE EXAMINATION.

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14.	In semiconducting devices the law of mass action in terms of free electron concentration (n), hole concentration (p) and intrinsic concentration (n_i) is given by : (1) $np = n_i^{1/2}$ (2) $np = n_i^{3/2}$ (3) $np = n_i^2$ (4) $np = n_i^{-1/2}$

Question No.	Questions
15.	Rectification efficiency (η) of a full wave rectifier in terms of R_f and R_L is given by : (1) $\eta=\{81.1/(1+R_f/R_L)\}\%$ (2) $\eta=\{81.1/(1-R_f/R_L)\}\%$ (3) $\eta=\{81.1/(1+R_L/R_f)\}\%$ (4) None of these
16.	In terms of current amplification factor(α) the collector current is given by : (1) $I_c = \alpha.I_B + I_{CBO}$ (2) $I_c = (\alpha/1-\alpha).I_B + I_{CBO}/(1-\alpha)$ (3) $I_c = \alpha.I_E - I_{CBO}$ (4) $I_c = (\alpha/1-\alpha).I_E + I_{CBO}/(1-\alpha)$
17.	In case of common base configuration of a transistor the output characteristics gives : (1) The collector current is very high with small variation in collector base voltage (2) The collector current is very low with large variation in collector base voltage (3) The collector current does not depend upon collector base voltage (4) The collector current is very high with large variation in collector base voltage
18.	The common collector configuration is used : (1) For high frequency applications (2) For audio frequency applications (3) For impedance matching (4) None of these

Question No.	Questions
19.	The voltage gain (A) of a common source Field Effect Transistor amplifier (with output resistance r_d, load resistance R_L and amplification factor μ) is given by : (1) $A=\mu.R_L/(r_d + R_L)^2$ (2) $A=\mu.R_L/(r_d + R_L)^{1/2}$ (3) $A=\mu.R_L/(r_d - R_L)$ (4) $A=\mu.R_L/(r_d + R_L)$
20.	A Zener diode is also a pn junction diode it can be used as : (1) Full wave rectifier (2) Half wave rectifier (3) AC voltage regulator (4) DC voltage regulator
21.	The dielectric constant of a material at optical frequency is mainly due to : (1) Ionic polarizability (2) Electronic polarizability (3) Dipolar polarizability (4) Ionic & dipolar polarizability
22.	When a mono-atomic gas is placed in a uniform electric field (E), the displacement of the nucleus is proportional to : (1) E^2 (2) E^3 (3) E (4) Independent of E
23.	In dielectric, the polarization is the function of : (1) Square of applied field (2) Applied field (3) Exponential of applied field (4) Logarithmic of applied field

Question No.	Questions
24.	The electric vector E and magnetic vector H, inside a conductor : (1) Are never in phase (2) Remains in phase (3) Phase depends upon the conductivity of medium (4) None of these
25.	Two plane waves having the same angular frequency, dielectric constant, amplitude (E) and opposite circular polarization is superimposed. The resulting wave is : (1) Linearly polarized with amplitude E (2) Linearly polarized with amplitude 2E (3) Linearly polarized with amplitude 4E (4) Circularly polarized with amplitude E
26.	In the Rayleigh scattering, the amount of scattered light is proportional to : (1) $1/\lambda^4$ (2) $1/\lambda^2$ (3) $1/\lambda^3$ (4) $1/\lambda^2$
27.	A ray of light in a dense medium of refractive index 1.4 approaches the boundary between given medium and air at an angle of $\theta = \sin^{-1} (0.8)$. Then the ray will be : (1) Totally absorbed (2) Internally reflected (3) Showing an arbitrary behavior (4) Emerging at an angle greater than corresponding to $\sin^{-1} (0.8)$

Question No.	Questions
28.	The path of charged particle in a crossed electric and magnetic field is : (1) Parabolic (2) A Cycloid (3) Hyperbolic (4) Circular
29.	According to Dirac's theory, a position is : (1) An occupied state of positive energy (2) An occupied state of negative energy (3) An unoccupied state of negative energy (4) An unoccupied state of positive energy
30.	For a pressure volume system starting from 1st law of thermodynamics according to Mayer's, the relation between C_p and C_v is given as : (1) $C_p - C_v = R$ (2) $C_p - C_v = R$ (3) $C_p - C_v = 2R$ (4) $C_p - C_v = R^2$
31.	Fourier sine transform for a function $f(x) = e^{-ax}$ is given by : (1) $s/(a^2 + s^2)$ (2) $a/(a^2 + s^2)$ (3) $s/(a^2 - s^2)$ (4) $a/(a^2 - s^2)$
32.	The solution of the Laplace equation in cylindrical coordinates when it has no dependence on the Z coordinate involves : (1) Legendre's polynomial (2) Bessel Function (3) Associated Legendre's Function (4) Trigonometric Function

