MANAV RACHNA Vidyanatanlsshal

MANAV RACHNA UNIVERSITY

Declared as State Private University vide Haryana Act 26 of 2014

SET-A

DEPARTMENT OF PHYSICS

"End-term Examination, January-2023"

SEMESTER	**I**	**DATE OF EXAM**	**16.01.2023**
SUBJECT NAME	Mechanics	**SUBJECT CODE**	**PHH105 B - T**
BRANCH	Physics	**SESSION**	**I**
TIME	**9:00am -12:00pm**	**MAX. MARKS**	**100**
PROGRAM	**B.Sc**	**CREDITS**	**4**
NAME OF FACULTY	**Aditya Sharma**	**NAME OF COURSE COORDINATOR**	**Aditya Sharma**

Note: Part A and Part B: All questions are compulsory.

Q.NO.		QUESTIONS	MARKS	CO	BT LEVEL	PI
PART-A	Q.1	Find the Mass momentum of Inertia of a hollow rectangle with outer length 10 m and inner length 8 meter, outer width 6 meter and inner width 4 meter.	5	CO1	BT3	1.2.1, 2.2.3,
	Q.2	Find the magnitude of two forces, such that if they act at right angles, their resultant is $(10)^{1/2}$N. If they act at 60^0 their resultant is $(13)^{1/2}$.	5	CO1	BT3	1.2.1, 2.2.3,
PART -B	Q.3	Find the resultant of two forces 150 N and 200 N acting an angle whose tangent is 12/5.	5	CO2	BT3	1.2.1, 2.2.3,
	Q.4	Define and give formula of the (i) torque and work done by torque (ii) Mass moment of Inertia and (iii) Newton's laws of motion of Rotation.	5	CO2	BT2/3	1.2.1, 2.2.3,
PART-C	Q.5	Hypothesis that a particle is under the of uniform circular motion and its projection is along the diameter of a circle, thus evaluate the; (i) Velocity and Max. velocity, (ii) Acceleration and Max. Acceleration and (iii) Force and Max Force.	20	CO3	BT3	1.2.1, 2.2.3, 2.3.1,
	Q. 6	Prove that the motion of a simple pendulam is S.H.M. and thus prove; (i) $\frac{d^2y}{dx^2} + \omega^2 x = 0$, *(ii)* $T = 2\pi\sqrt{\frac{L}{g}}$	20	CO3	BT4	1.2.1, 2.2.3, 2.3.1,
PART-D	Q.7	What is gravitational potential? Apply the theory of gravitational potential to evaluate the potential due to a uniform circular ring at a point on its axis.	20	CO4	BT2/4	1.2.1, 2.2.3, 2.3.1,
	Q. 8	Define and Prove that gravitational Potential energy is given by; $U(r) = -\frac{Gm1m2}{r}$, where m1 and m2 are the masses separated by a distance r. **Or** Write the Kepler's laws of planetary motion and Drive the Kepler's first law.	20	CO4	BT4	2.2.1, 2.3.1,5.4.1

END

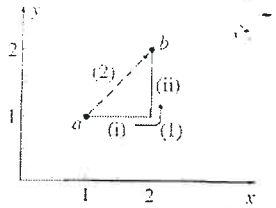
MANAV RACHNA UNIVERSITY
Declared as State Private University vide Haryana Act 26 of 2014

DEPARTMENT OF PHYSICS

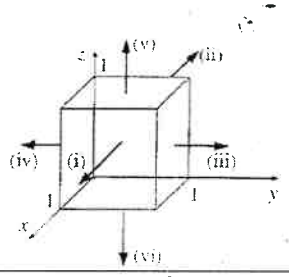
"End Term Examination, January-2023"

SEMESTER	**I**	**DATE OF EXAM**	**13/01/2023**
SUBJECT NAME	**Mathematical Physics-I**	**SUBJECT CODE**	**PHH104B-T**
BRANCH	**Physics**	**SESSION**	**I**
TIME	**9:00-12:00 P.M**	**MAX. MARKS**	**100**
PROGRAM	**B. Sc**	**CREDITS**	**4**
NAME OF FACULTY	**Dr. Deepti Maikhuri**	**NAME OF COURSE COORDINATOR**	**Dr. Deepti Maikhuri**

***Note**: Read the question paper carefully.*

Q.NO.		QUESTIONS	MARKS	CO ADDRESSED	BLOOM'S LEVEL	PI
PART-A	Q1	Solve the following differential equation: $x^2dy + y(x+y)dx=0$	10	CO1	BT3	1.2.1
PART-B	Q2	Prove that $v = (y^2 - z^2 + 3yz - 2x)\hat{x} + (3xz + 2xy)\hat{y} + (3xy - 2xz)\hat{z}$ is both solenoidal and irrotational.	10	CO2	BT4	1.2.1,6.2.1
PART-C	Q3A	Calculate the line integral of the function $v = (y^2)\hat{x} + 2x(y+1)\hat{y}$ from the point a = (1,1,0) to the point b = (2,2,0) along the paths (1) and (2) as shown in below given figure.  or Calculate the line integral of the function $v = (x^2)\hat{x} + (2yz)\hat{y} + (y^2)\hat{z}$ from origin to the point (1,1,1) via path (0,0,0)→(0,0,1) (0,1,1)→(1,1,1)	20	CO3	BT5	1.2.1,6.2.1

****

	Q3(B)	Check the divergence theorem using, the function $v = y^2\hat{x} + (2xy + z^2)\hat{y} + (2yz)\hat{z}$ and the unit cube situated at the origin as shown in figure. 	20	CO3	BT3	1.2. 1,6. 2.1
PART-D	Q5	Express the unit vectors $\hat{r}, \hat{\theta}, \hat{\Phi}$ in terms of $\hat{\imath}, \hat{\jmath}, \hat{k}$ and vice versa. Also determine the expressions for line, surface and volume element in spherical coordinate system. or Using the properties of Dirac delta function Evaluate the integral $\int_V \left\|\vec{r} - \vec{b}\right\|^2 \{r^4 + r^2(\vec{r}.\vec{c}) + c^4\}\delta^3(\vec{r}.\vec{c})d\tau$ where V is the volume of the sphere of radius b about the origin and $\vec{c} = 5\hat{x} + 3\hat{y} + 2\hat{z}$	20	CO4	BT4	4.1. 1,6. 2.1, 10. 2.1
	Q6	Using curvilinear coordinate system determine the gradient, divergence and curl expressions in spherical coordinate system.	20	CO4	BT4	4.1. 1,6. 2.1, 10. 2.1
		********** END **********				

****

MANAV RACHNA
vidyasobhanlakshe

MANAV RACHNA UNIVERSITY
Declared as State Private University vide Haryana Act 26 of 2014

DEPARTMENT OF PHYSICS

"End Term Examination, Jan-2023"

SEMESTER	**I**	**DATE OF EXAM**	**12/01/2023**
SUBJECT NAME	**Quantum Mechanics for Engineers**	**SUBJECT CODE**	**PHH101B-T**
BRANCH	**CSE, Robotics & AI**	**SESSION**	**9am -12 noon**
TIME	**3 hrs**	**MAX. MARKS**	**100**
PROGRAM	**B.Tech**	**CREDITS**	**04**
NAME OF FACULTY	**Dr. Jaiparkash**	**NAME OF COURSE COORDINATOR**	**Dr. Jaiparkash**

***Note**: All questions are compulsory.*

SET -B

Q.NO.		QUESTIONS	MARKS	CO ADDRESSED	BLOOM'S LEVEL	PI
PART-A	1(A)	Show that group velocity is always equal to particle velocity.	7	CO1	L2	2.1.1
	1(B)	A particle is described by the wave function $\Psi = Ae^{-kx}$ in the region $0 < x < \infty$. Determine the value of A so that wave function is normalized.	3	CO1	L3	2.1.1
PART-B	Q.2	Explain Dirac Delta potential and hence find the Eigen values and Eigen function for a particle moving in a delta potential.	10	CO2	L2	2.1.1
PART-C	Q.4(a)	An electron is moving freely inside a three dimensional metal piece having length, breadth and thickness to be equal to a, b, and c respectively. Assuming the potential at the surfaces to be infinite, find the expressions for Eigen value and Eigen function of the electron.	15	CO3	L2	2.1.1
	Q.4 (b)	The OH – radical has a moment of inertia of 1.48×10^{-47} kg m^2. Calculate its inter-nuclear distance. Also calculate its angular momentum and angular velocity for $l = 5$. Determine the energy absorbed in transition from $l = 5$ to $l = 6$.	5	CO3	L2	2.1.1

