


Roll No.		Course Code: MPH1201			
OP JINDAL UNIVERSITY				 OPJU <small>UNIVERSITY OF SRI LANKA</small> <small>COOPERATIVE</small>	
Mid Semester Examination, May-2023					
M.Sc 2 nd Semester [03PG011]					
Physics					
Solid State Physics					
Time: 2 Hrs.		Max. Marks: 50			
Note:					
		M	CO	KL	
Section A (20 marks)					
Answer any 4 questions [04 x 05 marks=20 marks]					
1	a.	Explain the energy spectra of atoms, molecule and solids.	5	1	1
	b.	Write a notes on nearly free electron model and origin of the energy gap.	5	1	2
	c.	What is superconductivity. Write a short review on superconductivity.	5	3	1
	d.	What is Isotope effect.	5	3	2
	e.	Derive London equation. Give its physical significance.	5	3	2
Section B (30 marks)					
Answer any 3 questions [03 x 10 marks=30 marks]					
2	a.	What is Kroning-Penney model. Give the simplest example of one dimensional potential which has been treated by Kroning and Penney.	10	5	3
	b.	Establish the wave equation in a periodic potential and find the its solution.	10	1	3
	c.	What is Meissner effect. Explain, how superconducting state of material effected with the inclusion of magnetic lines.	10	3	3
	d.	What is BCS theory. Explain superconducting behavior on the basis of BCS theory.	10	3	3

02/05/23
08

Course Code: MPH 1202

OP JINDAL UNIVERSITY

Mid Semester Examination, May-2023

M.Sc. (Physics) 2nd Semester [03PG011]

Department of Physics, School of Science

Quantum Mechanics-I

Time: 2 Hrs.

Max. Marks: 50

Note:

M CO KL

Section A (20 marks)

Answer any 4 questions [04 x 05 marks=20 marks]

1	a.	Consider particles in a box of width L with ground state wave function given below. Find the value of $\langle p \rangle$ in region $0 \leq x \leq L$. Here p is momentum. $\Psi = \sqrt{\frac{2}{L}} \sin \frac{\pi x}{L}$	5	CO1	K3
	b.	What is de-Broglie hypothesis? Calculate the wavelength associated with an electron subjected to a potential difference of 1.2 kV.	5	CO1	K2
	c.	Prove that $[a, a^\dagger] = 1$.	5	CO2	K2
	d.	What is parity operator? Determine its eigen values. Prove that the Hamiltonian commutes with the parity operator.	5	CO2	K3
	e.	Prove that $[L_x, J_y] = i\hbar L_z$	5	CO2	K3


Section B (30 marks)

Answer any 3 questions [03 x 10 marks=30 marks]

2	a.	Consider particle in finite potential well of width L. Determine the wave functions using Schrodinger equation and sketch them. Discuss quantum tunneling. Do the energy values in this case is higher as compared with the infinite well potential? Give the reason.	10	CO1	K3
	b.	Using the matrix theory of harmonic oscillator, prove that energy eigen values $E_n = (n+1/2) \hbar \omega$, where $n = 0, 1, 2, \dots$ and ω is angular frequency.	10	CO2	K3
	c.	Prove that $[x, p_x^n] = n i \hbar p_x^{n-1}$.	10	CO1	K2
	d.	Find the eigen values and eigen vectors of the matrix $\begin{pmatrix} 1 & 1 & 1 \\ -1 & -3 & -3 \\ 2 & 4 & 4 \end{pmatrix}$	10	CO2	K3