Question No.	Questions
33.	The equation sin x = (x–1)² + 0.5 has : (1) Two real root (2) No real roots (3) One real root (4) None of these
34.	If tensor $A_{ij} = A_{ji}$ and $B_{ij} = -B_{ji}$, then : (1) A_{ij} is symmetric and B_{ij} is anti symmetric (2) A_{ij} is anti symmetric and B_{ij} is symmetric (3) A_{ij} is symmetric and B_{ij} is asymmetric (4) A_{ij} is symmetric and B_{ij} is not anti symmetric
35.	An electron annihilates with positron, the order of wave length of radiation emitted is : (1) In nano meter (2) In Pico meter (3) In fento meter (4) In micro meter
36.	A particle is subjected to a constant force. The displacement versus time plot for relativistic motion will be : (1) Straight Line (2) Parabolic (3) Hyperbolic (4) Circular
37.	In a good conductor the phase difference electric and magnetic field is given by : (1) $\pi/4$ (2) $\pi/6$ (3) $\pi/8$ (4) π

Question No.	Questions
38.	If an electromagnetic wave is propagated in a medium of permittivity ε and permeability μ then ratio $(\mu/\varepsilon)^{1/2}$ is : (1) Intrinsic impedance of the medium (2) Square of R.I. of the medium (3) R.I. of the medium (4) Energy density of the medium
39.	An electron is accelerated from rest by 10.2 mV. The percentage increase in its mass is : (1) 200 (2) 2000 (3) 20000 (4) 20
40.	Electromagnetic waves are propagating along a hollow, metallic wave guide whose cross section is a square of side, W. The minimum frequency of the e.m. waves is : (1) c/W (2) 2c/W (3) π c/W^2 (4) π c/W
41.	If concentration of electrons in a semiconductor is increased the concentration of holes will : (1) remains constant (2) decrease slightly (3) decrease so much that product 'np' will remain constant (4) also increase

Question No.	Questions
42.	The current in a superconductor : (1) are confined to the surface of the superconductor (2) are confined to the middle portion of the superconductor (3) can exist in quantized form (4) give rise to a potential drop
43.	The volume of a nucleus in an atom is proportional to the : (1) Mass number (2) Proton number (3) Neutron number (4) Electron number
44.	The mass of two isobars of Ni and Cu are $_{28}Ni^{64}$ = 63.9280u and $_{29}Cu^{64}$ =63.9298u, the B.E. per nucleon of $_{28}Ni^{64}$: (1) 4.28 MeV (2) 8.77 MeV (3) 3.20 MeV (4) 6.44 MeV
45.	The threshold energy of the increasing projectile for the given reaction is $_9F^{19} + n \rightarrow {}_8O^{19} + p$ (Q value of reaction is Q= –3.9 MeV) : (1) 4.10 MeV (2) 8.70 MeV (3) 3.20 MeV (4) 6.44 MeV
46.	Which of the following disintegration series of heavy elements will give 209 Bi as stable nucleus : (1) Thorium series (2) Neptunium series (3) Uranium series (4) Actinium series

Question No.	Questions
47.	A neutron passing through a detector is detected because of : (1) The ionization it produces (2) The scintillation light it produces (3) The electron hole pair it produces (4) The secondary particles produced in the nuclear reaction in the detector medium
48.	If B.E. per Nucleon= 1MeV, $m_p = 1.00758u$ and $m_n = 1.00898u$, then mass of deuterium nucleus in Kg is : (1) 1.67×10^{-27} Kg (2) 1.67×10^{-24} Kg (3) 1.752×10^{-27} Kg (4) 3.344×10^{-27} Kg
49.	Which one of the following elementary particles is called baryon : (1) Electron (2) μ-meson (3) π - meason (4) Neutron
50.	Primary cosmic rays are composed of very energetic : (1) Electrons (2) Protons (3) Neutrons (4) Measons
51.	When two identical Zener diodes are connected in series what happens to the breakdown voltage of the combination ? (1) It becomes zero (2) It remains same (3) It is doubled (4) It is halved

Question No.	Questions
52.	The overall gain of a two stage amplifier is 180dB. If the gain of first stage is 100dB, then the voltage gain of second stage is : (1) 20 (2) 80 (3) 100 (4) 8000
53.	A MOSFET differs from JFET mainly because : (1) Of the power rating (2) MOSFET has two gates (3) JFET has a p-n junction (4) MOSFET do not have a physical channel
54.	A certain D-MOSFET is biased at $V_{GS} = 0$ V, its data sheet specifies $I_{Dss} = 20mA$, $V_{GS}(off) = -5V$, the value of drain current is : (1) 0A (2) 20mA (3) 2mA (4) None of these
55.	If the output of logic gates is 0 when all its input are at 1, then the gate is : (1) NAND or Ex-NOR (2) Ex-OR or NOR (3) AND or NOR (4) NOR or OR
56.	A half adder is a digital circuit with : (1) Three inputs one output (2) Three inputs two outputs (3) Two inputs two outputs (4) Two inputs one output

Question No.	Questions
57.	Asynchronous counters are known as : (1) Ripple counters (2) Decade counters (3) Modulus counters (4) Multiple clock counters
58.	The most suitable gates to check whether the number of ones in a digital word is : (1) Ex-OR (2) NAND (3) NOR (4) AND, OR and NOT
59.	The speed of conversion is maximum in : (1) Successive -approximation A/D convertor (2) Parallel- comparator A/D convertor (3) Counter ramp A/D convertor (4) Dual slope A/D convertor
60.	The slowest A/D convertor is : (1) Successive -approximation A/D convertor (2) Parallel- comparator A/D convertor (3) Counter ramp A/D convertor (4) Dual slope A/D convertor
61.	The D' Alembert's Principle is valid only when : (1) work done by force of constraints is zero (2) virtual work done by force of constraints is zero (3) force of constraints are holonomics (4) work done by applied force is zero