******

	Q.5(a)	Find the rotational energy of a molecule assuming it as a rigid rotator using Schrodinger equation.	15	CO3	L2	2.1.1
	Q.5(b)	Find the values of commutators [x, p] and [t, E].	5	CO3	L3	2.1.1
Part D	Q7.	Explain the working of the basic classical logic gates along with truth table using suitable logics	15.	CO4	L2	2.1.1
	Q8.	(i) Write the notes on Tensor product of qubits and Entanglement. (ii) Convert 32.8 into binary number system	10	CO4	L2	2.1.1
	Q9.	Discuss the following quantum logic gates: (i) Identity gate, (ii) Not gate, (iii) Phase shift gate, (iv) Hadamard gate(v) Controlled NOT gate	15	CO4	L2	2.1.1

********** END **********

****

MANAV RACHNA Vidyaparishad

MANAV RACHNA UNIVERSITY

Declared as State Private University vide Haryana Act 26 of 2014

SET-B

DEPARTMENT OF PHYSICS

"End-term Examination, January-2023"

SEMESTER	I	**DATE OF EXAM**	21.01.2023
SUBJECT NAME	Essential of Physics	**SUBJECT CODE**	PHH106B - T
BRANCH	Chemistry + Mathematics	**SESSION**	I
TIME	9:00am -12:00pm	**MAX. MARKS**	100
PROGRAM	B.Sc	**CREDITS**	4
NAME OF FACULTY	Aditya Sharma	**NAME OF COURSE COORDINATOR**	Aditya Sharma

Note: Part A and Part B: All questions are compulsory.

Q.NO.		QUESTIONS	MARKS	CO	BLOOM'S LEVEL	PI
PART-A	Q.1	Determine the resultant amplitude of two interfering waves and thus establish the condition for maximum and minimum intensity on the screen under the Young's experiment.	5	CO1	BT2	1.2.1, 2.2.3,
	Q.2	At certain point on the screen, the path difference for the two interfering waves is $1/8^{th}$ of the wavelength. Find the ratio of the intensity at this point to that of the central bright fringe.	5	CO1	BT3	1.2.1, 2.2.3,
PART -B	Q.3	What is the Nicol Prism. Demonstrate its functionality as polarizer and analyzer.	5	CO2	BT2/3	1.2.1, 2.2.3,
	Q.4	Calculate the thickness of mica sheet required for making a quarter wave plate $\lambda = 5460$ Å.μ_o and μ_e are, 1.586 and 1.598.	5	CO2	BT2/3	1.2.1, 2.2.3,
PART-C	Q.5	(a) Drive Schrodinger wave equation for time independent case and also generate the time dependent equation. (b)Calculate the energy of photon in eV if it has λ= 1Å. Also estimate the momentum of the photon. (c) Calculate the energy difference between ground state and first excited sate of an election in one dimensional rigid box of the length of 1Å.	10 + 5 +5 = 20	CO3	BT3	1.2.1, , 2.2.1, 2.3.1,
	Q. 6	Drive the Wien's Formula by obtaining the Plank's radiation law. **Or** Derive the Schrödinger equation for spherical polar coordinates.	20	CO3	BT4	1.2.1, , 2.2.1, 2.3.1,,
PART-D	Q.7	Drive the all Maxwell's equation in differential from and write importance of such equation.	20	CO4	BT4	2.2.1, 2.3.1,
	Q. 8	Write the postulate Pointing theorem and drive it. **Or** Write and drive, (i) Gradient of a Scalar Field, if $S = x^2y^3z^4$ calculate the gradient at point (1, -2, -1), (ii) Divergence of a Vector field, if r = (xi+yj+zk) then calculate **div r**, (iii) Curl of a vector field, if vector $A = xz^3i - 2x^2yzj+2yz^4k$ then find Curl A at point (1, -1, 1).	20	CO4	BT3/4	2.2.1, 2.3.1

END

MANAV RACHNA
vidyanabarifesha

MANAV RACHNA UNIVERSITY
Declared as State Private University vide Haryana Act 26 of 2014

DEPARTMENT OF PHYSICS

"End Term Examination, Jan-2023"

SEMESTER	**I**	**DATE OF EXAM**	**13/01/2023**
SUBJECT NAME	**Quantum Mechanics - I**	**SUBJECT CODE**	**PHH503B**
BRANCH	**Physics**	**SESSION**	**9am -12 noon**
TIME	**3 hrs**	**MAX. MARKS**	**100**
PROGRAM	**M.Sc**	**CREDITS**	**04**
NAME OF FACULTY	**Dr. Jaiparkash**	**NAME OF COURSE COORDINATOR**	**Dr. Jaiparkash**

Note: *All questions are compulsory.*

SET -B

Q.NO.		QUESTIONS	MARKS	CO ADDRESSED	BLOOM'S LEVEL	PI
PART-A	1(A)	State and prove Ehrenfest's theorem.	7	CO1	L2	2.1.1
	1(B)	The state of a free particle is represented by a wave function $\Psi = N e^{-\frac{x^2}{2a^2}+ikx}$. Find the normalization constant N.	3	CO1	L3	2.1.1
PART-B	Q.2	State and prove Heisenberg's uncertainty principle.	6	CO2	L3	2.1.1
	Q.3	Find the value of constant B that makes e^{-ax^2} an Eigen function of the operator $\left(\frac{d^2}{dx^2} - Bx^2\right)$.	4	CO2	L2	2.1.1
PART-C	Q.4(a)	Apply the Schrodinger equation to find the rotational energy value and wave function for the molecule assuming it as a rigid rotator.	15	CO3	L2	2.1.1
	Q.4 (b)	The electron of the hydrogen atom is in its ground state described by the wave function $\Psi = C e^{-\frac{r}{a_0}}$. Find the value of C so that wave function is normalized. Also find the $< r^2 >$.	5	CO3	L3	2.1.1
	Q.5	Solve Schrodinger wave equation for hydrogen atom and hence explain the shapes of ***s*** and ***p*** – subshells.	15	CO3	L2	2.1.1

****

	Q.6	Determine the energy required to excite $^{12}C^{16}O$ molecule from $J = 2$ to $J = 3$ if the inter-nuclear separation is 1.5 Å.	5	CO3	L3	2.1.1
Part D	Q7.	Discuss the time independent perturbation theory for non-degenerate states and obtain expressions for the second order correction to energy and Eigen function.	20	CO4	L2	2.1.1
	Q8.(a)	Discuss the time independent perturbation theory for degenerate states and obtain expression for the first order correction to energy	15	CO4	L2	2.1.1
	Q8.(b)	Apply perturbation theory to evaluate the first order energy correction in the ground state $\Psi = \frac{1}{\sqrt{\pi a_o^3}} e^{-\frac{r}{a_o}}$ of a Hydrogen atom due to Stark Effect assuming that electric field is applied along Z-axis.	5	CO4	L3	2.1.1

********** **END** **********

****

MANAV RACHNA
Vidyageetarikshal

MANAV RACHNA UNIVERSITY

Declared as State Private University vide Haryana Act 26 of 2014

DEPARTMENT OF PHYSICS

"End Term Examination, Jan.-2023" **SET-B**

SEMESTER	**I**	**DATE OF EXAM**	**16-01-2023**
SUBJECT NAME	**Mathematical Physics**	**SUBJECT CODE**	**PHH501B**
BRANCH	**Physics**	**SESSION**	**9:00AM to 12:00 Noon**
TIME	**3 Hours**	**MAX. MARKS**	**100**
PROGRAM	**M.Sc**	**CREDITS**	**4**
NAME OF FACULTY	**Haider Abbas**	**NAME OF COURSE COORDINATOR**	**Haider Abbas**

Note: Part A : All questions are compulsory.

