Course Code: SOS-B-23DSA101

OP JINDAL UNIVERSITY

Mid Semester Examination, November-2023

B.Sc. Hons 1st Semester

Offered to Physics, Chemistry, Mathematics and DSA

GE I: Introduction to Programming

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.	Write a program to accept the number from a user and find the factorial of a number using a function.	5	1	1
	b.	Write a program to read a temperature in Celsius from the user and Convert it into Fahrenheit.	5	1	1
	c.	Write a program to check whether the number entered is an Armstrong number or not. **$153 = 1^3+5^3+3^3$**	5	2	1
	d.	Write a program to display the pattern of stars given as follows: *	5	2	1
	e.	Write a Python program to read the marks of 5 subjects through the keyboard. Calculate the total marks, percentage and grade of marks obtained by the student. Assume maximum marks that can be obtained by a student in each subject us calculate the total marks, percentage and grade of a student.	5	2	1
Section B (30 marks) Answer any 3 questions [03 x 10 marks=30 marks]					
2	a.	Explain looping control statements in Python with syntax and example to each.	10	2	2
	b.	Describe Operator. What are the types of operators in Python? Explain the types of Operator in detail.	10	1	2
	c.	Explain the function of Python and describe it with syntax and example. What are the types of arguments in Python function definition in detail?	10	3	2
	d.	Explain Data Types in Python and describe them with syntax and example. What are the types of Data Type in Python? Explain in detail.	10	1	2

Course Code: SOS-B- PH 101

O P JINDAL UNIVERSITY

Mid Semester Examination, Oct.-2023

B.Sc. 1ST Semester

MECHANICS

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.	Define Simple Harmonic motion. Obtain an expression for a differential equation and its solution.	05	CO2	K3
	b.	Prove that $Y = 9K\eta/(\eta + 3K)$	05	CO5	K3
	c.	Obtain an expression differential equation of the Damped harmonic oscillator and its solution.	05	CO2	K3
	d.	Prove that $Y = 2\eta(1+\sigma)$	05	CO5	K3
	e.	Derive an expression of the total energy of a simple harmonic oscillator.	05	CO2	K3
Section B (30 marks) Answer any 3 questions [03 x 10 marks=30 marks]					
2	a.	Find an expression of Gravitational Potential and Intensity inside and outside a spherical shell of mass M and radius a.	10	CO2	K3
	b.	Obtain an expression differential equation of the Forced harmonic oscillator (F.H.O.) and its solution.	10	CO7	K2
	c.	Find an expression of Gravitational Potential and Intensity inside and outside a Solid Sphere of mass M and radius a.	10	CO2	K2
	d.	Define the Kepler's law. Also, state and prove Kepler's first law.	10	CO4	K3
	e.	Prove that $Y = 3K(1-2\sigma)$	10	CO5	K3

Course Code: SOS-B-PH102

OP JINDAL UNIVERSITY

Mid Semester Examination, October-2023

B.Sc. 1st Semester [03UG021]

Physics

Mathematical Physics-I

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.	Find $A \cdot B$ and $A \times B$ where $A = 2i - 3j + 4k$, $B = -i + 2j + 2k$	2	CO4	K1
	b.	Find angle 'θ' between the vectors $\vec{a} = \hat{i} + \hat{j} - \hat{k}$ and $\vec{b} = \hat{i} - \hat{j} + \hat{k}$.	2	CO4	K1
	c.	Find 'm' so that the vectors are coplanar $2\hat{i} - 4\hat{j} + 5\hat{k}, \hat{i} - m\hat{j} + 4\hat{k}, 3\hat{i} + 2\hat{j} - 5\hat{k}$	2	CO4	K1
	d.	Find $\nabla\left(\frac{1}{r}\right)$	2	CO5	K1
	e.	Find the unit normal to the surface $x^2 + y^2 = z$ at a point (1, 2, 5)	2	CO5	K1
Section B (16 marks) Answer any 4 questions [04 x 04 marks=16 marks]					
2	a.	Obtain the directional derivative of the function $f = x^2 - y^2 + 2z^2$ at the point $P(1,2,3)$ in the direction of the line PQ where Q is the point $(5,0,4)$.	4	CO5	K2
	b.	Show that the the vector $\vec{V} = (y^2 - z^2 + 3yz - 2x)\hat{i} + (3xz + 2xy)\hat{j} + (3xy - 2xz + 2z)\hat{k}$ is both solenoidal and irrotational.	4	CO5	K2
	c.	Obtain *div* $\vec{F}$ and *curl* $\vec{F}$ where $\vec{F} = grad\ (x^3 + y^3 + z^3 - 3xyz)$	4	CO5	K1
	d.	If $u\vec{F} = \nabla v$, where u, v are scalar fields and $\vec{F}$ is a vectors field, show that $\vec{F} \cdot curl\ \vec{F} = 0$.	4	CO5	K2