Question No.	Questions
62.	In Lagrange's Equation Q_j represents : (1) Generalized force having dimension of force explicitly (2) Quantized force having dimension of force (3) Generalized force may or may not have dimension of force (4) Work done by generalized force
63.	If coordinates are cyclic in nature then : (1) Lagrangian 'L' is independent of velocity (2) Lagrangian 'L' is independent of coordinates (3) Lagrangian 'L' is dependent of velocity (4) Lagrangian 'L' is independent of both velocity and coordinates
64.	If the components of force acting on the particle are conservative and dissipative then Lagrange's Equation is given by : (1) $\frac{d}{dt}(\{\partial L|\partial \dot{q}_j\}) - \{\partial L|\partial q_j\} + \{\partial G|\partial q_j\} = 0$ (2) $\frac{d}{dt}(\{\partial L|\partial \dot{q}_j\}) + \{\partial L|\partial q_j\} + \{\partial G|\partial q_j\} = 0$ (3) $\frac{d}{dt}(\{\partial L|\partial \dot{q}_j\}) - \{\partial L|\partial q_j\} - \{\partial G|\partial q_j\} = 0$ (4) $\frac{d}{dt}(\{\partial L|\partial \dot{q}_j\}) + \{\partial L|\partial q_j\} - \{\partial G|\partial q_j\} = 0$

Question No.	Questions
65.	If equation of a conic with one focus at origin is given by $1/r = C[1 + \varepsilon \cos (\theta - \theta_0)]$ then nature of the orbit is ellipse when : (1) $0 < \varepsilon < 1$ and $E > 0$ (2) $0 < \varepsilon < 1$ and $E < 0$ (3) $\varepsilon > 1$ and $E > 0$ (4) $\varepsilon = 1$ and $E = 0$
66.	A particle moves in a circular orbit under a central force. Suddenly the force constant 'k' becomes half without change in velocity, the orbit becomes : (1) elliptical (2) parabolic (3) straight (4) not change
67.	The Hamiltonian, $H = T + V$ gives total energy : (1) when Cartesian and generalized coordinates do not depend on time explicitly (2) when only generalized coordinates do depend on time explicitly (3) when only Cartesian coordinates do not depend on time explicitly (4) when cartesian and generalized coordinates depend on time explicitly
68.	If (q,p) set obeys Hamilton' equations then new (Q,P) set obey canonical transformation when : (1) Generalized coordinates and momentum are independent variables (2) Generalized coordinates are independent variables (3) Cartesian coordinates are independent variables (4) Generalized coordinates and momentum are not independent variables

Question No.	Questions
69.	The quantized energy of Harmonic oscillator is given by : (1) $En = \left(n + \dfrac{1}{2}\right) hv$ (2) $En = \left(n - \dfrac{1}{2}\right) hv$ (3) $En = \left(n^2 + \dfrac{1}{2}\right) hv$ (4) $En = (n + 1) hv$
70.	Write the value of Eigen function and Eigen value in a given equation $-\dfrac{d^2}{dx^2} (\sin 3x) = 9 \sin 3x$: (1) $\sin x$, 9 (2) 3, $\sin 3x$ (3) $\sin 3x$, 9 (4) $-\sin 3x$, 9
71.	In case of a particle in a potential well of finite depth, the number of anti symmetric states depends : (1) value of applied potential, V_0 (2) mass of particle (3) depth of potential well (4) none of these
72.	In case of a particle in a 3D box, number of states for a particle having ½ spin are given by : (1) two (2) zero (3) one (4) none of these

Question No.	Questions
73.	The value of commutator $[L_x, L_y, L_z]$ is given by : (1) $i\hbar \left(L_x^2 - L_y^2\right)$ (2) $i\hbar \left(L_z^2 - L_x^2\right)$ (3) $i\hbar \left(L_y^2 - L_z^2\right)$ (4) None of these
74.	Eigen vectors of product A^B^ are : (1) Orthogonal (2) Non-orthogonal (3) Orthogonal as well as non orthogonal (4) None of these
75.	Pauli exclusion principle is applicable only for : (1) bosons (2) fermions (3) boson as well as fermions (4) none of these
76.	The necessary and sufficient condition for $A \times (B \times C) = (A \times B) \times C$ is given by : (1) $(A \times C) \times B = 0$ (2) $A \times (B \times C) = 0$ (3) $C \times (A \times B) = 0$ (4) None of these
77.	If $\nabla u = 2r^4\, \vec{r}$ then r is given by : (1) $(1/2)r^5 +$ constant (2) $r^6 +$ constant (3) $(1/5)r^6 +$ constant (4) $(1/3)r^6 +$ constant

