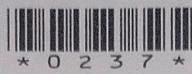


B.Tech. First Year (Second Semester) Artificial Intelligence & Data Science / Computer Science & Engineering / Machine Learning / Electrical Engineering / Civil Engineering / Mechanical Engineering / Electronics & Telecommunication Engineering

Indian Knowledge System

(AI24206 / CS24206 / ML24206 / EE24105 / CE24105 / ME24105 / ET24105)

Total Pages : 2



* 0 2 3 7 *

Time : One & Half Hour

Max. Marks : 30

Instructions to Candidates :

1. Question No. 1 A, 2 A, & 3 A are Compulsory.
2. Due marks will be given to neatness.

1. A) Solve the following question/s.

- i) How many types of Sanskaras are there as per Vedic age. 1
- ii) Enlist any types of culture. 1

B) Solve **any two questions of the following.**

- i) Define Culture in ancient India & Explain its Characteristics. 4
- ii) Explain the importance of Vasudhaive Kutumbkam 4
- iii) Explain the terms as per ancient era. 4
- a) Position of Women
- b) Family

2. A) Solve the following question/s.

- i) Enlist the subjects coverup during ancient education. 1
- ii) Enlist the places where gurus use to give ancient education. 1

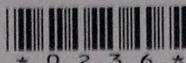
B) Solve **any two questions of the following.**

- i) Explain the salient features of Patanjali education system. 4
- ii) Explain the various modes of education system of ancient education system. 4
- iii) Explain the education system in the Takshashila University during Ancient time. 4

3. A) Solve the following question/s.
- i) Enlist any 4 metals in the 'seven metals of antiquity', 1
 - ii) Enlist the three main branches of metallurgy. 1
- B) Solve **any two** questions of the following.
- i) Explain the contribution of ancient India in the field of environment conservation. 4
 - ii) Explain the contribution of Sushruta in the field of surgery. 4
 - iii) Explain the salient features of water management in ancient India 4

**B.Tech. First Year (Second Semester) Artificial Intelligence & Data Science /
Computer Science & Engineering / Machine Learning
Computer Fundamentals
(AI24205 / CS24205 / ML24205)**

Total Pages : 2



* 0 2 3 6 *

Time : One & Half Hour

Max. Marks : 30

Instructions to Candidates :

1. Assume suitable data whenever necessary and clearly state the assumptions made.
 2. Diagrams/sketches should be given wherever necessary.
 3. Write answers only blue/black pen.

1. A) Solve the following multiple choice questions.

- i) Which of the following is an example of system software?

 - a) MS Word
 - b) Windows OS
 - c) VLC Media Player
 - d) Google Chrome

- ii) Which type of computer is the most powerful and used for complex calculations?

 - a) Supercomputer
 - b) Microcomputer
 - c) Minicomputer
 - d) Mainframe

B) Solve **any two** questions of the following.

- i) List and explain any four characteristics of computers.

- ii) What is an operating system? Name two types of operating systems and explain them.

- iii) Describe two applications of computers in daily life.

2. A) Solve the following multiple choice questions.

- ii) What is the sum of binary numbers 1011 and 1101?

 - a) 10110
 - b)** 11000
 - c) 10010
 - d) 10101

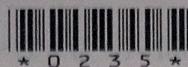
B) Solve **any two** questions of the following.

- i) Convert the hexadecimal number $(3FA5)_{16}$ into decimal, binary and octal.