03/05/23

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Roll No:		Course Code: MPH 1203																				
OP JINDAL UNIVERSITY Mid Semester Examination, May-2023 M.Sc. 2 nd Semester [03PG012]		 OPJU <small>UNIVERSITY OF DISTANCE EDUCATION AND MANAGEMENT</small>																				
Physics																						
Computational Methods and Programming																						
Time: 2 Hrs.		Max. Marks: 50																				
Note: Scientific calculator is allowed.																						
		M	CO	KL																		
Section A (20 marks)																						
Answer any 4 questions [04 x 05 marks=20 marks]																						
1	a.	Find a real root of the equation $3x + \sin x - e^x = 0$ by the method of False position correct to four decimal places.	5	1	1																	
	b.	Find to four places of decimal, the smallest root of the equation $e^{-x} = \sin x$ by Newton's method.	5	1	1																	
	c.	Predict the mean radiation dose at an altitude of 3000 feet by fitting an exponential curve $y = ab^x$ to the given data: <table style="margin-left: 40px; border-collapse: collapse;"> <tr> <td style="padding-right: 10px;">Altitude (x):</td> <td style="padding-right: 10px;">50</td> <td style="padding-right: 10px;">450</td> <td style="padding-right: 10px;">780</td> <td style="padding-right: 10px;">1200</td> <td style="padding-right: 10px;">4400</td> <td style="padding-right: 10px;">4800</td> <td style="padding-right: 10px;">5300</td> </tr> <tr> <td>Dose of radiation (y):</td> <td>28</td> <td>30</td> <td>32</td> <td>36</td> <td>51</td> <td>58</td> <td>69</td> </tr> </table>	Altitude (x):	50	450	780	1200	4400	4800	5300	Dose of radiation (y):	28	30	32	36	51	58	69	5	1	2	
	Altitude (x):	50	450	780	1200	4400	4800	5300														
Dose of radiation (y):	28	30	32	36	51	58	69															
d.	The latent heat of vaporisation of steam r , is given in the following table at different temperature t : <table style="margin-left: 40px; border-collapse: collapse;"> <tr> <td style="padding-right: 10px;">t:</td> <td style="padding-right: 10px;">40</td> <td style="padding-right: 10px;">50</td> <td style="padding-right: 10px;">60</td> <td style="padding-right: 10px;">70</td> <td style="padding-right: 10px;">80</td> <td style="padding-right: 10px;">90</td> <td style="padding-right: 10px;">100</td> <td style="padding-right: 10px;">110</td> </tr> <tr> <td>r:</td> <td>1069.1</td> <td>1063.6</td> <td>1058.2</td> <td>1052.7</td> <td>1049.3</td> <td>1041.8</td> <td>1036.3</td> <td>1030.8</td> </tr> </table> For this range temperature, a relation of the form $r = a + bt$ is known to fit the data. Find the values of a and b by the method of group averages.	t :	40	50	60	70	80	90	100	110	r :	1069.1	1063.6	1058.2	1052.7	1049.3	1041.8	1036.3	1030.8	5	1	2
t :	40	50	60	70	80	90	100	110														
r :	1069.1	1063.6	1058.2	1052.7	1049.3	1041.8	1036.3	1030.8														

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e.	The population of a town in the decimal census was as given below. Estimate the population for the year 1895 and 1925.	5	1	2
	Year x: 1891 1901 1911 1921 1931			
	Population y (in thousandts): 46 66 81 93 101			

Section B (30 marks)

Answer any 3 questions [03 x 10 marks=30 marks]

2	a.	From the following data:	10	1	1																		
		<table border="1"> <tr> <td>X</td> <td>65</td> <td>63</td> <td>67</td> <td>64</td> <td>68</td> <td>62</td> <td>70</td> <td>66</td> </tr> <tr> <td>Y</td> <td>68</td> <td>66</td> <td>68</td> <td>65</td> <td>69</td> <td>66</td> <td>68</td> <td>65</td> </tr> </table>				X	65	63	67	64	68	62	70	66	Y	68	66	68	65	69	66	68	65
	X	65				63	67	64	68	62	70	66											
	Y	68				66	68	65	69	66	68	65											
	i. Find variance of X, variance of Y, COV(X,Y), σ_x , and σ_y																						
	ii. Find correlation coefficient																						
		iii. Regression coefficients																					
		iv. Regression line of x on y and regression line of y on x.																					
	b.	Use Lagrange's interpolation formula, to find f(6) and By means of Newton's divided differences formula, find the values of f(8) and f(15) from the following table	10	1	2																		
		<table> <tr> <td>x:</td> <td>4</td> <td>5</td> <td>7</td> <td>10</td> <td>11</td> <td>13</td> </tr> <tr> <td>f(x):</td> <td>48</td> <td>100</td> <td>294</td> <td>900</td> <td>1210</td> <td>2028</td> </tr> </table>				x:	4	5	7	10	11	13	f(x):	48	100	294	900	1210	2028				
x:	4	5	7	10	11	13																	
f(x):	48	100	294	900	1210	2028																	
	c.	Solve the following equation by Gauss Jordan method $x + 3y + 3z = 16; x + 4y + 3z = 18; x + 3y + 4z = 19$	10	2	1																		
	d.	Solve the following equation by Jacobi's iterative method $5x - y + z = 10; 2x + 4y = 12; x + y + 5z = -1$	10	2	1																		

