Roll No.:.....

National Institute of Technology, Delhi

Name of the Examination: B.Tech. (Mid-Sem)

Branch : Artificial Intelligence and Data Science in CSE
Semester : I
Title of the Course : Quantum Physics
Course Code : PHBB 112

Time: 1.5 Hours
Maximum Marks: 25

Instruction:

1. All questions are compulsory.
2. Assume any suitable data, if necessary.
3. [CO- Course Outcome; BL- Bloom's Level; PO- Program Outcome]

	PART-A	Marks	CO	BL	PO
Q1. A	Define Photoelectric effect.	1	I	1	1
B	Dual nature of the particle is explained by.....	1	I	2	1
C	The nature of the angular moment is ..... in quantum physics.	1	I	2	1
D	Write two difference between classical physics and quantum physics.	1	I	1	1
E	Write 2 i −3 in polar coordinates.	1	I	2	2
F	$\|\Psi\rangle = \begin{pmatrix}3+i\\-9\end{pmatrix}$; $\|\Phi\rangle = \begin{pmatrix}i-1\\-10i\end{pmatrix}$; $\alpha = 7i - 2$, $\beta = -4 - 8i$ Calculate $\alpha\|\Psi\rangle + \beta\|\Phi\rangle$.	2	IV	4	2
G	Brief about the Hilbert space and completeness relation.	2	II	2	1
H	To rotate (real) vectors in $\mathbb{R}^2$ by an angle θ, we take their product with the (real) rotation matrix: $R(\theta) = \begin{pmatrix}cos\theta & -sin\theta\\ sin\theta & cos\theta\end{pmatrix}$ i. Calculate the matrix R(π/3). ii. Write down the vector resulting from rotating (−5, 9) by π/3 radians, in both Cartesian and polar coordinates.	2	IV	5	3
I	In the Hilbert space C2, consider the Hermitian operator $\sigma_x = \begin{pmatrix}0&1\\1&0\end{pmatrix}$. Find its eigenstates and eigenvalues. Then calculate the probability to measure each of the eigenvalues given that system is in the state $\psi\rangle = \frac{1}{\sqrt{10}}\begin{pmatrix}1\\3\end{pmatrix}$.	2	IV	5	3
J	Brief about the system axiom, state axiom, and operator axiom.	3	II	2	1
	PART-B				
Q2.	Consider the two bases $\|B_1\rangle = \frac{1}{\sqrt{2}}\begin{pmatrix}1\\1\end{pmatrix}$ $\|B_2\rangle = \frac{1}{\sqrt{2}}\begin{pmatrix}1\\-1\end{pmatrix}$ $\|C_1\rangle = \frac{1}{\sqrt{2}}\begin{pmatrix}1\\i\end{pmatrix}$ $\|C_2\rangle = \frac{1}{\sqrt{2}}\begin{pmatrix}-i\\-1\end{pmatrix}$ I. The vector is represented in the standard basis as $\|\psi\rangle = \begin{pmatrix}-3\\2+i\end{pmatrix}$ Find its representations in the basis $\|B_i\rangle$ and $\|C_i\rangle$. II. Find the change-of-basis matrix $P_{C\leftarrow B}$ Calculate $P_{C\leftarrow B}\|\psi\rangle_B$ and verify that the result is equal to the expression you obtained in 'I' for $\|\psi\rangle_C$.	4	IV	3	3
Q3. a)	Find a condition that is equivalent to an equality in the Cauchy Schwarz inequality. That is, find an "if and only if" statement for $\|\langle\Psi\|\Phi\rangle\| = \|\Psi\|\,\|\Phi\|$ involving properties of $\|\Psi\rangle$ and $\|\Phi\rangle$.	3	IV	4	2
b)	Show that the eigenvalues of a unitary matrix must all have magnitude 1.	2	II	2	2

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NATIONAL INSTITUTE OF TECHNOLOGY, DELHI

MID-SEMESTER EXAMINATION

B. Tech (1st Year): Semester-1 (2023) Course Code: HMBB101

Course Name: Theory and Practices of Human Ethics Date: 13.10.2023

Time: 1hour 30 minutes Max. Marks: 25

Instructions: (1) Question no.1 is compulsory for all

(2) Attempt any four out of the five questions from Question No. 2-6.

(3)Each question carries 5 marks.

(4) There are six questions in all.