- ii) Perform the binary multiplication of $(1010)_2$ and $(1101)_2$ and also divide $(1111)_2$ by $(101)_2$ using binary division. 4
- iii) Explain ASCII and Unicode with an example of character representation. 4
- 3.** A) Solve the following multiple choice questions.
- i) Which of the following is a characteristic of a good algorithm? 1
 - a) Ambiguity
 - b) Infinite steps
 - c) Well-defined inputs and outputs
 - d) High execution time
 - ii) Which searching algorithm checks each element one by one? 1
 - a) Binary Search
 - b) Merge Sort
 - c) Linear Search
 - d) Quick Sort
- B) Solve **any two** questions of the following.
- i) Define an algorithm. Explain its key characteristics with an example. 4
 - ii) Apply Binary Search to find the number 15 in the list [5, 10, 15, 20, 25]. Show each step clearly. 4
 - iii) Write a pseudocode for Bubble sort algorithm. 4

**B.Tech. First Year (Second Semester) Artificial Intelligence & Data Science /
Computer Science & Engineering / Machine Learning
Digital Electronics
(AI24204 / CS24204 / ML24204)**

Total Pages : 3



* 0 2 3 5 *

Time : Three Hours

Max. Marks : 60

Instructions to Candidates :

1. Assume suitable data if required.

1. A) Solve the following multiple choice questions.

i) Binary equivalent of $(67)_{10}$.

1

- | | |
|---------------------|---------------------|
| a) $(1001001)_{02}$ | b) $(1100001)_{02}$ |
| c) $(1000011)_{02}$ | d) $(1100011)_{02}$ |

ii) How to recognize any signed negative binary number?

1

- | | |
|---------------|------------------|
| a) Using MSB | b) Using LSB |
| c) Using Byte | d) None of above |

B) Solve **any two** questions of the following.

i) Convert $(1001101.101)_{02}$ to equivalent Decimal number and Octal number

4

ii) Convert $(118.22)_{10}$ to equivalent Binary and Hexadecimal number.

4

iii) Convert $(1110)_{02}$ in gray code and Excess-3 Code.

4

2. A) Solve the following multiple choice questions.

i) The NOR gate output will be high if the two inputs are -----

1

- | | |
|-------|-------|
| a) 00 | b) 01 |
| c) 10 | d) 11 |

ii) Select the 2's complement of 11001011 ?

1

- | | |
|-------------|-------------|
| a) 01010111 | b) 11010100 |
| c) 00110101 | d) 11100010 |

B) Solve **any two** questions of the following.

i) Add 11010 and 10111.

4

- ii) Perform Subtraction by using 1s complement $(110101)_{02} - (100101)_{02}$ 4
- iii) Elaborate AND and OR Gate along with Truth Table. 4
- 3.** A) Solve the following multiple choice questions.
- i) List correct name of Boolean law for $A + B = B + A$. 1
 a) Commutative Law b) Associative Law
 c) Distributive Law d) None of above
- ii) De Morgan's theorem states that ----- 1
 a) $(AB)' = A' + B'$ b) $(A+B)' = A' * B$
 c) $A' + B' = A' * B'$ d) $(AB)' = A' + B$
- B) Solve **any two** questions of the following.
- i) Prove that $(A + B).(A+C) = A + BC$ 4
- ii) Simplify the following function using k-map 4
 a) $F(A, B, C) = \sum m(1, 3, 6, 7)$
 b) $F(A, B, C) = \pi M(1, 3, 7)$
- iii) Determine the minimal sum of the products for the function $F(A, B, C, D) = \sum m(4, 5, 7, 12, 14, 15) + \sum d(3, 8, 10)$ using k-map. 4
- 4.** A) Solve the following multiple choice questions.
- i) In a combinational circuit, the output at any time depends only on the ----- at that time. 1
 a) Voltage b) Intermediate values
 c) Input values d) Clock pulses
- ii) Half subtractor is used to perform subtraction of ----- 1
 a) 2 bits b) 3 bits
 c) 4 bits d) 5 bits
- B) Solve **any two** questions of the following.
- i) Design & implement the 1:8 Demultiplexer using 1:4 demultiplexer. 4
- ii) Construct the half adder using logic gates and verify its operation using truth table. 4
- iii) Explain 3:8 line decoder in detail. 4

5. A) Solve the following multiple choice questions.

- ii) On a positive edge-triggered S-R flip-flop, the outputs reflect the input condition when ---

 - a) The clock pulse is LOW
 - b) The clock pulse is HIGH
 - c) The clock pulse transitions from LOW to HIGH
 - d) The clock pulse transitions from HIGH to LOW

B) Solve **any two** questions of the following.