Roll No.		Course Code: MPH1204			
OP JINDAL UNIVERSITY					
Mid Semester Examination, May-2023					
M.Sc 2 nd Semester [03PG011]					
Physics					
Electrodynamics and Plasma Physics					
Time: 2 Hrs.		Max. Marks: 50			
Note:					
		M	CO	KL	
Section A (20 marks)					
Answer any 4 questions [04 x 05 marks=20 marks]					
1	a.	Find the angular distribution of radiation emitted by an accelerated charge.	5	2	1
	b.	Discuss coulomb gauge.	5	1	2
	c.	Derive $Curl H = J + \frac{\partial D}{\partial t}$. Also discuss the significance of the equation.	5	1	1
	d.	Establish the inhomogeneous wave equation.	5	2	2
	e.	Find the expression for radiation produced by moving charge.	5	2	2
Section B (30 marks)					
Answer any 3 questions [03 x 10 marks=30 marks]					
2	a.	Explain Gauge transformation. Discuss current is scalar quantity but it has direction.	10	1	3
	b.	What is meant by the divergence of magnetic vector potential A.	10	1	3
	c.	What are four vectors. Find the expression for momentum four vectors.	10	1	3
	d.	Prove that Lienard-Wiechart potential is a method to transform retarded potential to the relativistic form.	10	2	3

OP JINDAL UNIVERSITY

Mid Semester Examination, May 2015
M.Sc. 1st Semester, PHYSICS

Physics

Electrodynamics and Classical Physics

Duration: 2 hours

Roll No. _____

Section A (20 marks)

Answer any 4 questions (04 x 5 = 20 marks)

- a) Find the angular distribution of radiation emitted by an accelerated charge.
- b) Find the energy levels of a particle in a 1D infinite potential well.
- c) Derive the expression for the electric field of a uniformly charged sphere.
- d) Derive the expression for the magnetic field of a uniformly charged rotating sphere.

Section B (30 marks)

Answer any 3 questions (03 x 10 = 30 marks)

- a) Derive the Lorentz transformation equations for space and time coordinates.
- b) What is meant by the divergence of magnetic vector potential?
- c) What are four vector fields and their equations in Cartesian coordinates?
- d) Prove that Lorentz-Wahlund potential is a solution to Laplace's equation in the relativistic form.

10	10	10	10	10
10	10	10	10	10
10	10	10	10	10
10	10	10	10	10
10	10	10	10	10

Roll No:		Course Code: MCH 1201			
OP JINDAL UNIVERSITY					
Mid Semester Examination, May-2023					
M.Sc. 2 nd Semester [03PG012]					
CHEMISTRY					
Inorganic Chemistry-II					
Time: 2 Hrs.		Max. Marks: 50			
		M	CO	KL	
Section A (10 marks)					
All Questions are compulsory [05 x 02 marks=10 marks]					
1	a.	Calculate the microstates in p^2 and d^3 configuration.	2	1	1
	b.	Draw the Orgel diagram for d^8 configuration.	2	1	2
	c.	Write a note on atomic term symbols.	2	1	2
	d.	Write the splitting terms of P, D and F electronic states.	2	1	1
	e.	Write the properties of magnetic force lines.	2	2	1
Section B (16 marks)					
Answer any 4 questions [04 x 04 marks=16 marks]					
2	a.	Write the salient features of Tanabe-Sugano diagram with one example.	4	1	1
	b.	Determine the ground state term for d^6 , d^9 , p^3 and p^2 configuration	4	1	2
	c.	Define selection rule and also explain the mechanism for its breakdown.	4	1	2
	d.	Explain spin free -spin paired equilibria with example.	4	2	2
	e.	Draw only the Orgel diagram for d^5 system.	4	1	2
Section C (24 marks)					
Answer any 3 questions [03 x 08 marks=24 marks]					
3	a.	Determine all the term symbols and also mention the ground state term symbol for the following complexes: <ul style="list-style-type: none"> • $K[PtCl_3[C_2H_4]]$ • $[Co(NH_3)_6]^{2+}$ • $[Ni(CN)_4]^{2-}$ • RuO_4 	8	1	3
	b.	Draw and explain type of transitions and number of peaks in the Orgel diagram of d^3 and d^9 in both octahedral and tetrahedral field.	8	1	3
	c.	Write short note on: <ul style="list-style-type: none"> • Spectrochemical Series • Nephelauxetic Series 	8	2	2
	d.	Explain the magnetic properties of transition metal complexes.	8	2	2
	e.	Calculate the value of crystal field splitting energy (Dq) and Racah parameter (B) for d^1 and d^2 system.	8	1	3