	e.	Prove that $div(\vec{a} \times \vec{b}) = \vec{b} \cdot curl\, \vec{a} - \vec{a} \cdot curl\, \vec{b}$	4	CO4	K2
Section C (24 marks) Answer all questions [03 x 08 marks=24 marks]					
3	a.	Explain the physical meaning of divergence and Curl.	8	CO5	K2
	b.	Obtain the scalar potential function ϕ for $\vec{V} = y^2 i + 2xy\, j - z^2 k$	8	CO5	K2
	c.	If $\vec{r} = x\,\hat{i} + y\,\hat{j} + z\,\hat{k}$, then show that i. $div\, r^n \vec{r} = (n+3)\, r^n$ ii. $div\, grad\, r^n = n(n+1) r^{n-2}$	8	CO5	K2
	d.	Prove that $\vec{\mathbf{b}} \cdot \nabla \left(\vec{\mathbf{a}} \cdot \nabla \frac{1}{r} \right) = \frac{3\,(\vec{\mathbf{a}} \cdot \vec{\mathbf{r}})\,(\vec{\mathbf{b}} \cdot \vec{\mathbf{r}})}{r^5} - \frac{(\vec{\mathbf{a}} \cdot \vec{\mathbf{b}})}{r^3}$ where $\vec{\mathbf{a}}$ and $\vec{\mathbf{b}}$ are constant vectors.	8	CO5	K2

Course Code: SOS-B-BT102

OP JINDAL UNIVERSITY

Mid Semester Examination, November-2023

B.Sc. (H) 1st Semester [Program Code: 03UG024]

Biotechnology

Chemistry- I

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

Note: Attempt all sections

			M	CO	KL
Section A (10 marks)					
All Questions are compulsory [05 x 02 marks=10 marks]					
1	a.	Differentiate between accuracy and precision.	2	1	1
	b.	Define Mole.	2	1	1
	c.	Differentiate between temporary and permanent hardness of water.	2	1	1
	d.	State one significance of Dissolved Oxygen.	2	1	1
	e.	What is polarity of bond?	2	2	1
Section B (16 marks)					
Answer any 4 questions [04 x 04 marks=16 marks]					
2	a.	Draw the Lewis dot structures of the following: i. HNO_3 ii. PO_4^{3-}	4	2	2
	b.	Calculate the mass percentage of oxygen in nitrite ion	4	1	2
	c.	Differentiate between BOD & COD.	4	1	2
	d.	Define Molarity. A 250 mL solution was prepared by dissolving 55.5 g calcium chloride in water. It is then diluted by mixing another 750 ml water. Calculate the molarity before and after dilution.	4	1	2
	e.	State the limitations of Lewis-Kossel theory.	4	2	1
Section C (24 marks)					
Answer any 3 questions [03 x 08 marks=24 marks]					
3	a.	An Organic compound contains 40.0% carbon, 6.67% hydrogen and 53.33% oxygen. It has a molecular mass of 60.0 g. What is its empirical formula and molecular formula?	8	1	3

	b.	One of the principal components of LPG used for household cooking is butane, C_4H_{10}. It undergoes combustion according to the following reaction: $2C_4H_{10} + 13O_2 \longrightarrow 8CO_2 + 10H_2O$ i. Calculate the mass of oxygen required to burn 290 g of butane. ii. Determine the molecules of carbon dioxide produced during the combustion.	8	1	3
	c.	What is EDTA? Discuss the principle involved in determination of Hardness of water by EDTA method. Write chemical reactions involved.	8	1	2
	d.	Using VSEPR theory identify the geometry and shape of the following molecules: i. SF_4 ii. PH_3 iii. H_2S iv. CO_2	8	2	2
	e.	i. Discuss (using suitable example) the formation of an ionic and covalent bond using Lewis-Kossel approach. ii. Determine the formal charge of the underlined elements: $\underline{S}O_4^{2-}$ and $\underline{N}H_4^+$	8	2	2

Course Code: SOS- B-CH101

OP JINDAL UNIVERSITY

Mid Semester Examination, October-2023

B.Sc. 1st Semester [03UG022]