- i) Explain the operation of SR Flip flop using truth table.
 - ii) Illustrate the operation of MS JK Flip-flop
 - iii) Explain the operation of the D-flip flop using truth table.

6 A) Solve the following multiple choice questions.

B) Solve **any two** questions of the following.

- i) Design 4-bit ring counter and verify its operation. 4
 - ii) Design 2-bit synchronous counter with required timing diagram. 4
 - iii) Explain Serial in serial Out Shift Register. 4

* * * * *

B.Tech. First Year (Second Semester) Machine Learning
Object Oriented Programming
(ML24203)

Total Pages : 3



* 0 2 3 3 *

Time : Three Hours

Max. Marks : 60

Instructions to Candidates :

1. All questions carry marks as indicated.
2. Assume suitable data wherever necessary.

1. A) Solve the following multiple choice questions.

- i) Which of the following is responsible for executing Java bytecode? 1
 - a) Java Development Kit (JDK)
 - b) Java Runtime Environment (JRE)
 - c) Java Virtual Machine (JVM)
 - d) Java Compiler

- ii) What does OOP stand for? 1
 - a) Open Operating Program
 - b) Object-Oriented Programming
 - c) Optimal Output Process
 - d) Ordered Output Protocol

B) Solve **any two** questions of the following.

- i) Describe the roles of the Java Development Kit (JDK), the Java Virtual Machine (JVM) and the Java Runtime Environment (JRE) in the process of executing a Java Program. 4

- ii) Explain the key differences between procedural programming and object-oriented programming. 4

- iii) Discuss the structure of a simple Java program with example. 4

2. A) Solve the following multiple choice questions.

- i) Which of the following Java keywords is used to declare a variable that can store whole numbers? 1
 - a) float
 - b) double
 - c) int
 - d) char

- ii) What is the term for converting a variable from one data type to another? 1
 - a) Operator overloading
 - b) Data encapsulation
 - c) Type casting
 - d) Method overriding

- B) Solve any two questions of the following.
- i) Describe the concepts of operator precedence and associativity in Java. Explain how these rules affect the evaluation of complex expressions and provide an example to illustrate how different operator precedence can lead to different results. 4
 - ii) What are loops in Java? Explain different looping constructs with examples. 4
 - iii) Explain any three decision making statements in Java with example. 4
3. A) Solve the following multiple choice questions.
- i) What is the special method called that is automatically invoked when an object is created? 1
 - a) Main method
 - b) Static method
 - c) Constructor
 - d) Void method
 - ii) Which keyword is used to refer to the current object with in a method or constructor? 1
 - a) super
 - b) static
 - c) this
 - d) final
- B) Solve any two questions of the following.
- i) Explain constructors in Java with an example program. 4
 - ii) Demonstrate the significance of the "this" keyword in Java? 4
 - iii) Write a Java program that accepts two numbers using scanner class, calculate its sum and displays the result. 4
4. A) Solve the following multiple choice questions.
- i) Which keyword is used to create an abstract class in Java? 1
 - a) interface
 - b) final
 - c) abstract
 - d) static
 - ii) What term describes the ability of a class to inherit properties and methods from another class? 1
 - a) Polymorphism
 - b) Encapsulation
 - c) Inheritance
 - d) Abstraction
- B) Solve any two questions of the following.
- i) Demonstrate method overloading and method overriding with examples. 4
 - ii) Implement multiple inheritance in Java. 4
 - iii) Write a Java program to create a package add a class to it and use that class in another program. 4

5. A) Solve the following multiple choice questions.

B) Solve any two questions of the following.

- i) Discuss exception handling mechanism in Java with example. 4
 - ii) Apply throw and throws keyword in java to handle exceptions. 4
 - iii) Implement a Java program to handle an arithmetic exception. 4

6. A) Solve the following multiple choice questions.

B) Solve **any two** questions of the following.