Course Code: MCH1202

OP JINDAL UNIVERSITY

Mid Semester Examination, May-2023

M.Sc. 2nd Semester

Chemistry

Organic Chemistry- II



Time: 2 Hrs.

Max. Marks: 50

Note: Attempt all sections

M	CO	KL
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Section A (20 marks)

Answer any 4 questions [04 x 05 marks=20 marks]

1	a.	What is S _E i reactions? How it is different from S _E 2?	5	2	3
	b.	Discuss the reactivity and orientation of electrophilic substitution reaction in benzene containing more than one substituents.	5	2	2
	c.	What is SET mechanism of nucleophilic aliphatic substitution reactions and discuss various evidences in support of this mechanism	5	1	2
	d.	Why Nucleophilic substitution reaction in aromatic system and electrophilic substitution reactions in aliphatic system do not occur readily?	5	1,2	3
	e.	Briefly discuss the kinetics features of Sulphonation of Benzene.	5	2	2

Section B (30 marks)

Answer any 3 questions [03 x 10 marks=30 marks]

2	a.	Discuss S _E 1 mechanism. Explain its Stereo-chemistry.	10	1,6	2
	b.	Discuss the mechanism of Electrophilic Aromatic substitution reactions. State the evidence in support of the mechanism	10	1	3
	c.	Explain S _N 1 reaction. Compare its stereochemical features with S _N 2 reaction.	10	2,6	3
	d.	Compare briefly the mechanism and factors influencing Benzyne & S _N Ar mechanisms.	10	2	3

Course Code: CH1212



OP JSC UNIVERSITY

MS. SCIENCE, RAIPUR, JHARHANDA

M.Sc. 2nd Semester

Chemistry

Organic Chemistry - II

Time: 3 hours

Total Marks: 100

M. CO. 102

Section A (10 marks)

Answer any 4 questions (10 x 2.5 marks)

a.	What is the difference between a ketone and an aldehyde?	2	1	2
b.	Explain the reactivity and orientation of electrophilic substitution reaction in benzene containing nitro group.	2	2	2
c.	What is the mechanism of nucleophilic substitution reaction and give an example in support of the reaction.	2	1	2
d.	Why is nucleophilic substitution reaction in aromatic system and electrophilic substitution reaction in aliphatic system in the reverse order?	2	1.5	2
e.	Explain the kinetic factors of halogenation of benzene.	2	2	2

Section B (16 marks)

Answer any 4 questions (16 x 4 marks)

a.	Discuss the mechanism of Friedel-Crafts alkylation.	10	1.5	2
b.	Discuss the mechanism of electrophilic aromatic substitution reaction. Give an example in support of the reaction.	10	1	2
c.	Explain the mechanism of nucleophilic substitution reaction with an example.	10	1.5	2
d.	Discuss briefly the mechanism and kinetic factors influencing benzene halogenation.	10	2	2

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Course Code: **SOS-M-CH-1203**

O P JINDAL UNIVERSITY

Mid-Semester Examination, May-2023

M.Sc. 2nd Semester

Physical Chemistry II MCH 1203

[03 PG 012]



Time: 2 Hrs.