BSc Honors Chemistry

Inorganic Chemistry CC-I

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.	What is Quantum numbers? To write their types and find the value of all quantum numbers : $4p^5$, $3f^7$, $2s^2$ and $6d^8$	5	1	1
	b.	Explain Aufbau's principle with diagram and suitable examples.	5	1	2
	c.	To write the name of S block elements and their electronic configuration.	5	3	1
	d.	Explain Shapes of s, p, d and f orbitals.	5	1	2
	e.	To write the name of 14^{th} and 17^{th} group of p block elements and their electronic configuration.	5	2	1

Section B (30 marks)

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

2	a.	Derive Schrödinger's wave equation with the significance of ψ and ψ^2	10	1	2
	b.	Discuss the followings: 1. Hund's rule of maximum multiplicity 2. De- Broglie equation. 3. Boron Family elements.	10	1,2	1
	c.	Explain Ionization enthalpy and factors affecting with applications.	10	2	1
	d.	To write notes on: 1. Bohr's Theory of atomic model with atomic spectrum of H atom. 2. Effective nuclear charge, shielding or screening effect, Slater rules.	10	1,3	1

Course Code: SOS-B-CH102

OP JINDAL UNIVERSITY

Mid Semester Examination, November-2023

B.Sc. 1st Semester [Program Code: 03UG022]

B.Sc. (Hons.) Chemistry

PHYSICAL CHEMISTRY

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

			M	CO	KL
Section A (20 marks) Answer any 4 questions [04 x 05 marks=20 marks]					
1	a.	Write the postulates of kinetic theory of gases.	5	1	1
	b.	Define average velocity with example.	5	1	1
	c.	Explain collision diameter and collision number.	5	1	1
	d.	Define degree of freedom and also calculate the total and vibrational degree of freedom in CH≡CH molecule.	5	1	2
	e.	Explain the compressibility factor (z) with the help of graph.	5	2	2
Section B (30 marks) Answer any 3 questions [03 x 10 marks=30 marks]					
2	a.	Derive the kinetic gas equation.	10	1	3
	b.	Define mean free path and effect of temperature and pressure on it.	10	1	2
	c.	The average velocity of hydrogen at STP is 1.70 x 105 cm sec-1 and mean free path is 1.70×10^{-5}. Calculate the collision number.	10	1	2
	d.	Why real gases deviate from ideal behaviour and also derive the Vander Wall equation for real gases.	10	2	2
	e.	Calculate the temperature at which the hydrogen molecule will have an average speed of 176400 cm sec^{-1}.	10	1	2

Course Code: SOS-B-MA101

OP JINDAL UNIVERSITY

Mid Semester Examination, October-2023

B. Sc. 1st Semester [03UG023]

B. Sc. Hons. Mathematics

Calculus-I

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.	Evaluate the integral $\int_0^{\frac{\pi}{2}} \cos^6 x dx.$	5	1	1
	b.	Write a short note on concavity and inflection points	5	2	1
	c.	Evaluate the integral $\int \tan^n x dx.$	5	1	1
	d.	Find the nth derivative of $\cos 2x \cos 3x.$	5	1	1
	e.	If $y = \frac{\sin^{-1} x}{\sqrt{1-x^2}}$, then prove that $(1-x^2)y_2 - 3xy_1 - y = 0.$	5	1	1

Section B (30 marks)

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

			M	CO	KL
2	a.	Write the Reduction formula for $\int_0^{\frac{\pi}{2}} \sin^m x \cos^n x dx.$	10	1	2
	b.	Trace the curve $y^2(a+x) = x^2(a-x), a > 0$	10	2	1
	c.	If $y = x \log \frac{x-1}{x+1}$ then, show that $y_n = (-1)^{n-2}(n-2)!\left[\frac{x-n}{(x-1)^n} - \frac{x+n}{(x+1)^n}\right]$	10	1	1
	d.	If $y = (\sin^{-1} x)^2$, show that $(1-x^2)y_{n+2} - (2n+1)xy_{n+1} - n^2 y_n = 0$, hence find $(y_n)_0$.	10	1	2

Course Code: SOS-B-MA102

OP JINDAL UNIVERSITY

Mid Semester Examination, November-2023

B.Sc. 1st Semester

(Offers to B.SC MATHS HONORS: 03UG021)