Question No.	Questions
78.	If vector $V=r/r^3$ the surface integral of r over the surface of a cube of size a and centered at the origin is given by : (1) 2π (2) 4π (3) $2\pi a^3$ (4) zero
79.	The Eigen Value of a matrix are 1, $-2i$ and $3i$. The matrix is : (1) Unitary (2) Anti-unitary (3) Hermitian (4) Anti-Hermitian
80.	The generating function of Legendre's polynomial $P_n(x)$ is given by : (1) $(1 + 2xu - u^2)^{1/2}$ (2) $1/(1 - 2xu + u^2)^{1/2}$ (3) $(x^2 - 1)n$ (4) $1/(1 - 2xu - u^2)$
81.	In a Carnot cycle, the thermodynamic temperature : (1) Depends on thermodynamics properties (2) Depends on nature of substance (3) Independent on thermodynamics properties or nature of substance (4) None of these
82.	In a refrigerator, the heat exhausted to the outer atmosphere is : (1) More than that absorbed from the contents (2) Same as that absorbed from the contents (3) Less than that absorbed from the contents of the refrigerator (4) None of these

Question No.	Questions
83.	In thermodynamics, the Clausius- Clapeyron Equation is used to : (1) Describe the variation of pressure and volume for a system containing two phases in equilibrium (2) Describe the variation of pressure and temperature for a system containing two phases in equilibrium (3) Describe the variation of pressure, temperature and volume for a system containing two phases in equilibrium (4) Describe the variation of pressure and temperature for a system containing two phases not in equilibrium
84.	Bose-Einstein and Fermi Dirac distribution approaches the Maxwell Boltzmann distribution when value of ratio of sections to no. of particle (g_i/n_i) is : (1) Very Large as compared to unity (2) Zero (3) Small as compared to unity (4) None of these
85.	Consider the Fermi Dirac distribution function f(E) at room temperature, where E refers to energy. If E_f is Fermi energy, which of following is true : (1) F (E_f) has a value of 1/2 (2) State with $E < E_f$ are filled completely (3) F(E) is large and tends to infinity as E decreases much below E_f (4) F(E) is a step function

Question No.	Questions
86.	Hydrogen molecules (mass m) are in thermal equilibrium at a temperature T. Assuming classical distribution of velocity, the most probable speed at RT is : (1) $k_B T/m$ (2) $2k_B T/m$ (3) $(2k_B T)^{1/2}/m$ (4) $m/(2k_B T)^{1/2}$
87.	A system of non-interacting Fermi particles with Fermi energy E_f, has density of states $E^{1/2}$, where E is energy of particle. The average energy per particle at absolute temperature is : (1) $1/6\ E_f$ (2) $1/5\ E_f$ (3) $2/5\ E_f$ (4) $3/5\ E_f$
88.	Consider a radiation cavity of volume V at temperature T. The average number of photon in equilibrium inside the cavity is proportional to : (1) T (2) T^2 (3) T^3 (4) T^4
89.	Planck's formula for black body radiation reduces to Rayleigh and Wien's formula respectively for : (1) Small and large wave length (2) Large and small wave length (3) Complex and large wave length (4) Large and complex wave length

Question No.	Questions
90.	Curie temperature of iron is that temperature below which it is : (1) Ferromagnetic (2) Superconducting (3) Radioactive (4) Electrically conducting
91.	Consider the Zeeman splitting of a single electron system for the $3d \rightarrow 3p$ electric dipole transition. The Zeeman spectrum is : (1) Randomly polarized (2) Only π polarized (3) Only σ polarized (4) Both π and σ polarized
92.	Transition rules for vibrational - rotational spectra are : (1) $\Delta n = 0,\ \Delta j = \pm 1$ (2) $\Delta n = \pm 1,\ \Delta j = 0$ (3) $\Delta n = 0,\ \Delta j = 0$ (4) $\Delta n = \pm 1,\ \Delta j = \pm 1$
93.	Resonance (NMR, ESR etc.) studies in solid provide information about (choose incorrect) : (1) The electron structure of single defects (2) The motion of the spin or of the surroundings (3) Collective spin excitations (4) External magnetic field sampled by spin

Question No.	Questions
94.	The population inversion in He-Ne laser is produced by : (1) Photon excitation (2) Electron excitation (3) Inelastic atomic collisions (4) Chemical reaction
95.	A laser wavelength 740nm has coherence time 4×10^{-5} s, the quality factor of the laser beam is : (1) 1.6×10^{-4} (2) 2.6×10^{-10} (3) 1.6×10^{-10} (4) 1.5×10^{-5}
96.	The packing fraction of fcc structure is : (1) 52% (2) 74% (3) 92% (4) 86%
97.	Primitive cell of hcp lattice contains number of basis equal to : (1) 1 (2) 4 (3) 2 (4) 3
98.	The volume of the primitive cell of the reciprocal lattice is : (1) $4 (2\pi/a)^3$ (2) $4 (\pi/a)^3$ (3) $4 (3\pi/a)^3$ (4) $4 (\pi/2a)^3$

Question No.	Questions
99.	A linear diatomic chain consists of two atoms having masses 2 Kg and 16Kg respectively. The extremum frequency of optical branch is : (1) $2^{1/2}$ (2) $1/2^{½}$ (3) $1/2$ (4) 2
100.	For a superconductor which of the following is not true : (1) Specific heat is discontinuous at transition temperature (2) The resistivity falls sharply at T_c (3) It is diamagnetic below T_c (4) It is paramagnetic below T_c

(Set–"X")

(DO NOT OPEN THIS QUESTION BOOKLET BEFORE TIME OR UNTIL YOU ARE ASKED TO DO SO)

(M.Phil/Ph.D/URS–EE–2018)
Subject : PHYSICS

Sr. No. 100008

Code **D**

Time : 1¼ Hours   Max. Marks : 100   Total Questions : 100

Roll No. _____ (in figure) _____ (in words)

Name : _____   Father's Name : _____

Mother's Name : _____   Date of Examination : _____

(Signature of the candidate)   (Signature of the Invigilator)

CANDIDATES MUST READ THE FOLLOWING INFORMATION/ INSTRUCTIONS BEFORE STARTING THE QUESTION PAPER.