1 Read the following case study and give answer to the questions that proceeds:

A young civil engineer graduated from an engineering college. He could have easily secured a job. His family was involved in business, but not related to engineering. Due to his family background and being from a well-to-do family, he thought of becoming an entrepreneur and taking up construction contracts. He made a survey of works available and got in touch with worker groups who are generally freelancers taking up jobs as and when they are available. Having got these mechanisms in place, he started bidding for jobs. Most of the jobs were undertaken by the government at that time. He initially got small jobs related to road work. Organizing people and materials for the job and getting the job done satisfactorily and in time was a Herculean task. He faced many difficulties as the workers did not turn up on time, materials needed to be given on credit, etc. Competitive bidding also meant that he had to work on thin margins and could not afford delays. The most difficult part, however, was dealing with the government officials and engineers. His running bills were not getting passed and were delayed for one reason or the other. He talked to other contractors about delays in payment. They advised him to pay some money to the engineer dealing with the work to get his bills passed without delay. Initially he was not happy with this but then decided to give in. After only a few months, he decided that contract jobs were not his cup of

tea and he could not bribe officials for getting his due. His conscience was always nagging him on this. He gave up being an entrepreneur and contractor and decided to take up a salaried job.

(a) Give your viewpoint about the experience of this young engineer.

(b)What according to you should be the supreme goal or goals of studying engineering ethics?

© Do you think such cases are a reason as to why engineers do not become entrepreneurs?

2. How was Big Five discovered and what are the big five dimensions of personality given by this model? Elaborate on each dimension in detail.

3. "The actual action on the gene is dependent on the availability of environment." In this context, discuss the role of environment factors in the formation of personality.

4. Differentiate between the following(ANY TWO):

(a) Internal and External Locus of Control Traits

(b) Field dependent and Field independent Traits

(c) Ethics and Human Values

Support your answer with some examples.

5.Describe how organizations operate as open systems? Explain how organization are invaluable to society, in terms of significant role played by them at the organizational level?

6. Discuss the issue of 'functional chimney problem' in context of functional structures?

What do you mean by organization and what are the basics components of the formal structure in an organization?

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National Institute of Technology, Delhi

Mid Semester Examination (Autumn 2023)

Branch	**: B. Tech AI & DS**	**Semester**	**: 1st**
Title of the Course	**: Discrete Mathematics**	**Course Code**	**: ADLB102**
Time	**: 1.5 Hours**	**Maximum Marks**	**: 25**

QNo.	Questions	Marks	CO	BL
1a	Let A= {1,2,3,4,5} and B= {4,5,6,7}. Find B Δ (A Δ B).	1	CO2	L2
1b	If 2+2=4, then 3+3=7 iff, 1+1=4 i) true ii) false	1	CO1	L2
1c	A fuzzy set given as {(a,0.15), (b,0.9), (c,1), (d,0), (e,0.5)}, with a universal set X = {a, b, c, d, e}. Find the support of the given fuzzy set.	1	CO2	L2
1d	The following inference is a fallacy: "If the client is guilty, then he was at the scene of the crime. The client was at the scene of the crime. Hence the client is not guilty. " i) true ii) false	1	CO1	L2
1e	Given that A U B = A U C, is it necessary that B=C?	1	CO2	L3
1f	State Russell's paradox.	1	CO2	L1
2a	Apply the negation of the following statements: i. Some students in the class have studied calculus. ii. Every car is fast and dangerous.	2	CO1	L3
2b	A certain country is inhabited only by people who either always tell the truth or always tell lies, and who will respond to questions only with a "yes" or a "no". A tourist comes to a fork in the road, where one branch leads to the capital and other does not. There is no sign indicating which branch to take, but there is an inhabitant Mr Z, standing at the fork. What single question should the tourist ask him to determine which branch to take?	2	CO1	L4
2c	A computer company receives 350 applications from computer graduates for a job planning a line of new web servers. Suppose that 220 of these people majored in CSE, 147 majored in Business, and 51 majored both in CS and Business. How many of these applicants majored neither in CS nor in Business?	2	CO2	L3