Q.NO.	QUESTIONS	MARKS	CO ADDRESSED	BLOOM'S LEVEL	PI
1	Q.3. Find the eigenvalues and eigenvectors of the matrix $\begin{pmatrix} 1 & -6 & -4 \\ 0 & 4 & 2 \\ 0 & -6 & -3 \end{pmatrix}$	10	CO1	BT3	2.1.1
2	Find the C.F for the differential equation $(xsinx + cosx)\frac{d^2y}{dx^2}$ - xcos x $\frac{dy}{dx}$+ycosx = $sinx(xsinx + cosx)^2$	10	CO2	BT3	2.2.1, 2.3.1
3	Solve by series solution $x^2\frac{d^2y}{dx^2}+x\frac{dy}{dx}+(x^2-n^2)y=0$	20	CO3	BT4	2.2.1, 2.3.1
4	Solve by series solution $4x\frac{d^2y}{dx^2}+2\frac{dy}{dx}+y=0$	10	CO3	BT4	2.2.1, 2.3.1
5	Prove that $\frac{d}{dx}[xJ_nJ_{n+1}]= x\,(J^2_n - J^2_{n+1})$	10	CO3	BT4	2.2.1, 2.3.1
6	Find $L^{-1}\frac{3S+1}{(S-1)(S^2+1)}$	10	CO4	BT4	2.2.1, 2.3.1,5.4.1
7	Find the Fourier transform of f (x) = 1/2a, if $\|x\| \le a$ = 0 if $\|x\| > a$	10	CO4	BT4	2.2.1, 2.3.1,5.4.1
8	Solve the initial value problem $2y'' +5y' +2y = e^{-2t}$, y(0)=1, y'(0)=1	10	CO4	BT4	2.2.1, 2.3.1,5.4.1
9	Find the Fourier series for the periodic function f(x)= 0, $-\pi < x < 0$ x, $0 < x < \pi$	10	CO4	BT4	2.2.1, 2.3.1,5.4.11

MANAV RACHNA
MANAV RACHNA UNIVERSITY
Declared as State Private University vide Haryana Act 26 of 2014

DEPARTMENT OF PHYSICS

"End Term Examination, Jan-2023"

SEMESTER	**I**	**DATE OF EXAM**	**18/01/2023**
SUBJECT NAME	**Physics of Electronic Devices**	**SUBJECT CODE**	**PHH504B**
BRANCH	**Physics**	**SESSION**	**9am -12 noon**
TIME	**3 hrs**	**MAX. MARKS**	**100**
PROGRAM	**M.Sc**	**CREDITS**	**--**
NAME OF FACULTY	**Dr. Shiv Kumar Dixit**	**NAME OF COURSE COORDINATOR**	**Dr. Shiv Kumar Dixit**

Note: All questions are compulsory. *SET -A*

	Q.NO.	QUESTIONS	MARKS	CO ADDRESSED	BLOOM'S LEVEL	PI
PART-A	1(A)	Define conductivity (σ) and leakage current in a semiconductor. The intrinsic resistivity of germanium at room temperature is 0.47 Ω-cm. The electron and hole mobilities at room temperature are 0.39 and 0.19 m^2/V.s. respectively. Calculate the density of electrons in the intrinsic semiconductors. Also calculate the drift velocities of these charge carriers for a field of 10 KV/m.	5	CO1	L4	2.1.1
	1(B)	State and explain drift and diffusion current. A pure semiconductor (Si) is doped with donor impurity of 1:10^6. Find conductivity due to majority and minority carriers. Given total number of atoms in Si = 5× 10^{22} atoms/cm^3, Intrinsic concentration n_i = 1.5× 10^{10} atoms/cm^3, μ_n = 1300cm^2/V.s, μ_p = 500cm^2/V.s.	5	CO1	L3	2.1.1
PART-B	Q.2	Elaborate Avalanche and Zener breakdown mechanism.	5	CO2	L3	2.1.1
	Q.3	What are the conditions for reciprocity and symmetry for a 2 port network? Explain Z parameters for two port network.	5	CO2	L3	2.1.1

****

MANAV RACHNA Vidyanatariksha

MANAV RACHNA UNIVERSITY

Declared as State Private University vide Haryana Act 26 of 2014

DEPARTMENT OF PHYSICS

"END Term Examination, JAN-2023"

SEMESTER	**I**	**DATE OF EXAM**	21/01/2022
SUBJECT NAME	**Classical Mechanics**	**SUBJECT CODE**	**PHH502B-T**
BRANCH	**PHYSICS**	**SESSION**	**I**
TIME	**09.00 AM-12.00 PM**	**MAX. MARKS**	**100**
PROGRAM	**M. Sc. Physics**	**CREDITS**	**4**
NAME OF FACULTY	**Dr. Ananna Bardhan**	**NAME OF COURSE COORDINATOR**	**Dr. Ananna Bardhan**

Note: All questions are compulsory.

[SET A]

Q.NO.		QUESTIONS	MARKS	CO ADDRESSED	BLOOM'S LEVEL	PI
PART-A	1a	Differentiate between inertial and non-inertial frame of references. Prove that "*All those frames, which are moving with constant velocity relative to an inertial frame, are also inertial*".	07	CO1	BT3	2.2.1
	1b	The differential equation of a simple harmonic oscillator of mass m is given by $m\frac{d^2x}{dt^2}+Cx=0$, where x is the displacement at time t and C is the force constant. Solve the equation to find the expression for the displacement, velocity and acceleration	03	CO1	BT5	1.2.1, 1.3.1
PART-B	2	What are generalized coordinates and generalized velocity. Obtain the Lagrangian for spherical pendulum.	10	CO2	BT4	1.2.1, 1.3.1
PART-C	3	State and prove all three Kepler's laws of planetary motion.	20	CO3	BT3.4	2.2.1
	4a	Derive differential equation of an orbit $f\left(\frac{1}{u}\right)=\frac{J^2u^2}{m}\left[\frac{d^2u}{d\theta^2}+u\right]$	14	CO3	BT4	1.2.1, 1.3.1
	4b	A particle of mass 50 gm moves under an attractive central potential of magnitude $4r^3$ dynes. The angular momentum is equal to 1000gmcm^2/s. (i) Find the effective potential energy. (ii) Find the total energy for circular motion.	06	CO3	BT5	1.3.1
PART-D	5	Explain generating function for canonical transformations. Discuss and drive all four canonical transformations.	20	CO4	BT4	1.2.1
	6	Drive Hamiltonian function H and Hamiltonian canonical equations of motions. Prove that the Hamiltonian H of a conservative system is equal to the total energy of the system.	20	CO4	BT4	2.2.1

********** END **********

****

MANAV RACHNA Vidyaparikshat

MANAV RACHNA UNIVERSITY

Declared as State Private University vide Haryana Act 26 of 2014

DEPARTMENT OF PHYSICS

A

"T3 Examination, January-2023"

SEMESTER	I	DATE OF EXAM	23-01-2023
SUBJECT NAME	COMPUTATIONAL METHODS AND PROGRAMMING	SUBJECT CODE	PHS505B
BRANCH	Physics	SESSION	Morning
TIME	9:00 AM to 10.30 AM	MAX. MARKS	50
PROGRAM	MSc	CREDITS	2
NAME OF FACULTY	Dr. Sandeep Kumar	NAME OF COURSE COORDINATOR	Dr. Sandeep Kumar

Note: All questions are compulsory.

Q.NO.		QUESTIONS	MARKS	CO ADDRESSED	BLOOM'S LEVEL	PI
PART-A	1(A)	Explain the following MATLAB functions with example showing both input and output: **zeros (m, n)**	2	CO1	BT1	2.1
	1(B)	**sum(A)**	2	CO1	BT2	5.2
	1(C)	Create a row vector **L from 325 to 405 with an interval of 20.**	2	CO1	BT1	3.3, 2.1, 7.1
	1(D)	**plot(x1,y1,x1,y2,'2','b')**	2	CO1	BT1	2.2, 4.3
	1(E)	[ ] and **length(v)**	2	CO1	BT1	8.1, 10. 1
PART-B & PART-C	Q2	**a)** Create a matrix of zeros with 6 rows and 6 columns. **b)** Create two different vectors of the same length and subtract them. **c)** Create a 4 x 4 matrix and display the first row of and the second column on the screen.	5	CO2	BT2, BT1	2.1, 10. 2
	Q3	**a)** Using the plot command for multiple plots, plot y = sin(x) and y = cos(x) on the same graph for values of x defined by: x = 0:pi/30:2*pi	15	CO2	BT3	8.1, 11. 3

****

		b) Using the plot command for a single plot and the hold commands, plot y = atan(x)(x) and y = acot(x) on the same graph for values of x defined by: x = -pi/2:pi/30:pi/2 **c)** Find the general solution of the following first order ODE: $dy/dt + ytan(t) = \sin(2t)$				
PART-D	Q4	**a)** Write a Matlab function to solve the following differential equation using ode45 $y_1'(t) = y_2$, Use as initial conditions $y_1(0) = 0$, $y_2(0) = 1$, plot your solution for 0 ≤ t ≤ 4*pi. **b)** Solve the following ODE using ode45 with relative and absolute error of 10^{-12}, $y'(t) = 8cos(t) - 3y^3$, $y(0) = 1$. The initial time is t = 0, and the end time is t = 10. Plot the solution.	20	CO3	BT4	8.1, 11. 3
********** **END** **********						

****

MANAV RACHNA vidyaparibagha

MANAV RACHNA UNIVERSITY

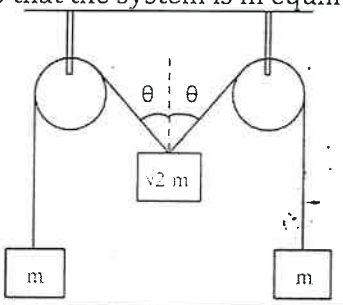
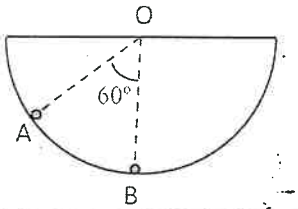
Declared as State Private University vide Haryana Act 26 of 2014

DEPARTMENT OF PHYSICS

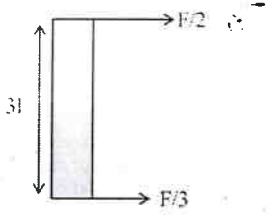
"End Term Examination, Jan-2023"

SEMESTER	**I**	**DATE OF EXAM**	**13.01.2023**
SUBJECT NAME	**Physics – I**	**SUBJECT CODE**	**PHH121-T**
BRANCH	**PHYSICS**	**SESSION**	**Morning**
TIME	**09:00 am to 12:00 pm**	**MAX. MARKS**	**80**
PROGRAM	**B.Sc. B.Ed.**	**CREDITS**	**4**
NAME OF FACULTY	**Ms. Moditma**	**NAME OF COURSE COORDINATOR**	**Ms. Moditma**

Note: Part A : All questions are compulsory.