1. All questions are compulsory.

2. The candidates must return the Question book-let as well as OMR answer-sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means / mis-behaviour will be registered against him / her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.

3. Keeping in view the transparency of the examination system, carbonless OMR Sheet is provided to the candidate so that a copy of OMR Sheet may be kept by the candidate.

4. Question Booklet along with answer key of all the A, B, C, D code will be got uploaded on the University website after the conduct of Entrance Examination. In case there is any discrepancy in the Question Booklet / Answer Key, the same may be brought to the notice of the Controller of Examination in writing / through E.Mail within 24 hours of uploading the same on the University Website. Thereafter, no complaint in any case, will be considered

5. The candidate MUST NOT do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question book-let itself. Answers MUST NOT be ticked in the Question book-let.

6. **There will be no Negative marking. Each correct answer will be awarded one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.**

7. Use only Black or Blue <u>BALL POINT PEN</u> of good quality in the OMR Answer-Sheet.

8. BEFORE ANSWERING THE QUESTIONS, THE CANDIDATES SHOULD ENSURE THAT THEY HAVE BEEN SUPPLIED CORRECT AND COMPLETE BOOK-LET. COMPLAINTS, IF ANY, REGARDING MISPRINTING ETC. WILL NOT BE ENTERTAINED 30 MINUTES AFTER STARTING OF THE EXAMINATION.

Question No.	Questions
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22.	In Lagrange's Equation Q_j represents : (1) Generalized force having dimension of force explicitly (2) Quantized force having dimension of force (3) Generalized force may or may not have dimension of force (4) Work done by generalized force
23.	If coordinates are cyclic in nature then : (1) Lagrangian 'L' is independent of velocity (2) Lagrangian 'L' is independent of coordinates (3) Lagrangian 'L' is dependent of velocity (4) Lagrangian 'L' is independent of both velocity and coordinates
24.	If the components of force acting on the particle are conservative and dissipative then Lagrange's Equation is given by : (1) $\frac{d}{dt}(\{\partial L|\partial \dot{q}_j\}) - \{\partial L|\partial q_j\} + \{\partial G|\partial q_j\} = 0$ (2) $\frac{d}{dt}(\{\partial L|\partial \dot{q}_j\}) + \{\partial L|\partial q_j\} + \{\partial G|\partial q_j\} = 0$ (3) $\frac{d}{dt}(\{\partial L|\partial \dot{q}_j\}) - \{\partial L|\partial q_j\} - \{\partial G|\partial q_j\} = 0$ (4) $\frac{d}{dt}(\{\partial L|\partial \dot{q}_j\}) + \{\partial L|\partial q_j\} - \{\partial G|\partial q_j\} = 0$
25.	If equation of a conic with one focus at origin is given by $1/r = C[1 + \varepsilon \cos(\theta - \theta_0)]$ then nature of the orbit is ellipse when : (1) $0 < \varepsilon < 1$ and $E > 0$ (2) $0 < \varepsilon < 1$ and $E < 0$ (3) $\varepsilon > 1$ and $E > 0$ (4) $\varepsilon = 1$ and $E = 0$

Question No.	Questions
26.	A particle moves in a circular orbit under a central force. Suddenly the force constant 'k' becomes half without change in velocity, the orbit becomes : (1) elliptical (2) parabolic (3) straight (4) not change
27.	The Hamiltonian, $H = T + V$ gives total energy : (1) when Cartesian and generalized coordinates do not depend on time explicitly (2) when only generalized coordinates do depend on time explicitly (3) when only Cartesian coordinates do not depend on time explicitly (4) when cartesian and generalized coordinates depend on time explicitly
28.	If (q,p) set obeys Hamilton' equations then new (Q,P) set obey canonical transformation when : (1) Generalized coordinates and momentum are independent variables (2) Generalized coordinates are independent variables (3) Cartesian coordinates are independent variables (4) Generalized coordinates and momentum are not independent variables

Question No.	Questions
29.	The quantized energy of Harmonic oscillator is given by : (1) $En = \left(n + \dfrac{1}{2}\right) h\nu$ (2) $En = \left(n - \dfrac{1}{2}\right) h\nu$ (3) $En = \left(n^2 + \dfrac{1}{2}\right) h\nu$ (4) $En = (n + 1) h\nu$
30.	Write the value of Eigen function and Eigen value in a given equation $-\dfrac{d^2}{dx^2}(\sin 3x) = 9 \sin 3x$: (1) $\sin x$, 9 (2) 3, $\sin 3x$ (3) $\sin 3x$, 9 (4) $-\sin 3x$, 9
31.	Consider the Zeeman splitting of a single electron system for the $3d \rightarrow 3p$ electric dipole transition. The Zeeman spectrum is : (1) Randomly polarized (2) Only π polarized (3) Only σ polarized (4) Both π and σ polarized
32.	Transition rules for vibrational - rotational spectra are : (1) $\Delta n = 0$, $\Delta j = \pm 1$ (2) $\Delta n = \pm 1$, $\Delta j = 0$ (3) $\Delta n = 0$, $\Delta j = 0$ (4) $\Delta n = \pm 1$, $\Delta j = \pm 1$
33.	Resonance (NMR, ESR etc.) studies in solid provide information about (choose incorrect) : (1) The electron structure of single defects (2) The motion of the spin or of the surroundings (3) Collective spin excitations (4) External magnetic field sampled by spin

