Course Code: MPH 2101

OP JINDAL UNIVERSITY

Mid Semester Examination, October-2023

M.Sc. 3rd Semester [03PG011]

Physics

Quantum Mechanics II

Time: 2 Hrs. **Max. Marks: 50**

Note:

			M	CO	KL
Section A (10 marks) All Questions are compulsory [05 x 02 marks=10 marks]					
1	a.	Variational principle is applicable for: (i) E1 ≤ <H>, (ii) <H> ≤ E1, (iii) <H> = E1, and (iv) <H> > E1	2	CO1	K1
	b.	Corpuscular theory of light states that light is made of: (i)Particles, (ii) wave, (iii) electron, and (iv) proton.	2	CO2	K1
	c.	Zero-point energy of One Dimensional Harmonic Oscillator is? (i) 2ħω, (ii) 1/2 ħω, (iii) ¼ ħω, and (iv) ħω.	2	CO1	K2
	d.	What will be the relation between V and E in barrier to the right (i) V > E, (ii) V< E, (iii) V=E, and (iv) V≥ E	2	CO1	K2
	e.	The differential scattering cross-section $\sigma(\theta, \varphi)$ is defined by (i) $^{n}/_{d\Omega}$ / ^{N}, (ii) $^{N}/_{d\Omega}$ / $_{n}$, (iii) NdΩ, and (iv) ndΩ	2	CO2	K1
Section B (16 marks) Answer any 4 questions [04 x 04 marks=16 marks]					
2	a.	Write down five postulates of quantum mechanics in detail.	4	CO2	K1
	b.	Explain Young's double slit experiment.	4	CO2	K2
	c.	Define density operator, density matrix and momentum operator. What are the limitations of density matrix.	4	CO2	K1 &k2
	d.	Define differential scattering cross - section and total cross section. What is the unit in which they are measured.	4	CO2	K1
	e.	What is variation formula and expectation value of Energy?	4	CO1	K1
Section C (24 marks) Answer any 3 questions [03 x 08 marks=24 marks]					
3	a.	Estimate the ground state of a Helium.	8	CO1	K3
	b.	Calculate zero point Energy of one dimensional Harmonic Oscillator.	8	CO1	K3
	c.	Explain WKB approximation. Discuss briefly the validity conditions of WKB approximation.	8	CO1	K2
	d.	Obtain the first and second order Stark effect on the ground state energy of a H - atom.	8	CO2	K3
	e.	Explain Stern Gerlach Experiment in detail.	8	CO1	K3

Course Code: **MPH 2102**

OP JINDAL UNIVERSITY

Mid Semester Examination, October-2023

M.Sc. (Physics) 3rd Semester [03PG011]

Department of Physics, School of Science

Electronic & Photonic Devices

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.	Describe construction, working and I-V characteristics of unijunction transistor (UJT).	5	CO1	K2
	b.	Discuss that how JFET differs from BJT and advantages of JFET over BJT.	5	CO2	K2
	c.	Discuss the advantages and disadvantages of MESFET. Why is GaAs used in MESFET? Write down some applications of MESFET.	5	CO2	K2
	d.	Describe crowbar circuit and its application.	5	CO1	K2
	e.	Discuss the application of SCR in on-off control of current.	5	CO1	K2
Section B (30 marks) Answer any 3 questions [03 x 10 marks=30 marks]					
2	a.	Draw the equivalent circuit of 4-layer diode using pnp and npn transistors and describe its working. How is 4-layer diode used in a relaxation oscillator?	10	CO1	K3
	b.	Explain construction and working of MOSFET in enhancement mode. Point out some of shortcomings MOSFET.	10	CO2	K3
	c.	Explain the application of SCR in backup lighting for power interruption using suitable circuit diagram.	10	CO1	K3
	d.	Describe the working of JFET with suitable diagram with I-V characteristics. What is pinch-off voltage?	10	CO2	K3

Course Code: MCH2102

OP JINDAL UNIVERSITY

Mid Semester Examination, October-2023

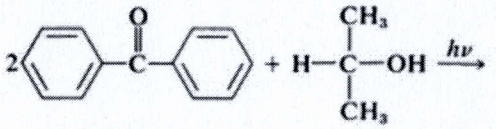
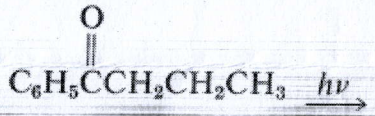
M.Sc. 3rd Semester [03PG012]