Q.NO.		QUESTIONS	MARKS	CO ADDRESSED	BLOOM'S LEVEL	PI
PART-A	1(A)	A particle is falling freely under gravity. In the first 't' seconds it covers a distance 'x_1' and in the next 't' seconds it covers a distance 'x_2'. Find the time 't'.	5	CO1	BT3	
	1(B)	Consider the figure below, with the strings and pulleys being massless and frictionless. Find the value of θ so that the system is in equilibrium. 	5	CO1	BT2	
PART-B	Q2(A)	Assuming gravity to be negligible, derive the expression for velocity of a rocket with time. Further, explain the need for a multistage rocket.	7	CO2	BT3	
	2(B)	A ball of mass 2 kg is placed a point A inside a smooth semicircular track of radius 'r'. If it is released from rest, find the velocity of the ball when it reaches the bottom B of the circle, using the energy conservation principle. 	3	CO2	BT2	

****

PART-C	Q3(A)	A wheel mounted on a stationary axle starts at at rest and is given the following angular acceleration: $\alpha = 9 - 12t$ Find the number of revolutions that the wheel turns before it stops. ***OR*** A wheel is rotating at the rate of 50 rev/min. What should be magnitude of retarding angular acceleration of the wheel so that it stops in 8 s. How many revolutions it will cover before stopping.	5	CO3	BT3	
	Q3(B)	Consider a rigid body rotating with angular velocity ω. Show that the kinetic energy of the body can be represented as $KE = \frac{1}{2} I\omega^2$, where $I = \sum_i m_i r_i^2$	5	CO3	BT3	
	Q4	Find the moment of inertia of a (i) Solid sphere about an axis passing through its center (ii) Plane sheet about an axis through its center an perpendicular to its pane	10	CO3	BT4	
	Q5	What net force should act on the rod (in which direction and at what point) for equilibrium. 	10	CO3	BT3	
PART-D	Q6(A)	The gravitational potential due to a linear mass distribution long x-axis is given by $V = kx^{-2}$. Find the gravitational field due to the mass distribution.	3	CO4	BT1	
	6(B)	Derive the expression of orbital velocity and time period of a satellite at a height 'h' above the earth's surface. Describe what is a geostationary satellite.	7	CO4	BT2	
	Q7	State Kepler's Laws of planetary motion. Using the general expression of equation of motion under central forces, given by $\frac{d^2\alpha}{d\theta^2} + \alpha = f\left(\frac{1}{\alpha}\right)\frac{\mu}{L^2\alpha^2}$; where $f\left(\frac{1}{\alpha}\right) = \frac{dU}{dr}$, Show that for bodies moving under gravitational forces, the equation of motion represents that of a conic section, with the exact trajectory depending on total energy of the system. **OR** Find the distribution of gravitational potential and gravitational field due to a hollow sphere, at a point lying outside and inside the sphere. Also represent the same graphically.	20	CO4	BT4	

********** **END** **********

****

MANAV RACHNA
Vidyagaotrikshal

MANAV RACHNA UNIVERSITY
Declared as State Private University vide Haryana Act 26 of 2014

DEPARTMENT OF PHYSICS

"T3 Examination, December-2022"

SEMESTER	**III**	**DATE OF EXAM**	**15-12-2022**
SUBJECT NAME	**Quantum Mechanics (Physics - II)**	**SUBJECT CODE**	**PHH 204B-T**
BRANCH	**Mechanical Engineering**	**SESSION**	**Morning (9:00-12:00)**
TIME	**3Hrs**	**MAX. MARKS**	**100**
PROGRAM	**B. Tech. (ME)**	**CREDITS**	**4**
NAME OF FACULTY	**Dr. D. K. Sharma**	**COURSE COORDINATOR**	**Dr. D. K. Sharma**

Note: All questions are compulsory.

Set-A

		QUESTIONS	MARKS	COs	BLOOM'S LEVEL	PI
PART-A PART-B	Q1	Give the laws of photoelectric emission. Derive Einstein's photoelectric equation and show how it explains these laws.	10	CO1	BT1	1.3.1, 2.1.2, 2.2.4
	Q2	Explain de-Broglie hypothesis of matter waves and derive an expression for the de-Broglie wavelength of matter waves.	10	CO2	BT2	1.3.1, 2.1.2, 2.2.4
PART-C	Q3	Derive Schrodinger's time-dependent wave equation for a particle. Give the physical interpretation of the wave function.	20	CO3	BT2, BT3	4.1.1,5.4.1,6.1.1
	Q4	Solve the Schrodinger equation for a particle enclosed in a one dimensional rigid box of side L and obtain its eigenvalues and eigen functions. Draw a graph of its first three eigen functions.	20	CO3	BT3	4.1.1,5.4.1,6.1.1
PART-D	Q5	Explain the Kronig-Penny model of electron in periodic potential. What are its consequences?	20	CO4	BT4	5.4.1,6.1.1, 8.1,10.1,11.1
	Q6	Show that the Hall coefficient is independent of the applied magnetic field and inversely proportional to current density and electronic charge.	20	CO4	BT5	4.1.1,6.1.1, 8.1,10.1,11.1

********** END **********

****

MANAV RACHNA
Vidyopeeth Shikshan Sansthan

MANAV RACHNA UNIVERSITY

Declared as State Private University vide Haryana Act 26 of 2014

DEPARTMENT OF PHYSICS

T3 Examination, December-2022" Set A

SEMESTER	III	DATE OF EXAM	17.12.2022
SUBJECT NAME	Mathematical Physics-III	SUBJECT CODE	PHH202B-T
BRANCH	Physics	SESSION	I
TIME	09:00-12:00 Noon	MAX. MARKS	100
PROGRAM	B.Sc	CREDITS	4
NAME OF FACULTY	Haider Abbas	NAME OF COURSE COORDINATOR	Haider Abbas

Note: All questions are compulsory.

Q.NO.		QUESTIONS	MARKS	CO ADDRESSED	BLOOM'S LEVEL	PI
PART-A	Q.1	Find the Fourier sine and cosine transforms of e^{-ax}.	10	CO1	BT2	2.1.1
	Q.2	By applying residue theorem, evaluate $\int_0^{\pi} \frac{d\theta}{3+2\cos\theta}$	10	CO2	BT2	2.2.1, 2.3.1
PART-B	Q.3	The probability that a machine A will be performing an usual function in 5 years' time is ¼, while the probability that machine B will still be operating usefully at the end of the same period is 1/3. Find the probability in the following cases that in 5 years time: (i) Both machine will be performing an usual function. (ii) Neither will be operating. (iii) only machine B will be operating. (iv) At least one of the machines will be operating.	10	CO3	BT4	2.2.1, 2.3.1
	Q.4	Find the first four moments of the binomial distribution.	20	CO3	BT4	2.2.1, 2.3.1
	Q.5	A die is thrown 8 times and it is required to find the probability that number 3 will be shown (i) Exactly 2 times (ii) At least seven times (iii) At least once.	10	CO3	BT4	2.2.1, 2.3.1
PART-C	Q.6	Write a notes on bifurcation and fractals with suitable example of each.	10	CO4	BT4	2.2.1, 2.3.1,5.4.1
	Q.7	Show that there is no distinction between contravariant and covariant vectors when we restrict ourselves to rectangular Cartesian transformation of coordinates.	15	CO4	BT4	2.2.1, 2.3.1,5.4.1
	Q.8 (a)	Solve $\frac{dy}{dx}=\frac{y^2-xy}{x^2+xy}$	9	CO4	BT4	2.2.1, 2.3.1,5.4.1
	Q.8 (b)	Solve $x\frac{dy}{dx}+y\log y=xye^x$	6	CO4	BT4	2.2.1, 2.3.1,5.4.1

MANAV RACHNA Vidyonatarilabha

MANAV RACHNA UNIVERSITY

Declared as State Private University vide Haryana Act 26 of 2014

(A)

DEPARTMENT OF PHYSICS

"End-Term Examination, December-2022"

SEMESTER	III-rd	**DATE OF EXAM**	15-12-2022
SUBJECT NAME	Electromagnetic theory	**SUBJECT CODE**	PHH203B-T
BRANCH	Physics	**SESSION**	Morning
TIME	09.00AM - 12.00AM	**MAX. MARKS**	100
PROGRAM	BSc	**CREDITS**	4
NAME OF FACULTY	Dr. Sandeep Kumar	**NAME OF COURSE COORDINATOR**	Dr. Sandeep Kumar

Note: All questions are compulsory..