Question No.	Questions
34.	The population inversion in He-Ne laser is produced by : (1) Photon excitation (2) Electron excitation (3) Inelastic atomic collisions (4) Chemical reaction
35.	A laser wavelength 740nm has coherence time 4×10^{-5} s, the quality factor of the laser beam is : (1) 1.6×10^{-4} (2) 2.6×10^{-10} (3) 1.6×10^{-10} (4) 1.5×10^{-5}
36.	The packing fraction of fcc structure is : (1) 52% (2) 74% (3) 92% (4) 86%
37.	Primitive cell of hcp lattice contains number of basis equal to : (1) 1 (2) 4 (3) 2 (4) 3
38.	The volume of the primitive cell of the reciprocal lattice is : (1) $4 (2\pi/a)^3$ (2) $4 (\pi/a)^3$ (3) $4 (3\pi/a)^3$ (4) $4 (\pi/2a)^3$
39.	A linear diatomic chain consists of two atoms having masses 2 Kg and 16Kg respectively. The extremum frequency of optical branch is : (1) $2^{1/2}$ (2) $1/2^{\frac{1}{2}}$ (3) $1/2$ (4) 2

Question No.	Questions
40.	For a superconductor which of the following is not true : (1) Specific heat is discontinuous at transition temperature (2) The resistivity falls sharply at T_c (3) It is diamagnetic below T_c (4) It is paramagnetic below T_c
41.	When two identical Zener diodes are connected in series what happens to the breakdown voltage of the combination ? (1) It becomes zero (2) It remains same (3) It is doubled (4) It is halved
42.	The overall gain of a two stage amplifier is 180dB. If the gain of first stage is 100dB, then the voltage gain of second stage is : (1) 20 (2) 80 (3) 100 (4) 8000
43.	A MOSFET differs from JFET mainly because : (1) Of the power rating (2) MOSFET has two gates (3) JFET has a p-n junction (4) MOSFET do not have a physical channel

Question No.	Questions
44.	A certain D-MOSFET is biased at $V_{GS} = 0$ V, its data sheet specifies $I_{Dss} = 20\,mA$, $V_{GS}(off) = -5V$, the value of drain current is : (1) 0A (2) 20mA (3) 2mA (4) None of these
45.	If the output of logic gates is 0 when all its input are at 1, then the gate is : (1) NAND or Ex-NOR (2) Ex-OR or NOR (3) AND or NOR (4) NOR or OR
46.	A half adder is a digital circuit with : (1) Three inputs one output (2) Three inputs two outputs (3) Two inputs two outputs (4) Two inputs one output
47.	Asynchronous counters are known as : (1) Ripple counters (2) Decade counters (3) Modulus counters (4) Multiple clock counters
48.	The most suitable gates to check whether the number of ones in a digital word is : (1) Ex-OR (2) NAND (3) NOR (4) AND, OR and NOT

Question No.	Questions
49.	The speed of conversion is maximum in : (1) Successive -approximation A/D convertor (2) Parallel- comparator A/D convertor (3) Counter ramp A/D convertor (4) Dual slope A/D convertor
50.	The slowest A/D convertor is : (1) Successive -approximation A/D convertor (2) Parallel- comparator A/D convertor (3) Counter ramp A/D convertor (4) Dual slope A/D convertor
51.	In two dimensional electron gas the magnetic susceptibility : (1) Increase with temperature (2) Decrease with temperature (3) Is independent of temperature (4) May increase or decrease with temperature
52.	Bose Einstein condensation temperature T_b refers to the temperature below which : (1) an assembly of Bose gas condenses to liquid state (2) there is a significantly large occupancy of ground state in a system of bosons (3) bosons essentially behave like fermions (4) there is an appreciable occupation of ground state in a electron system

Question No.	Questions
53.	The mean square displacement of a particle undergoing Brownian motion at a temperature T is proportional to : (1) T (2) $1/T$ (3) $T^{1/2}$ (4) $T^{1/2}$
54.	In semiconducting devices the law of mass action in terms of free electron concentration (n), hole concentration (p) and intrinsic concentration (n_i) is given by : (1) $np = n_i^{1/2}$ (2) $np = n_i^{3/2}$ (3) $np = n_i^2$ (4) $np = n_i^{-1/2}$
55.	Rectification efficiency (η) of a full wave rectifier in terms of R_f and R_L is given by : (1) $\eta = \{81.1/(1+R_f/R_L)\}\%$ (2) $\eta = \{81.1/(1 - R_f/R_L)\}\%$ (3) $\eta = \{81.1/(1+R_L/R_f)\}\%$ (4) None of these
56.	In terms of current amplification factor(α) the collector current is given by : (1) $I_c = \alpha . I_B + I_{CBO}$ (2) $I_c = (\alpha/1-\alpha).I_B + I_{CBO}/(1-\alpha)$ (3) $I_c = \alpha . I_E - I_{CBO}$ (4) $I_c = (\alpha/1-\alpha).I_E + I_{CBO}/(1-\alpha)$