Chemistry

Organic Chemistry- III

Time: 2 Hrs. **Max. Marks: 50**

Note: Attempt all sections

			M	CO	KL
Section A (20 marks) Answer any 4 questions [04 x 05 marks=20 marks]					
1	a.	Using Jablonski diagram discuss the various radiative and non-radiative processes.	5	1	1
	b.	Using suitable examples, explain Norrish type I reactions.	5	2	2
	c.	Write a note on "Valence Isomerization in Aromatic Compounds".	5	2	2
	d.	Discuss the photochemistry of Photo-Fries Rearrangement reaction.	5	2	2
	e.	Explain the mechanism of Paterno-Buchi reaction using suitable examples.	5	2	2
Section B (30 marks) Answer any 3 questions [03 x 10 marks=30 marks]					
2	a.	What is Quenching? How it can occur? Derive Stern-Volmer equation for quenching of fluorescence.	10	1	2
	b.	What is meant by photo-stereo-mutation of cis-trans isomers of alkenes? Why in such stereo-mutations generally, the thermodynamically less stable form predominates in the product mixture? Elaborate.	10	2	3
	c.	Discuss the mechanism of the following reactions: i. Barton Reaction ii. Di-π methane rearrangement	10	2	2
	d.	Write all possible products obtained in the following reactions and explain the mechanism involved:  i.  ii.	10	2	3
	e	Define quantum yield. Explain the reason of high and low quantum yields using suitable examples. Also describe how it can be measured.	10	1	2

Course Code: MCH 2103

OP JINDAL UNIVERSITY

Mid Semester Examination, October-2023

MSc. 3rd Semester [03PG012]

Department of Chemistry

Physical Chemistry-III

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.	Give two examples of how a "quantum mechanics" may use a wave function?	5	CO1	1
	b.	List the postulates of quantum mechanics and explain them.	5	CO1	1
	c.	Given a classical observable (position, momentum, kinetic energy, total energy), write down the corresponding quantum operators.	5	CO1	2
	d.	What are the properties of a wave function? Not every function can be a wave function. Why?	5	CO1	1
	e.	What is a commutator? How is the commutator related to whether two quantities can be observed *simultaneously* to arbitrary accuracy?	5	CO2	1
Section B (30 marks) Answer any 3 questions [03 x 10 marks=30 marks]					
2	a.	Derive equation for standing wave ?	10	CO1	3
	b.	Find the expression for the following operators: $a)\ \left(\frac{d}{dx}+x\right)^2$ $b)\left(\frac{d}{dx}+x\right)\left(\frac{d}{dx}-x\right)$	10	CO2	3
	c.	Show that the commutator $\left[x,\frac{d}{dx}\right]=-1$	10	CO2	3
	d.	Determine whether the momentum operator commutes with KE and Total energy operators for time independent equations	10	CO2	2

Course Code: SOS-B- MPH 2105

OP JINDAL UNIVERSITY

Mid-Semester Examination, Oct-2023

M.Sc. 3rd Semester

Communication Electronics-I

[03UG011]

Time: 2 Hrs. **Max. Marks: 50**

Note:

Section A (20 marks)

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

			M	CO	KL
1	a.	Differentiate between Klystrons and TWT?	5	CO-1	K2
	b.	Explain the Microwave waveguide. Distinguish between TEM, TE, and TM modes of propagation in rectangular waveguides.	5	CO-4	K2
	c.	Explain the Principle and Construction of Two Cavity Klystron.	5	CO-1	K2
	d.	Derive the expressions for the field components due to TE waves in a circular waveguide.	5	CO-2	K2
	e.	Describe with the neat sketch the constructional details and principle of operation of a traveling wave tube.	5	CO-2	K2

Section B (30 marks)

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

2	a.	Explain how the oscillations are sustained in cavity magnetron with suitable sketches assuming that π–mode oscillations already exist.	10	CO-1	K2
	b.	Derive the expressions for the field components due to TE, and TM waves in rectangular waveguides.	10	CO-2	K2
	c.	What is a Circular wave guide? Derive the expressions for the field components due to TM waves in a circular waveguide.	10	CO-2	K2
	d.	Describe with the neat sketch the constructional details and principle of operation of a reflex klystron tube. With the help of the Applegate, the diagram illustrates the phenomenon of bunching.	10	CO-1	K2