Q.NO.		QUESTIONS	MARKS	CO ADDRESSED	BLOOM'S LEVEL	PI
PART-A&B	Q1	If $\vec{r} = x\hat{a}_x + y\hat{a}_y + z\hat{a}_z$ and $\vec{T} = 2zy\hat{a}_x + xy^2\hat{a}_y + x^2yz\hat{a}_z$, determine $(\nabla \cdot \vec{r})\vec{T}$	10	CO1	BT1, BT2, BT3	1.11., 1.3.1, 2.1.1, 2.2.2, 4.1.1, 6.2.1
	Q2	Explain Coulomb's law and field intensity for point charges. Point charges 5 nC and -2 nC are located at (2, 0, 4) and (-3, 0, 5), respectively. Determine the force on a 1nC point charge located at (1, -3, 7).	10	CO1	BT1,BT2, BT3	1.11., 1.3.1, 2.1.1, 2.2.2, 4.1.1, 6.2.1
	Q3	What is Bio-savart law? Derive the formula of magnetic field intensity produced by a differential current element at a point at distance r.	10	CO2	BT1,BT2, BT3	1.11., 1.3.1, 2.1.1, 2.2.2, 4.1.1, 6.2.1
	Q4	Write down the Maxwell equation for static EM fields as well as for time varying fields. Discuss their physical significance also.	10	CO2	BT1,BT2, BT3	1.11., 1.3.1, 2.1.1, 2.2.2, 4.1.1, 6.2.1
PART-C & Part-D	Q5	In free space ($z \leq 0$), a plane wave with $\vec{H} = 10cos(10^8t - \beta z)\,\hat{a}_x$ mA/m is incident normally on a lossless medium ($\varepsilon = 1.5\varepsilon_0, \mu = 6\mu_0$) in region $z \geq 0$. Determine the reflected wave H_r, E_r and the transmitted wave H_t, E_t.	15	CO3	BT1,BT2, BT4	1.11., 1.3.1, 2.1.1, 2.2.2, 4.1.1, 6.2.1
	Q6	Discuss the reflection of plane wave at normal incidence. Derive the formulas of reflection and transmitted coefficients.	15	CO3	BT2, BT3, BT4	1.11., 1.3.1, 2.1.1, 2.2.2, 4.1.1, 6.2.1
	Q7	Discuss different types of transmission lines. For a two conductor transmission line, find out the solution of V and I using Kirchhoff's law. Obtain the formulas for characteristic impedance of the circuit model.	20	CO4	BT2, BT3, BT4	1.11., 1.3.1, 2.1.1, 2.2.2, 4.1.1, 6.2.1
	Q8	30-m-long lossless transmission line with Z_o = 50 ohm operating at 2 MHz is terminated with a load Z_L= 60 + j40 ohm. If u = 0.6c on the line, find (a) The reflection coefficient V (b) The standing wave ratio s (c) The input impedance	10	CO4	BT3, BT4	1.11., 1.3.1, 2.1.1, 2.2.2, 4.1.1, 6.2.1

********** END **********

****

MANAV RACHNA
Vidyantarikshat

MANAV RACHNA UNIVERSITY
Declared as State Private University vide Haryana act 26 of 2014

DEPARTMENT OF PHYSICS

"T3 Examination, December-2022"

SEMESTER	**III**	**DATE OF EXAM**	**12-12-2022**
SUBJECT NAME	**Quantum Mechanics**	**SUBJECT CODE**	**PHH 201B-T**
BRANCH	**PHYSICS**	**SESSION**	**Morning (9:00-12:00)**
TIME	**3Hrs**	**MAX. MARKS**	**100**
PROGRAM	**B.Sc.**	**CREDITS**	**4**
NAME OF FACULTY	**Dr. D. K. Sharma**	**COURSE COORDINATOR**	**Dr. D. K. Sharma**

Note: All questions are compulsory.

Set-B

Q.NO.		QUESTIONS	MARKS	COs	BLOOM'S LEVEL	PI
PART-A	Q1	Establish Planck's radiation formula and show that the Wien's formula and Rayleigh-Jean's formula are the special cases of Planck's formula.	10	CO1	BT2	1.3.1, 2.1.2, 2.2.4
PART-B	Q2	Derive Schrodinger's time-independent wave equation for a particle. Give the physical interpretation of the wave function.	10	CO2	BT3, BT5	1.3.1, 2.1.2, 2.2.4
PART-C	Q3	Solve the Schrodinger equation for hydrogen atom to fine eigen function and show that its ground state electron can have some probability at the nucleus.	20	CO3	BT2, BT3	4.1.1,5.4.1,6.1.1
	Q4	Discuss the one dimensional simple harmonic oscillator and obtain its eigen-values & eigen functions.	20	CO3	BT4	4.1.1,5.4.1,6.1.1
PART-D	Q5	A particle with energy E is approaching a potential step with potential function V =Vo for 0 < x and zero when x < 0. Determine the values of reflection and transmission coefficients.	20	CO4	BT3, BT4	4.1.1,5.4.1, 1,11.1
	Q6	Discuss the problem of the leakage of a particle through a rectangular potential barrier of finite width and explain the theory of α-particle decay.	20	CO4	BT5	6.1.1, 8.1,10.1,11.1

********** **END** **********

****

MANAV RACHNA
Vidyaparibhasha

MANAV RACHNA UNIVERSITY
Declared as State Private University vide Haryana Act 26 of 2014

(A)

DEPARTMENT OF PHYSICS
"End-Term Examination, December-2022"

SEMESTER	III[rd]	**DATE OF EXAM**	12-12-2022
SUBJECT NAME	Electrodynamics and Plasma Physics	**SUBJECT CODE**	PHH602B
BRANCH	Physics	**SESSION**	Morning
TIME	9.00AM - 12.00AM	**MAX. MARKS**	100
PROGRAM	MSc	**CREDITS**	4
NAME OF FACULTY	Dr. Sandeep Kumar	**NAME OF COURSE COORDINATOR**	Dr. Sandeep Kumar

Note: All questions are compulsory.

	Q.NO.	QUESTIONS	MARKS	CO ADDRESSED	BLOOM'S LEVEL	PI
PART-A&B	Q.1	The electric field of a plane electromagnetic wave is $\vec{E} = E_0 \exp[i(\hat{x}k\cos\alpha + \hat{y}k\sin\alpha - \omega t)]$. If $\hat{x}$, $\hat{y}$, and $\hat{z}$ are Cartesian unit vectors. Calculate the wave vector $\vec{k}$ of the electromagnetic wave.	10	CO1	BT1, BT2, BT3	1.11., 2.1.1, 2.2.1,4.1.1
	Q.2	An electromagnetic wave with $\vec{E}(z,t) = E_0 \cos(\omega t - kz)\hat{i}$ is travelling in free space and crosses a disc of radius 2m placed perpendicular to the Z axis. If E_0 = 60 V/m. Calculate the average power in watt, crossing the disc along the z-direction.	10	CO2	BT1, BT3	1.11.,2.1.1,2.2.1,4.1.1
PART-C & PART-D	Q.3	Derive the expressions of fields for an accelerating Charge.	15	CO3	BT1, BT4	1.11.,2.1.1, 2.2.1, 4.1.1,
	Q.4	Deduce an expression for Larmor's formula for a relativistic accelerated charge.	15	CO3	BT1, BT2, BT4	1.11.,2.1.1,2.2.1, 4.1.1
	Q.5	Calculate the time averaged Poynting vector, in W/m^2, for a wave with $\vec{E} = 24\exp[j(\omega t + \beta z)]\hat{a}_y$ in free space.	10	CO3	BT2, BT3, BT4	1.11.,2.1.1,2.21, 4.1.1
	Q.6	Discuss in detail the concept of the temperature in plasma. What are the necessary conditions for an ionized gas to be plasma?	10	CO4	BT2, BT3, BT4	1.11.,2.1.1,2.21, 4.1.1
	Q.7	What are the plasma Oscillation? Deduce an expression for plasma frequency with the help of mass conservation of continuity.	10	CO4	BT2, BT3, BT4	1.11.,2.1.1,2.21, 4.1.1
	Q.8	Explain hydrodynamical description of plasma. Establish the equation of magnetohydrodynamics. Compute λ_D and N_D for the following cases: (a) glow discharge with $n = 10^{16}$ m^{-3}, $KT_e = 2\ eV$, (b) The earth's ionosphere, with $n = 10^{12}$ m^{-3}, $KT_e = 0.1\ eV$. (c) A θ-pinch, with $n = 10^{23}$ m^{-3}, $KT_e = 800\ eV$.	20	CO4	BT2, BT3, BT4	1.11.,2.1.1,2.21, 4.1.1