<table>
<tr><td>2d</td><td>Prove: $A - (B \cap C) = (A - B) \cup (A - C)$</td><td>2</td><td>CO2</td><td>L4</td></tr>
<tr><td>2e</td><td>Find whether the following argument is consistent:
p->q, p->r, q->~r, p</td><td>2</td><td>CO1</td><td>L3</td></tr>
<tr><td>3a</td><td>Show that $(\sim P \wedge (\sim Q \wedge R)) \vee (Q \wedge R) \vee (P \wedge R) \equiv R$ using laws of logical equivalence.</td><td>3</td><td>CO1</td><td>L2</td></tr>
<tr><td>3b</td><td>i) Mr. Bin lives in city P. He gets four different job opportunities at a time as A, B, C, D at Q, R, S and T respectively. These four alternatives are differing in salary, distance from its residency, and stability in job as well as his interest in job. Now the goal of Mr. Bin is to choose a better and beneficial job. What will he choose? (1.5)
<table>
<tr><th>JOB NAME</th><th>SALARY/ MONTH</th><th>INTEREST IN JOB</th><th>DISTANCE IN km</th><th>STABILITY IN JOB</th></tr>
<tr><td>A</td><td>20,000 (0.5)</td><td>LITTLE (0.4)</td><td>380 (0.24)</td><td>PERMANENT (1.0)</td></tr>
<tr><td>B</td><td>35,000 (0.87)</td><td>MODERATE (0.8)</td><td>290 (0.42)</td><td>CONTRACT (0.5)</td></tr>
<tr><td>C</td><td>15,000 (0.37)</td><td>HIGH (1.0)</td><td>135 (0.73)</td><td>MAY BE PERMANANT (0.7)</td></tr>
<tr><td>D</td><td>30,000 (0.75)</td><td>FEW (0.1)</td><td>220 (0.56)</td><td>TEMPORARY (0.3)</td></tr>
</table>
ii) Among the integers 1 to 1000, how many are not divisible by 5 and 7, but divisible by 3? (1.5)</td><td>3</td><td>CO2</td><td>L4</td></tr>
<tr><td>3c</td><td>Prove that if n is an integer and (3n+2) is even, then n is even using:
i) a proof by contradiction
ii) a proof by contraposition</td><td>3</td><td>CO1</td><td>L3</td></tr>
</table>

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National Institute of Technology, Delhi

Mid Semester Examination (Autumn Semester 2023)

Branch : **CSE, B.Tech (AI and DS)** **Maximum Marks** : **25**
Semester : **1st year, I Sem** **Time** : **1.5 Hours**
Title of the Course : **Mathematical Foundation of Data Science** **Course Code** : **ADLB 101**

Q. No	Questions	Marks	CO	BL	PO
1 (a)	What do you mean by Quantitative and Qualitative data? Explain with suitable example.	2	CO1	L1	2
1 (b)	Differentiate between: i. Continuous and Discrete data ii. Nominal and Ordinal Data	2	CO1	L1	2
2 (a)	Find the inverse of the following matrix, if exists. $\begin{bmatrix} 0 & 1 & 2 \\ 1 & 0 & 3 \\ 4 & -3 & 8 \end{bmatrix}$	2	CO2	L2	3
2 (b)	Two eigenvalues of a 3 x 3 real matrix P are $(2+\sqrt{-1})$ and 3. Find the determinant of P.	2	CO2	L2	2
3 (a)	The following system of equations has a unique solution. Find the possible values of a $x_1 + x_2 + 2x_3 = 1$ $x_1 + 2x_2 + 3x_3 = 2$ $x_1 + 4x_2 + ax_3 = 4$	2	CO2	L2	3
3 (b)	Find the LU factorization of following system of equations $x_1 + x_2 + x_3 = 1$ $3x_1 + x_2 - 3x_3 = 5$ $x_1 - 2x_2 - 5x_3 = 10$	3	CO2	L2	3

4 (a)	Let $P = \begin{bmatrix} 1 & 1 & -1 \\ 2 & -3 & 4 \\ 3 & -2 & 3 \end{bmatrix}$ and $Q = \begin{bmatrix} -1 & -2 & -1 \\ 6 & 12 & 6 \\ 5 & 10 & 5 \end{bmatrix}$ be two matrices. Find the rank of P + Q.	2	CO2	L2	2
4 (b)	For a given matrix $A = \begin{bmatrix} 2 & 2 & 2 \\ 2 & 2 & 2 \\ 2 & 2 & 2 \end{bmatrix}$ find the eigen values and corresponding eigen vectors.	3	CO2	L2	2
4(c)	If the matrix A is such that $A = \begin{bmatrix} 2 \\ -4 \\ 7 \end{bmatrix} [1 \quad 9 \quad 5]$ Then find the determinant of A.	2	CO2	L2	2
5 (a)	Four bad apples are mixed with 16 good apples. Find the probability distribution of the bad apples in a drawn of 3 apples. i. Let X be a discrete random variable and F(X) be the cumulative distribution function, the find F(X) for each X. ii. Find $P(X \leq 4)$ and $P(X > 2)$ iii. if $P(X \leq C) = 0$, then C =?	3	CO3	L2	3
5 (b)	A continuous random variable X has the following density function $F(x) = Kx^2$, $-3 < x < 3$; otherwise, 0. Find the value of i. K ii. $P(1 \leq x \leq 2)$, $P(x \leq 2)$ and $P(x > 1)$	2	CO3	L2	2

राष्ट्रीय प्रौद्योगिकी संस्थान दिल्ली

NATIONAL INSTITUTE OF TECHNOLOGY DELHI

(शिक्षामंत्रालय, भारत सरकार के अधीन एक स्वायत्त संस्थान)