Question No.	Questions
57.	In case of common base configuration of a transistor the output characteristics gives : (1) The collector current is very high with small variation in collector base voltage (2) The collector current is very low with large variation in collector base voltage (3) The collector current does not depend upon collector base voltage (4) The collector current is very high with large variation in collector base voltage
58.	The common collector configuration is used : (1) For high frequency applications (2) For audio frequency applications (3) For impedance matching (4) None of these
59.	The voltage gain (A) of a common source Field Effect Transistor amplifier (with output resistance r_d, load resistance R_L and amplification factor μ) is given by : (1) $A = \mu.R_L/(r_d + R_L)^2$ (2) $A = \mu.R_L/(r_d + R_L)^{1/2}$ (3) $A = \mu.R_L/(r_d - R_L)$ (4) $A = \mu.R_L/(r_d + R_L)$
60.	A Zener diode is also a pn junction diode it can be used as : (1) Full wave rectifier (2) Half wave rectifier (3) AC voltage regulator (4) DC voltage regulator

Question No.	Questions
61.	Which of the following is determinates error ? (1) Personal error (2) Erratic error (3) Relative error (4) Absolute error
62.	The Fourier transformation of a function f(t) is given by : (1) $\int_{-\infty}^{\infty} f(t) e^{-st} dt$ (2) $\int_{0}^{\infty} f(t) e^{+st} dt$ (3) $\int_{-\infty}^{\infty} f(t) e^{-jwt} dt$ (4) $\int_{-\infty}^{\infty} f(t) e^{+jwt} dt$
63.	An FM radio receiver is tuned to a 90.6 MHz broadcast station. It will receive an image frequency of : (1) 110 MHz (2) 112 MHz (3) 114 MHz (4) 120 MHz
64.	The signal to noise ratio(S/N) appearing at the output of each channel in Pulse Amplitude Modulation (PAM) is : (1) Three times the input S/N (2) One and half times the input S/N (3) Twice the input S/N (4) Independent of input S/N
65.	The Bohr model gives the value for the ionization potential for the Li^{2+} ion is : (1) 13.6eV (2) 27.2eV (3) 40.8eV (4) 122.4eV

Question No.	Questions
66.	LS coupling occurs often in : (1) All atoms (2) Lighter atoms (3) Heavy atoms (4) None of these
67.	The spectrum of sodium atom can be explained by considering : (1) JJ coupling (2) LS coupling (3) Heitler London theory (4) Relativistic correction
68.	The degeneracy of the J states arising from ^3p term with spin orbit interaction are : (1) 1,3,5 (2) 1,2,3 (3) 3,5,7 (4) 2,6,8
69.	The selection rules in JJ coupling for jumping of one electron are : (1) $\Delta l = 0$, $\Delta j = 0, \pm 1$ (2) $\Delta l = \pm 1$, $\Delta j = 0$ (3) $\Delta l = \pm 1$, $\Delta j = 0, \pm 1$ (4) $\Delta l = \pm 1$, $\Delta j = \pm 0$
70.	The number of Zeeman levels for the form $^2P_{3/2}$ in weak magnetic field is : (1) 04 (2) 07 (3) 05 (4) 03

Question No.	Questions
71.	If concentration of electrons in a semiconductor is increased the concentration of holes will : (1) remains constant (2) decrease slightly (3) decrease so much that product 'np' will remain constant (4) also increase
72.	The current in a superconductor : (1) are confined to the surface of the superconductor (2) are confined to the middle portion of the superconductor (3) can exist in quantized form (4) give rise to a potential drop
73.	The volume of a nucleus in an atom is proportional to the : (1) Mass number (2) Proton number (3) Neutron number (4) Electron number
74.	The mass of two isobars of Ni and Cu are $_{28}Ni^{64} = 63.9280u$ and $_{29}Cu^{64} = 63.9298u$, the B.E. per nucleon of $_{28}Ni^{64}$: (1) 4.28 MeV (2) 8.77 MeV (3) 3.20 MeV (4) 6.44 MeV

Question No.	Questions
75.	The threshold energy of the increasing projectile for the given reaction is $_9F^{19} + n \rightarrow {}_8O^{19} + p$ (Q value of reaction is Q= –3.9 MeV) : (1) 4.10 MeV (2) 8.70 MeV (3) 3.20 MeV (4) 6.44 MeV
76.	Which of the following disintegration series of heavy elements will give 209 Bi as stable nucleus : (1) Thorium series (2) Neptunium series (3) Uranium series (4) Actinium series
77.	A neutron passing through a detector is detected because of : (1) The ionization it produces (2) The scintillation light it produces (3) The electron hole pair it produces (4) The secondary particles produced in the nuclear reaction in the detector medium
78.	If B.E. per Nucleon= 1MeV, m_p = 1.00758u and m_n = 1.00898u, then mass of deuterium nucleus in Kg is : (1) 1.67×10^{-27} Kg (2) 1.67×10^{-24} Kg (3) 1.752×10^{-27} Kg (4) 3.344×10^{-27} Kg