********** END **********

****

MANAV RACHNA Vidyaparishad

MANAV RACHNA UNIVERSITY
Declared as State Private University vide Haryana Act 26 of 2014

DEPARTMENT OF PHYSICS

"End term Examination, Dec-2022"

SEMESTER	**III**	**DATE OF EXAM**	**17/12/2022**
SUBJECT NAME	**Electricity and Electromagnetism**	**SUBJECT CODE**	PHH226-T
BRANCH	**Physics**	**SESSION**	**Morning (9am-12noon)**
TIME	**3 hrs**	**MAX. MARKS**	**80**
PROGRAM	**B.Sc B.ED**	**CREDITS**	--
NAME OF FACULTY	**Dr. Shiv Kumar Dixit**	**NAME OF COURSE COORDINATOR**	**Dr. Shiv Kumar Dixit**

***Note**: All questions are compulsory.*

Set A

Q.NO.		QUESTIONS	MARKS	CO ADDRESSED	BLOOM'S LEVEL	PI
PART-A	Q.1	Define Gauss law with statement and derive an expression for measurement of electric flux density (D) for point charge and uniformly charged sphere for both cases.	10	CO1	L3	
	Q.2(a)	Define the term polarization and derive relation between D, E and P.	5	CO2	L3	
	Q.2(b)	Derive an expression for capacitance of a coaxial capacitor.	5	CO2	L3	
PART-B	Q.3 (a)	Define Ampere's circuit law and show that magnetostatic field is not conservative in nature.	5	CO3	L2	
	Q.3 (b)	Derive an expression for force on a charged particle and between two current elements using Biot Savarts law.	5	CO3	L2	

****

MANAV RACHNA
Vidyagatarlasha

MANAV RACHNA UNIVERSITY
Declared as State Private University vide Haryana Act 26 of 2014

DEPARTMENT OF PHYSICS

"END Term Examination, DEC-2022"

SEMESTER	**V**	**DATE OF EXAM**	**13.12.2022**
SUBJECT NAME	**Basic Electronics**	**SUBJECT CODE**	**PHH330-T**
BRANCH	**Education**	**SESSION**	**I**
TIME	**09.00 AM-12.00 PM**	**MAX. MARKS**	**80**
PROGRAM	**B. Sc. B. Ed.**	**CREDITS**	
NAME OF FACULTY	**Dr. Anshuman Sahai**	**NAME OF COURSE COORDINATOR**	**Dr. Anshuman Sahai**

Note: All questions are compulsory. *[SET A]*

Q.NO.		QUESTIONS	MARKS	CO ADDRESSED	BLOOM'S LEVEL	PI
PART-A	1a	What are intrinsic and extrinsic semiconductors? Explain how will you make p-type and n-type semiconductors.	4+4	CO1	BT3	
	1b	Plot the characteristic graphs showing the points of breakdown voltage and knee voltages in pn-junction diode.	2	CO1	BT2	
PART-B	2	With the help of neatly labeled diagram, explain the working of bipolar junction transistor in common collector mode. Also explain the current gains and the expression for collector current.	4+2	CO2	BT2	
	3	Prove: $\beta = \frac{\alpha}{1-\alpha}$	4	CO3	BT3	
PART-C	4	How will you make a NOR gate functions with 3 inputs using transistor and diode logic circuit only, along with truth tables. ***Or*** How will you make a NAND gate functions with 3 inputs using transistor and diode logic circuit only, along with truth tables.	20	CO3	BT4	
	5	What is a differential amplifier? Explain the working of differential amplifier with double ended outputs.	20	CO3	BT3	
	6	What is the time-domain representation of waves? Derive the relation for amplitude modulated wave and explain the terms upper side band and lower side band. What would be the case of output signal when the modulation depth is greater than 1? Give an example of over modulated wave. ***Or*** Derive the relation for frequency modulated wave and explain the terms upper side band and lower side band. What would be the case of output signal when the m>1?	10	CO4	BT2	
	7	An AM wave is represented by the expression: $v = 5(1+0.5\cos 6280t)\sin 211\times10^4 t$ volts. (i) What are the minimum and maximum amplitudes of the AM wave? (ii) What frequency components are contained in the modulated wave and what is the amplitude of each component?	5	CO4	BT4	
		Explain why modulation was required in communications and their different types in brief. A sinusoidal carrier voltage of 2MHz and 50volts is amplitude modulated by 5kHz producing 75% modulation. Calculate the frequency and amplitude of LSB and USB.	5	CO4	BT3, BT4	

********** END **********

****

MANAV RACHNA
Vidyanabarikshai

MANAV RACHNA UNIVERSITY
Declared as State Private University vide Haryana Act 26 of 2014

DEPARTMENT OF PHYSICS

"End Term Examination, December-2022"

SEMESTER	3rd	DATE OF EXAM	15.12.2022
SUBJECT NAME	Advanced Solid-State Physics	SUBJECT CODE	PHH603B
BRANCH	Physics	SESSION	I
TIME	9:00 A.M-12:00 NOON	MAX. MARKS	100
PROGRAM	M. Sc.	CREDITS	4
NAME OF FACULTY	Dr. Deepti	NAME OF COURSE COORDINATOR	Dr. Deepti

Note: All questions are compulsory. Use of scientific calculator is allowed during the exam.

[SET –A]

Q.NO.		QUESTIONS	MARKS	CO ADDRESSED	BLOOM'S LEVEL	PI
PART A	1	Discuss the various conclusions derived from the K-P equation, by giving its plot.	10	CO1	BT4	4.1.1 ,11.1. 1
PART B	2	Write down the wave equation in plasma and show that, how it supports electrostatic and magnetostatic waves?	5+5	CO2	BT5	2.1.1, 4.1.1
PART C	3	what is meant by local field on dielectric and how it is calculated for a cubic structure? Deduce Clausius - Mosotti relation and explain, its use in predicting the dielectric constants of solids. Find the total polarizability of CO_2, if its susceptibility is 0.985×10^{-3}. Density of CO_2 is $1.977 Kg/m^3$	6+10+4	CO3	BT3, BT4	4.1.1, 11.1. 1
	4	At what frequency do the real and imaginary parts of the polarizability become dominant? Illustrate their distribution around that frequency. Show that the imaginary part of the dielectric constant is the measure of dielectric loss.	10+10	CO3	BT4	2.1.1, 4.1.1, 11.1. 1
PART D	5	Describe Langevin's theory of paramagnetism. Obtain paramagnetic susceptibility of a free electron gas employing quantum statistics. Approximately how large must be the magnetic induction for the orientation energy to be comparable to the thermal energy at room temperature? Assume $\mu_m=5\mu_B$.	6+10+4	CO4	BT4, BT5	2.1.1 ,4.1.1 ,11.1. 1
	6	Distinguish between ferrimagnetic and antiferromagnetic substances. On the basis of two sublattice model and ignoring α and β , Deduce T_C,T_N and derive the expression for the susceptibility of ferrimagnetic and antiferromagnetic material.	10+5+5	CO4	BT3, BT4	2.1.1 ,4.1.1 ,11.1. 1
		********** END **********				

****

MANAV RACHNA Vidyaparikshad

MANAV RACHNA UNIVERSITY
Declared as State Private University vide Haryana Act 26 of 2014

DEPARTMENT OF PHYSICS

"END Term Examination, DEC-2020"

SEMESTER	**III**	**DATE OF EXAM**	**17-12-2022**
SUBJECT NAME	**Syn. Char. Tech.**	**SUBJECT CODE**	**PHH-605B**
BRANCH	PHYSICS	**SESSION**	I
TIME	**09-12:00 Noon**	**MAX. MARKS**	**100**
PROGRAM	**M.Sc. Physics**	**CREDITS**	**4**
NAME OF FACULTY	**Dr. Anshuman Sahai**	**NAME OF COURSE COORDINATOR**	**Dr. Anshuman Sahai**

Note: All questions are compulsory.