CC-II: Geometry and Algebra

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.	Find the quotient and remainder when $f(x) = x^3 + 5x^2 + 4x + 50$ polynomial is divided by **x-3** using Synthetic Division Method.	5	CO5	2
	b.	If R^{-1} and S^{-1} are inverse of the relation R and S respectively, then prove that **$(SoR)^{-1}=R^{-1}o\ S^{-1}$.**	5	CO4	2
	c.	If mapping f: X--> Y and A and B are two subsets of X, then prove that $f(A \cup B) = f(A) \cup f(B)$.	5	CO4	2
	d.	If **f: X--> Y** and **g: Y--> Z** be one-one onto mappings, then prove that the mapping **gof: X--> Z** is also one-one onto and also prove **$(gof)^{-1}=f^{-1}o\ g^{-1}$.**	5	CO4	2
	e.	Explain addition modulo 'n' and multiplication modulo 'n' with suitable example.	5	CO5	1

Section B (30 marks)

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

2	a.	If **R** is an equivalence relation in the set A, then prove that $\mathbf{R^{-1}}$ is an equivalence relation in the set A. **AND** Using Euclidean Algorithm to find the gcd of 662 and 414.	10	CO4	2
	b.	Apply the division algorithm to find the quotient and remainder on dividing p(x) by g(x) as given $p(x) = x^4 - 3x^2 + 4x + 5$ *and* $g(x) = x^2 - x + 1$. And Define Well-ordered Set. Prove that for any positive integer n, $1 + 3 + \ldots\ldots + (2n-1) = n^2$	10	CO5	2
	c.	Define Equivalence Relation. If R and S be an equivalence relation in the set X, then prove that $R \cap S$ is an equivalence relation in X.	10	CO5	2
	d.	Write the algorithm of linear congruence modulo 'n' and Solve **$15x \equiv 15 \pmod 5$.**	10	CO5	3

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Course Code: SOS-B-BT-101

OP JINDAL UNIVERSITY

Mid Semester Examination, November-2023

B.Sc. 1st Semester [Biotechnology]

Biotechnology (Hons)

Cell Biology (SOS-B-BT-101)

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

Note: ***Please READ the questions properly and answer. Kindly draw the Diagram wherever required. Write the question numbers properly on your answer copy and keep at least 2-3 lines gap between the two answer.***

			M	CO	KL
Section A (20 marks) Answer any 4 questions [04 x 05 marks=20 marks]					
1	a.	Who gave the cell theory and what are the key postulates of Cell Theory?	5	1	2
	b.	Draw the Prokaryotic Cell Structure and label it properly.	5	1	2
	c.	Write the differences between prokaryote and eukaryotes.	5	1	2
	d.	**Write the TRUE/FALSE for the following sentences:** 1. Prokaryotic cells are comparatively smaller than the eukaryotic cells. 2. DNA resides inside the nucleus in Bacteria such as *E. coli*. 3. Among cytoskeletal filaments, intermediate filaments are largest in terms of their diameter. 4. 1 nm is equal to the 10^{-9} m. 5. Usually all eukaryotic cells are >5 μ in size whereas bacterial cells are smaller and of 1-2 μ in size.	5	1,2	2
	e.	What is osmosis? What will happen to the cells if kept in hypotonic, isotonic and hypertonic solution?	5	2	2
Section B (30 marks) Answer any 3 questions [03 x 10 marks=30 marks]					
2	a.	Write a detailed note on Plasma Membrane. Write about different models with more emphasis on fluid mosaic model.	10	2	2
	b.	How cell organelles can be fractionated and what would be the order of nucleus, mitochondria and small vesicles in different fractions?	10	1	2
	c.	Write detailed note on Membrane Transport.	10	2	2
	d.	What do you understand by cytoskeleton? Write the types and functions of different cytoskeletal filaments.	10	2	2

Course Code: SOS-B-BT103

OP JINDAL UNIVERSITY

Mid Semester Examination, November-2023

B.Sc. 1st Semester

BIOTECHNOLOGY [03UG024]

Biostatistics

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

Note: Scientific Calculator is allowed

			M	CO	KL
Section A (10 marks) **All Questions are compulsory [05 x 02 marks=10 marks]**					
1	**a.**	Define nominal and ordinal data and give one example in each.	2	1	1
	b.	Write the names and condition for different types of kurtosis.	2	2	1
	c.	Find the derivative of $y = \sin(2x - 4)$	2	6	1
	d.	Find the mean of first 6 whole numbers	2	2	1
	e.	Define Skewness	2	2	1
Section B (16 marks) **Answer any 4 questions [04 x 04 marks=16 marks]**					
2	**a.**	Write difference between Primary and secondary data.	4	1	1
	b.	Write the Characteristics of a good questionnaire.	4	1	1
	c.	Find the coefficient of skewness and excess kurtosis of the following data 2, 3, 4, 6, 8, 5, 1	4	2	1
	d.	What are the objectives of collecting statistical information	4	1	1
	e.	Write the formula for raw moments, central moments and relation between them.	4	2	1
Section C (24 marks) **Answer any 3 questions [03 x 08 marks=24 marks]**					
3	**a.**	Write the primary rules of Classification of data. Explain different types of classification of data.	8	1	2
	b.	Explain the collection of data according to the categories depending upon the sources utilized.	8	1	2
	c.	Calculate the mean deviation, standard deviation and variance 0-5 (2) 5-10 (6) 10-15 (11) 15-20 (14) 20-25 (10) 25-30 (7)	8	2	2
	d.	Obtain the mean, median and mode of the following data Scores: 10-19 (5) 20-29 (8) 30-39 (15) 40-49 (28) 50-59 (22) 60-69 (12) 70-79 (10) No. of Students:	8	2	2