(An autonomous Institute under the aegis of Ministry of Education (Shiksha Mantralaya), Govt. of India)

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Autumn Semester AY 2023-24

Department of Computer Science and Engineering

Mid Semester Examination

October 12, 2023 (02:30 – 04:00 PM)

Degree	B. Tech.	**Branch**	AI & DS
Semester	I		
Subject Code & Name	ADBB 103 – Computer Programming-I		
Time: 90 Minutes	**Answer All Questions**		**Maximum: 25 Marks**

Q. No.	Questions	Marks	BL	CO
1.a	What is the contribution of the compiler in facilitating the execution of a program?	2	L1	CO1

1.b	Apply the concept of reversing a number to fill the blanks (__) in the following pseudo code:
	read n;
	rev ← 0;
	until (n__0) {
	rev ← rev*__ + n % __;
	n ← n/__;
	}
	write rev;
		3	L3	CO1

2.a	Enlist the general operations of a computer system.	2	L1	CO1
2.b	Contrast between Constants, Variables, and Keywords using proper examples.	3	L2	CO2
3.a	Summarize the activities required for the Program Development Cycle through a structured discussion.	2	L2	CO1

3.b	Illustrate the formatted output of the following code:
	#include <stdio.h>
	int main()
	{
	int m=2, n=3, o=7;
	if ((m>=n) && (m>=o));
		3	L2	CO2

	printf ("\n The largest number is: %d", m);
	if ((n>=m) && (n>=o));
	printf ("\n The largest number is: %d", n);
	if ((o>=m) && (o>=n));
	printf ("\n The largest number is: %d", o);
	return 0;
	}
	
	Discuss with a proper rationale.			

4.a	Develop an algorithm to read a character from standard input and write its ASCII value on standard output.	2	L3	CO2
4.b	Develop an algorithm for Petrol Vending Machine to calculate the volume of Petrol that needs to be released based on given input of "amount for buying petrol".	3	L3	CO2

5.a	Identify the error (if any) in the following code:
	
	#include<stdio.h>
	int main(){
	int m=n=5;
	int sum=0;
	sum=m+n;
	printf("%d \t %d",sum,n);
	return 0;
	}
	
	Also, write the output of the execution of the above code.
		2	L3	CO2

5.b	Explain the process of caching and how it affects the performance of the computer system.	3 (2+1)	L2	CO1

*******Good Luck*******

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Course Code: ADBB 104	Course Title: Computer Fundamentals
Duration: 1.5 hrs	Max Marks: 25
This Question paper consists of 5 questions and 2 pages. Attempt all the questions and be brief while writing the answers.	

Q. No	Questions	Marks	CO	BL
1 a.	A 34-bit floating-point number is represented by a 8-bit signed exponent, and a 25-bit fractional mantissa. Find out the range of the exponent. What will be the range of the exponent if the scale factor is represented in excess-128 format.	2	CO1	L2
b.	The following is a scheme for floating point number representation using 16 bits. Bit Position 15 14 ..... 9 8 ..... 0 s | e | m Sign Exponent Mantissa Let s, e and m be the numbers represented in binary in the sign, exponent, and mantissa fields respectively. Then the floating point number represented is: $\begin{cases} (-1)^s \left(1 + m \times 2^{-9}\right) 2^{e-31}, & \text{if the exponent} \neq 111111 \\ 0, & \text{otherwise} \end{cases}$ Find the maximum and minimum values that can be represented with the above representation.	2.5	CO1	L3
2 a.	Find the base (or radix) of the number system such that the following equation holds 226/13=14	1.5	CO1	L2
b.	Find the smallest integer no that can be represented with a 6-bit number in 2's complement form. Write down the 1's complement representation of decimal number -61.	2	CO1	L2

c.	Express the following Gray codes as binary numbers: (i) 101110 (ii) 0100011	2*0.5=1	CO1	L2
d.	What are self-complementing codes? Explain with the help of an example.	1.5	CO1	L1
3.	What are the manual and automatic computing devices? Explain the journey from the manual computing devices to the first analytical and tabulating machine.	3.5	CO2	L1
4.	Perform the following arithmetic using 1's complement (i) 100011+011101 (ii) 110001-111000 (iii) 100111-100010	1*3=3	CO1	L2
5 a.	Explain the concept of processor to I/O devices communication with the help of diagram. What is the role of interface unit in implementing such a type of communication in a computer system? Elaborate I/O read and I/O write operations.	4	CO2	L1
b.	List the differences between the following (i) Daisy Wheel Printer and Drum Printer (ii) EPROM and EEPROM	2*2=4	CO2	L2