[SET A]

Q.NO.		QUESTIONS	MARKS	CO ADDRESSED	BLOOM'S LEVEL	PI
PART-A	Q1(A)	Give the details of synthesis method of LASER deposition technique	5	CO1	BT3	
	1(B)	Explain the working of manufacturing of thin films by Molecular beam Epitaxy.	5	CO1	BT3	
PART-B	Q2(A)	Explain the working of spin coating method for the synthesis of thin films.	5	CO2	BT3	
	2(B)	Explain the method of Top down approach to synthesize the nanomaterials	5	CO2	BT3	
PART-C	3(A)	Give principle, construction and working of Photo-luminescence (PL) spectroscopy. What are the applications of PL in modern material science research?	10	CO3	BT3	
	3(B)	Give principle, construction and working of Raman spectroscopy. What are the applications of Raman spectrometer in Nano-science and nano-technology?	10	CO3	BT3	
	4(A)	Explain the working of X-ray diffraction methods along with the Bragg's diffraction law.	10	CO3	BT3	
	4(B)	Explain the working of FTIR spectroscopy. How will you characterize the liquid materials?	10	CO3	BT3	
PART D	5	Give principle, construction and working of TEM machine. How the low temperature help to generate the image. Describe the all vacuum pumps attached to it for generate the Ultra high vacuum.	20	CO4	BT4	
	6	Give principle, construction and working of SEM machine. How the elemental analysis can be obtained from the SEM. Describe the applications of SEM.	20	CO4	BT4	

********** END **********

****

MANAV RACHNA
vidyaparikshna

MANAV RACHNA UNIVERSITY
Declared as State Private University vide Haryana Act 26 of 2014

DEPARTMENT OF PHYSICS

"End-Term Examination, December-2022"

SEMESTER	**III**	**DATE OF EXAM**	**12/12/2022**
SUBJECT NAME	**Nuclear and Particle Physics**	**SUBJECT CODE**	**PHH 601 B**
BRANCH	**Physics**	**SESSION**	**Morning**
TIME	**3 hrs**	**MAX. MARKS**	**100**
PROGRAM	**M. Sc**	**CREDITS**	
NAME OF FACULTY	**Dr. Sucheta Juneja**	**NAME OF COURSE COORDINATOR**	**Dr. Sucheta Juneja**

***Note**: Part A: All questions are compulsory. Part B: Attempt any two descriptive types. Part C: Attempt any four. Part D: Attempt any two.*

Q.NO.		QUESTIONS	MARKS	CO ADDRESSED	BLOOM'S LEVEL	PI
PART-A	1(A)	Define Electric Quadrupole moment of the nucleus?	2	CO1	L2	1.1.1,4.2.1
	1(B)	Discuss types of direct reactions with reactions?	2	CO1	L1	1.3.1,2.2.1
	1(C)	Write short note on Yukawa meson theory?	2	CO1	L2	3.3.4,4.2.1
	1(D)	W-hat do you understand by Nucleon-Nucleon Phase shifts	2	CO1	L3	1.1.1.4.2.1
	1(E)	What do you understand by differential reaction cross-section?	2	CO1	L1	1.3.1,2.2.1
	1(F)	State Nuclear Isomerism?	2	CO1	L1	1.3.1,2.2.1
	1(G)	Using Breit-Wigner formula, discuss resonance scattering?	3	CO1	L4	1.3.1,2.2.1
	1(H)	Discuss Nuclear fission on basis of liquid drop model?	2	CO2	L2	6.2.1,1.3.1
	1(I)	Discuss spin and parity of nuclear ground states of nucleus?	3	CO2	L2	6.2.1,1.3.1

****

PART-B	Q2	What are the basic assumptions made by fermi? derive fermi theory of beta decay and density of states?	10	CO3	L5	6.4.1,1 .3.1
	Q3(A)	Describe construction of Shell model of the nucleus with discussion of magic numbers?	6	CO2	L5	6.3.1,2 .1.1
	3(B)	Is it possible to predict spin and parity on the basis of shell model? If yes, explain?	4	CO2	L4	6.4.1,1 .3.1
	Q4	Explain conservation laws for elementary particles in terms of Baryon number, Lepton number and strangeness?	10	CO4	L4	6.4.1,1 .3.1
PART-C	Q5(A)	What do you understand by beta decay? Discuss three forms of β-decay with their conditions for occurring having their usual meanings?	7	CO3	L4	2.2.1,4 .2.2
	Q5(B)	Write short note on Pauli Neutrino hypothesis?	3	CO3	L3	2.2.1,4 .2.2
	Q6	Discuss and Explain Collective model of Bohr and Mottelson and its two types?	10	CO2	L4	6.3.1,2 .2.1
	Q7(A)	Discuss the different processes by which Gamma or X-rays are absorbed ?	6	CO3	L4	4.3.1,6 .3.1
	Q7(B)	What do you understand by multipolarity in gamma transitions? Discuss mean life of the excited state that gives to gamma transition and their mathematical expression?	4	CO3	L3	2.1.1,6 .3.1
	Q8(A)	Find the energy of a neutrino in the following K-capture reaction $_{55}Cs^{131} + {}^{0}e_{-1} \rightarrow {}_{54}Xe^{131} + \upsilon$ The total energy released in this process is 355 keV and the binding energy of the K-electron in Xe^{131} is 35 keV. Further the daughter nucleus is formed directly in the ground state?	5	CO3	L4	6.3.1, 2.2.1
	Q8(B)	Identify the unknown particles in terms of charge, Baryon and Lepton number in the following reaction $\mu^- + p \rightarrow {}_1n^0 + \ldots\ldots$?	5	CO3	L4	4.3.1,2 .1.1
	Q9(A)	Write short note on CPT theorem?	5	CO4	L4	4.3.1,2 .1.1
	Q9(B)	Which of the following reaction can occur in terms of charge, Baryon, Lepton number and isospin? a) $p + p \rightarrow n + p + \pi^+$ b) $\pi^- + p \rightarrow n + \pi^0$	5	CO4	L3	4.2.1,2 .2.1

****

PART-D	Q10	Write the Gell-mann Nishijima Formula and how it is used for the classification of elementary particles? For particle Ω^- estimate strangeness S?	10	CO4	L5	6.3.1,4 .2.1
	Q11(A)	Estimate and derive the lifetime of beta decay and strength of the interaction matrix element?	5	CO3	L4	2.2.1,4 .2.1
	Q11(B)	Discuss the eight fold way symmetry for nucleon, and give relation between nucleon, sigma, lambda and Xi	5	CO4	L5	6.3.1,4 .2.1
	Q12	What are Quarks? Explain Quark model with quarks and antiquarks? Give the quark composition of (π^+) in terms of baryon number, charge, spin, strangeness and hypercharge?	10	CO4	L5	6.3.1, 2.2.1

********** **END** **********

****

MANAV RACHNA Vidyaparishad

MANAV RACHNA UNIVERSITY

Declared as State Private University vide Haryana Act 26 of 2014

DEPARTMENT OF PHYSICS

"End Term Examination, Dec-2022"

SEMESTER	**V**	**DATE OF EXAM**	**20.12.2022**
SUBJECT NAME	**Digital Electronics**	**SUBJECT CODE**	**PHH302B-T**
BRANCH	**Physics**	**SESSION**	**Morning (9-12noon)**
TIME	**180 min**	**MAX. MARKS**	**100**
PROGRAM	**B.Sc**	**CREDITS**	**--**
NAME OF FACULTY	**Dr. Shiv Kumar Dixit**	**NAME OF COURSE COORDINATOR**	**Dr. Shiv Kumar Dixit**

***Note**: All questions are compulsory.* *Set B*

Q.NO.		QUESTIONS	MARKS	CO ADDRESSED	BLOOM 'S LEVEL	PI
PART-A	Q.1(A)	Implement the OR gate using NAND and NOR gate only.	5	CO1	BT3	1.1.1
	Q.1(B)	What are inverting and non inverting amplifiers? Explain the concept of virtual ground in OP-AMP.	5	CO1	BT2	1.2.1
	Q.1(C)	Verify the following (i) A+B = A+B (ii) (A+B) (A+C) = A+BC	5	CO2	BT3	1.2.1
	Q.1(D)	Represent the function F = C + (AB) (using logic circuit diagram and simplify the following using Demorgan's theorem (i) $\overline{A+\overline{BC}}$ (ii) $\overline{AB+CD}$	5	CO2	BT1	1.1.1
PART-B	Q.2	Explain clocked JK flip flop with truth table and logic circuit diagram. What is race around condition in JK flip flop? Explain how it occurs? Suggest a method to overcome the	20	CO3	BT4	1.1.1

****

MANAV RACHNA
Vidyaparishad

MANAV RACHNA UNIVERSITY
Declared as State Private University vide Haryana Act 26 of 2014

DEPARTMENT OF PHYSICS

"END Term Examination, DEC-2022"

SEMESTER	**V**	**DATE OF EXAM**	**16.12.2022**
SUBJECT NAME	**Modern Physics**	**SUBJECT CODE**	**PHH304B-T**
BRANCH	**PHYSICS**	**SESSION**	**I**
TIME	**09.00 AM-12.00 PM**	**MAX. MARKS**	**100**
PROGRAM	**B. Sc. Physics**	**CREDITS**	**4**
NAME OF FACULTY	**Dr. Ananna Bardhan**	**NAME OF COURSE COORDINATOR**	**Dr. Ananna Bardhan**

Note: All questions are compulsory.