Question No.	Questions
79.	Which one of the following elementary particles is called baryon : (1) Electron (2) μ-meson (3) π- meason (4) Neutron
80.	Primary cosmic rays are composed of very energetic : (1) Electrons (2) Protons (3) Neutrons (4) Measons
81.	The dielectric constant of a material at optical frequency is mainly due to : (1) Ionic polarizability (2) Electronic polarizability (3) Dipolar polarizability (4) Ionic & dipolar polarizability
82.	When a mono-atomic gas is placed in a uniform electric field (E), the displacement of the nucleus is proportional to : (1) E^2 (2) E^3 (3) E (4) Independent of E
83.	In dielectric, the polarization is the function of : (1) Square of applied field (2) Applied field (3) Exponential of applied field (4) Logarithmic of applied field

Question No.	Questions
84.	The electric vector E and magnetic vector H, inside a conductor : (1) Are never in phase (2) Remains in phase (3) Phase depends upon the conductivity of medium (4) None of these
85.	Two plane waves having the same angular frequency, dielectric constant, amplitude (E) and opposite circular polarization is superimposed. The resulting wave is : (1) Linearly polarized with amplitude E (2) Linearly polarized with amplitude 2E (3) Linearly polarized with amplitude 4E (4) Circularly polarized with amplitude E
86.	In the Rayleigh scattering, the amount of scattered light is proportional to : (1) $1/\lambda^4$ (2) $1/\lambda^2$ (3) $1/\lambda^3$ (4) $1/\lambda^2$
87.	A ray of light in a dense medium of refractive index 1.4 approaches the boundary between given medium and air at an angle of $\theta = \sin^{-1}(0.8)$. Then the ray will be : (1) Totally absorbed (2) Internally reflected (3) Showing an arbitrary behavior (4) Emerging at an angle greater than corresponding to $\sin^{-1}(0.8)$

Question No.	Questions
88.	The path of charged particle in a crossed electric and magnetic field is : (1) Parabolic (2) A Cycloid (3) Hyperbolic (4) Circular
89.	According to Dirac's theory, a position is : (1) An occupied state of positive energy (2) An occupied state of negative energy (3) An unoccupied state of negative energy (4) An unoccupied state of positive energy
90.	For a pressure volume system starting from 1st law of thermodynamics according to Mayer's, the relation between C_p and C_v is given as : (1) $C_p - C_v = R$ (2) $C_p - C_v = R$ (3) $C_p - C_v = 2R$ (4) $C_p - C_v = R^2$
91.	In case of a particle in a potential well of finite depth, the number of anti symmetric states depends : (1) value of applied potential, V_0 (2) mass of particle (3) depth of potential well (4) none of these

Question No.	Questions
92.	In case of a particle in a 3D box, number of states for a particle having ½ spin are given by : (1) two (2) zero (3) one (4) none of these
93.	The value of commutator $[L_x, L_y, L_z]$ is given by : (1) $i\hbar \left(L_x^2 - L_y^2 \right)$ (2) $i\hbar \left(L_z^2 - L_x^2 \right)$ (3) $i\hbar \left(L_y^2 - L_z^2 \right)$ (4) None of these
94.	Eigen vectors of product $A^{\wedge}B^{\wedge}$ are : (1) Orthogonal (2) Non-orthogonal (3) Orthogonal as well as non orthogonal (4) None of these
95.	Pauli exclusion principle is applicable only for : (1) bosons (2) fermions (3) boson as well as fermions (4) none of these

Question No.	Questions
96.	The necessary and sufficient condition for $A \times (B \times C) = (A \times B) \times C$ is given by : (1) $(A \times C) \times B = 0$ (2) $A \times (B \times C) = 0$ (3) $C \times (A \times B) = 0$ (4) None of these
97.	If $\nabla u = 2r^4 \, \vec{r}$ then r is given by : (1) $(1/2)r^5 +$ constant (2) $r^6 +$ constant (3) $(1/5)r^6 +$ constant (4) $(1/3)r^6 +$ constant
98.	If vector $V = r/r^3$ the surface integral of r over the surface of a cube of size a and centered at the origin is given by : (1) 2π (2) 4π (3) $2\pi a^3$ (4) zero
99.	The Eigen Value of a matrix are 1, –2i and 3i. The matrix is : (1) Unitary (2) Anti-unitary (3) Hermitian (4) Anti-Hermitian
100.	The generating function of Legendre's polynomial $P_n(x)$ is given by : (1) $(1 + 2xu - u^2)^{1/2}$ (2) $1/(1 - 2xu + u^2)^{1/2}$ (3) $(x^2 - 1)n$ (4) $1/(1 - 2xu - u^2)$

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S.No	Set-A	Set-B	Set-C	Set-D
1	2	2	1	3
2	3	3	3	1
3	2	2	2	2
4	1	1	4	1
5	2	2	4	4
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44	4	1	2	2
45	4	2	1	3
46	2	3	2	3

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16/11/18

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S.No	Set-A	Set-B	Set-C	Set-D
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98	1	2	4	4
99	2	3	4	4
100	4	1	4	2

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