Max. Marks: 50

Note:

M	CO	K
		L

Section A (10 marks)

All Questions are compulsory [05 x 02 marks=10 marks]

1	a.	What do you mean by Adsorption? Give suitable examples.	02	CO 3	K1
	b.	Define electrochemical cells.	02	CO 2	K1
	c.	What do you mean by activity-coefficients?	02	CO 2	K1
	d.	Define autocatalysis. Give an example	02	CO 3	K1
	e.	Give few characteristics of enzyme catalysis.	02	CO 3	K1

Section B (16 marks)

Answer any 4 questions [04 x 04 marks=16 marks]

2	a.	Distinguish between physisorption and chemisorption.	04	CO 3	K2
	b.	What is adsorption isotherm? Explain Freundlich adsorption isotherm in detail?	04	CO 3	K1
	c.	Explain the various factors that contribute to the adsorption of gases on solids.	04	CO 3	K1
	d.	Explain thermodynamics of reversible electrodes and reversible cells.	04	CO 2	K1
	e.	Explain the role of catalysis in catalytic converters.	04	CO 3	K1

Section C (24 marks)

Answer any 3 questions [03 x 08 marks=24 marks]

3	a.	Derive the equation for enzyme catalysis (Michealis-Menten equation).	08	CO 3	K2
	b.	Derive Langmuir adsorption isotherm equation?	08	CO 3	K2
	c.	What is electrochemistry? Derive Nernst equation and their application.	08	CO 2	K2
	d.	What is Chemisorption? Derive Gibbs adsorption isotherm.	08	CO 3	K1
	e.	What is electrochemical cell? To write their application of electrochemical cell	08	CO 2	K1

Course Code: MCH 1204					
OP JINDAL UNIVERSITY					
Mid Semester Examination, May-2023					
M.Sc. 2nd Semester [03PG012]					
Department of Chemistry					
Group Theory and Spectroscopy					
Time: 2 Hrs.			Max. Marks: 50		
Note: All questions are compulsory					
			M	CO	KL
Section A (20 marks)					
Answer any 4 questions [04 x 05 marks=20 marks]					
1	a.	Explain subgroup, class, conjugate, similarity transformation with examples.	5	CO1	2
	b.	Differentiate between spectra and spectrum? Explain basic principle of spectroscopy?	5	CO3	2
	c.	What do you mean by improper axis of symmetry ? how it is differ with proper axis of symmetry?	5	CO2	1
	d.	Define electromagnetic spectrum? Explain its correlation with interaction of matter ?	5	CO3	1
	e.	Explain the postulates of Group theory and its application?	5	CO1	2
Section B (30 marks)					
Answer any 3 questions [03 x 10 marks=30 marks]					
2	a.	Write multiplication table for point group C_{2v} and C_{3v} .	10	CO1	3
	b.	How will you determine the point group of any molecules ? explain with example.	10	CO2	2
	c.	Define natural broadening of spectral lines? Correlate the causes of broadening of spectral lines and its effects on spectral line?	10	CO3	1
	d.	Describe all the symmetry elements of CH_4 and determine its point group?	10	CO2	2





OP JESUIT UNIVERSITY
1000 University Blvd
St. Louis, MO 63103
Department of Chemistry
Group Theory and Spectroscopy

Max. Marks: 50

Time: 2 hrs

Answer all questions in your own words.

M. CO. 10

Section A (20 marks)

Answer any 4 questions (4 x 5 marks = 20 marks)

1	5	1. Explain the difference between a point group and a space group.
2	5	2. Define the term 'character' in the context of group theory.
3	5	3. What is the character of the identity operation in any group?
4	5	4. Define the term 'irreducible representation'.
5	5	5. Explain the meaning of 'direct product' of two representations.

Section B (30 marks)

Answer any 3 questions (3 x 10 marks = 30 marks)

1	10	1. The character table for the point group C_{2v} is given below. Find the irreducible representation for the function $x^2 - y^2$.
2	10	2. The character table for the point group C_{3v} is given below. Find the irreducible representation for the function xy .
3	10	3. The character table for the point group C_{4v} is given below. Find the irreducible representation for the function xy .