[SET B]

Q.NO.		QUESTIONS	MARKS	CO ADDRESSED	BLOOM'S LEVEL	PI
PART-A	1	Discuss and derive Lorentz transformation equation.	10	CO1	BT3	2.2.1
PART-B	2	Discuss the effect of spin-orbit interaction and relativistic corrections on structure of the spectral line of hydrogen atom. Also, discuss and draw fine structure of the atom?	10	CO2	BT4	2.2.1
PART-C	3a	Distinguish between the normal and anomalous Zeeman effects. Derive the expression for Lande's g factor. Determine the Lande g values for the various levels of ^3P and ^3D.	15	CO3	BT3	1.2.1. 1.3.1
	3b	Find the magnetic moment, in the Bohr magneton, of an atom in the $^3P_2$ state.	05	CO3	BT5	2.2.1
	4a	Discuss types of molecular spectra with the help of suitable diagrams.	10	CO3	BT2	1.3.1
	4b	Calculate the two possible orientations of spin vector S with respect to a magnetic field B.	03	CO3	BT4	2.1.1
	4c	What do you understand by space quantization? How does orbital and spin angular momenta couple in a vector model of an atom?	07	CO3	BT4	1.2.1, 1.3.1
PART-D	5a	What do understand by parity? Differentiate between odd and even parity.	03	CO4	BT5	2.2.1
	5b	Discuss and illustrate each term used in the Weizsaecker mass formula of liquid drop model. Discuss its merits and demerits. How does this model explain the binding energy curve?	17	CO4	BT3	2.1.1
	6a	Discuss nuclear shell model in terms of its structure, angular - momenta and number of nucleons. How does this model explain the magic numbers?	15	CO4	BT3	2.2.1
	6b	Write the shell structure of $^{15}O_8$, $^{17}F_9$ nucleus. Also, find the angular momentum and parity.	05	CO4	BT4	2.1.1

********** END **********

****

MANAV RACHNA
Vidyanatarikshat

MANAV RACHNA UNIVERSITY

Declared as State Private University vide Haryana Act 26 of 2014

DEPARTMENT OF PHYSICS

"End Term Examination, December-2022"

SEMESTER	5th	DATE OF EXAM	14.12.2022
SUBJECT NAME	Condensed Matter Physics	SUBJECT CODE	PHH303B-T
BRANCH	Physics	SESSION	
TIME	9:00-12:00 NOON	MAX. MARKS	100
PROGRAM	B. Sc	CREDITS	4
NAME OF FACULTY	Dr. Deepti	NAME OF COURSE COORDINATOR	Dr. Deepti

Note: All questions are compulsory. Use of scientific calculator is allowed during the exam.

[SET –B]

Q.NO.		QUESTIONS	MARKS	CO ADDRESSED	BLOOM'S LEVEL	PI
PART-A	1	In powder X-ray diffraction pattern, using X-rays of wavelength 1.51Å. Three consecutive First order peaks are observed at 2ϕ value of 60^0, 90^0 & 112^0. If system is cubic & peak corresponds to (220) plane. Calculate (a) value of lattice constant (b) Obtain the Miller indices for the rest peaks & identify the system.	10	CO1	BT2, BT3	1.2.1
PART-B	2	A monoatomic simple cubic lattice with potential $U = \frac{1}{2}\alpha(r - r_0)^2 - \frac{1}{3}\beta(r - r_0)^3$ Where $r_0 = 2.8\mathring{A}$, $\alpha = 0.5\frac{eV}{A^2}$, $\beta = 0.1\frac{eV}{A^2}$ (i) Find the equilibrium lattice constant (ii) If X-rays of wavelength 2.8Å to be used then minimum angle that can be diffracted by powder sample of this crystal will be?	10	CO2	BT5	2.1.2
PART-C	3	Find the dispersion relation for a one-dimensional crystal with two types of atoms and discuss the nature of the optical and acoustical modes.	10+10	CO3	BT2, BT3, BT4, BT5	1.2.1, 6.2.1, 10.2. 1,2.1. 1,5.1. 1
	4	Determine the Density of vibrational modes of a continuous medium and obtain specific heat capacity of solids on the basis of Deby's model.	10+10	CO3	BT2, BT4, BT5	1.2.1, 6.2.1, 10.2. 1,2.1. 1,5.1. 1
PART-D	5	Discuss any two structure unfolding techniques in detail among the following (a)XRD (b)UV-Visible spectroscopy	10+5+ 5	CO4	BT2, BT4, BT5	1.2.1, 6.2.1, 10.2. 1,2.1.

****

	(c)FTIR spectroscopy				1,5.1.1
6	What is NMR technique used for? Discuss its principle and construction. What is NMR active and inactive nuclei? Discuss the relaxation process, shielding effect and deshielding effect in NMR. What are its advantages and applications?	5+10+5	CO4	BT2, BT3, BT5	1.2.1, 6.2.1, 10.2.1,2.1.1,5.1.1

********** END **********

****

MANAV RACHNA
Vidyavatarilshal

MANAV RACHNA UNIVERSITY

Declared as State Private University vide Haryana Act 26 of 2014

SET-B

DEPARTMENT OF PHYSICS

"End-term Examination, December-2022"

SEMESTER	**V**	**DATE OF EXAM**	12-12-2022
SUBJECT NAME	Statistical Physics	**SUBJECT CODE**	**PHH301B-T**
BRANCH	Physics	**SESSION**	**I**
TIME	**9:00 am -12:00 pm**	**MAX. MARKS**	**100**
PROGRAM	**B.Sc**	**CREDITS**	**4**
NAME OF FACULTY	**Aditya Sharma**	**NAME OF COURSE COORDINATOR**	**Aditya Sharma**

Note: Part A and Part B: All questions are compulsory. **Part C and Part D: Attempt any two.**

Q.NO.		QUESTIONS	MARKS	CO ADDRESSED	BLOOM'S LEVEL	PI
PART-A	Q.1	First excited state of H atom is 10.2 eV. What temperature is needed to excite H atoms to Ist excited state. (1 eV = 1.6×10^{-19}J and k = 1.38×10^{-23}J/K).	5	CO1	BT3	2.1.1, 2.3.1
	Q.2	Prove that probability of each event is 1/8 if three distinguishable coins were tosses. Also write the possible ways of tossing the coins.	5	CO1	BT3/2	2.2.1, 2.3.1
PART -B	Q.3	Prove that S = klogW	5	CO2	BT3/2	2.2.1, 5.4.11
	Q.4	Derive the expression for negative temperature and provide the conditions for the negative temperature.	5	CO2	BT2/3	2.2.1, 5.4.11
Part-C	Q.5	Hypothesis the entropy of a perfect gas and discuss the Gibb's paradox. Also explain the solution of Gibb's paradox.	20	CO3	BT4/5	2.2.1, 2.3.1,5.4.1
	Q. 6	Derive the expression for the most probable distribution of particles among various energy levels for a system obeying the Bose-Einstein's laws.	20	CO3	BT4/5	2.2.1, 2.3.1,5.4.1 1
	Q.7	(a) Calculate the average energy of Plank's oscillator of frequency v in thermal equilibrium at temperature T. (b) How many photons are present in 1 cm3 of radiation at 727 ^{0}C. What is their average energy?	10 + 10 =20	CO3	BT3	2.1.1, 2.3.1
PART-D	Q. 8	Estimate the value of Ef_0 for the electrons in Metals. Also establish relation for the Fermi-Dirac velocity distribution in x-direction.	20	CO4	BT4/5	2.2.1, 2.3.1,5.4.1
	Q. 9	Write a note: (i) Free electrons in metal, (ii) Fermi level (iii) Application of liquid He, (iv) Comparison of the three statistics.	20	CO4	BT2/3	2.2.1, 2.3.1,5.4.1 1
	Q.10	Drive the Plank's Radiation law under the quantum statistical mechanics laws.	20	CO4	BT4/5	2.2.1, 2.3.1,5.4.1

END