Course Code: SOS-B-23DSA102

OP JINDAL UNIVERSITY

Mid-Semester Examination, November-2023

B.Sc. 1st Semester [03UG025]

Data Science and Analytics

Statistics I

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.	Discuss different types of Kurtosis with examples.	5	1	1
	b.	What is Dispersion and discuss different types of dispersion	5	1	1
	c.	There are 10 good and 2 bad apples in a refrigerator. We have to choose 4 apples from the bag. What is the probability that (i) Exactly one apple is bad (ii) At least one apple is bad	5	2	1
	d.	Find the probability that a single toss of a die will result in a number less than 4 if (a) no other information is given and (b) it is given that the toss resulted in an odd number.	5	2	2
	e.	If P(A) =0.4, P(AUB)=0:7 and A and B are independent events, then find P(B).	5	2	2
Section B (30 marks) **Answer any 3 questions [03 x 10 marks=30 marks]**					
2	**a.**	Give an example of a data set with 8 number of data. (Choose the numbers at your own between 1 to 20). Find its Arithmetic mean, Geometric mean and Harmonic mean.	10	1	2
	b.	Find the Coefficient of skewness based on (i) Karl Pearson's Coefficient of Skewness: (ii) Bowley's Coefficient of Skewness: (iii) Based upon moments x: 1 2 3 5 7 9 10 f: 1 2 3 3 3 4 4	10	1	2

	c.	Find the mean deviation, Standard deviation, variance, Coefficient of Dispersion based on MD and SD, Coefficient of variation Interval: 0-10 10-20 20-30 30-40 40-50 50-60 Frequency: 2 4 7 12 4 1	10	1	2
	d.	Find the median, quartiles and mode of the following data Interval: 0-10 10-20 20-30 30-40 40-50 50-60 Frequency: 2 4 7 12 4 1	10	1	2

Course Code: SOS-B-23DSA102

OP JINDAL UNIVERSITY

Mid Semester Examination, October-2023

B. Sc. 1st Semester [03UG025]

B. Sc. Hons. Data Science and Analytics

Foundation Course in Mathematics

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

Section A (20 marks)

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

			M	CO	KL
1	a.	Find the rank of matrix: $\begin{bmatrix} 3 & -1 & 2 \\ -6 & 2 & 4 \\ -3 & 1 & 2 \end{bmatrix}$	5	4	1
	b.	Test the consistency and solve: $5x + 3y + 7z = 4, 3x + 26y + 2z = 9, 7x + 2y + 10z = 5.$	5	4	1
	c.	Using Cayley-Hamilton theorem, find A^8, if $A = \begin{bmatrix} 1 & 2 \\ 2 & -1 \end{bmatrix}$.	5	4	2
	d.	Find the first and second partial derivatives of $z = x^3 + y^3 - 3axy.$	5	2	1
	e.	If $x + \frac{1}{x} = 2\cos\theta$ and $y + \frac{1}{y} = 2\cos\phi,$ show that $x^m y^n + \frac{1}{x^m y^n} = 2\cos(m\theta + n\phi).$	5	4	1

Section B (30 marks)

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

2	a.	Find the inverse of the following matrix: $\begin{bmatrix} 2 & 1 & -1 \\ 0 & 2 & 1 \\ 5 & 2 & -3 \end{bmatrix}$	10	4	1
	b.	Find the eigen value and vectors of the matrix: $\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$.	10	4	1
	c.	If $u = e^{xyz}$, then prove that $\frac{\partial^3 u}{\partial x \partial y \partial z} = [1 + 3xyz + x^2 y^2 z^2]e^{xyz}.$	10	2	1
	d.	If $x^x y^y z^z = c$, show that at $x = y = z$, $\frac{\partial^2 z}{\partial x \partial y} = -(x \log ex)^{-1}.$	10	2	1