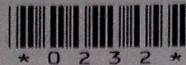
- i) Discuss the Files class in Java with an example. 4
 - ii) Demonstrate different File Operations in Java. 4
 - iii) Construct a Java program to create a file and perform write & read operations on it. 4

**B.Tech. First Year (Second Semester) Artificial Intelligence & Data Science /
Computer Science & Engineering / Machine Learning**

Quantum Physics and Material

(AI24202 / CS24202 / ML24202)

Total Pages : 3



Time : Three Hours

Max. Marks : 60

Instructions to Candidates :

1. Draw well labelled Diagram where ever necessary
2. Mass of Electron = 9.1×10^{-31} kg :
3. Charge on Electron = 1.6×10^{-19} C
4. Plank's Constant $h = 6.63 \times 10^{-34}$ J sec
5. Velocity of Light C = 3×10^8 m / sec

1. A) Solve the following multiple choice questions.

- i) The probability of finding an electron exactly at Fermi Energy level is ----- 1
 - a) 1
 - b) 0
 - c) Infinite
 - d) half
- ii) In LED is made up of ----- material. 1
 - a) Gallium Arsenide
 - b) Gallium phosphide
 - c) Gallium Arsenide phosphide
 - d) All of Above

B) Solve **any two** questions of the following.

- i) Discuss the working p-n junction diode in forward bias condition with necessary circuit diagram. 4
- ii) Define Striking potential in case of LED and state its any four applications. 4
- iii) Calculate the mobility of electron in a copper if free electron density is $8.496 \times 10^{22} / \text{cm}^3$ and resistivity of Cu is $1.7 \times 10^{-6} \Omega \cdot \text{cm}$ 4

2. A) Solve the following multiple choice questions.

- i) In Compton effect experiment the X ray beam of wavelength ----- A° are used. 1
 - a) 7.07
 - b) 0.707
 - c) 0.0707
 - d) None of above
- ii) The Wave velocity of De-Broglie's matter wave is ----- 1
 - a) Smaller than velocity of light.
 - b) Greater than velocity of light.
 - c) Half of the velocity of light.
 - d) Infinity

B) Solve any two questions of the following.

i) Justify the Statement "Electrons cannot exist inside the nucleus" with help of Heisenberg's uncertainty principal. 4

ii) Calculate De-Broglie's wavelength associated with electron moving with energy 100 eV 4

iii) Discuss the experimental arrangement of Compton effect experiment with schematic diagram. 4

3. A) Solve the following multiple choice questions.

i) In hall effect if the Magnetic field is applied along "-Z axis", the direction of current is along "+X axis", then magnetic force is acted along ----- direction 1

- a) +Z axis
- b) -Y axis
- c) +Y axis
- d) -X axis

ii) In perpendicular magnetic field the radius of electron path is directly proportional to ----- 1

- a) Mass of electron
- b) Velocity of electron
- c) Momentum of electron
- d) All of above

B) Solve any two questions of the following.

i) Current of 50 mA is passed through a metal strip which is subjected to magnetic flux density of 1.2 wb/m^2 . The magnetic Field is directed at right angles to the current direction. Thickness of strip in direction of magnitude field is 0.5 mm. The hall voltage is 100V. Calculate number of conduction electrons per cubic meter in the metal. 4

ii) In perpendicular magnetic field applied to very large region prove that the radius of path traced by electron is directly proportional to momentum of particle. 4

iii) In case of cathode Ray oscilloscope discuss the working of trigger circuit, Time Base Generator, Vertical amplifier and horizontal amplifier. 4

4. A) Solve the following multiple choice questions.

i) In Newton's Ring experiments, the ----- is used 1

- a) Plano Concave lens
- b) Nichol prism
- c) Grating
- d) None of above

ii) The plane transmission grating is used to study ----- 1

- a) Diffraction
- b) Interference
- c) Polarization
- d) All of above

B) Solve any two questions of the following.

i) Derive the equation for thickness of the thin film and radius of dark and bright ring with help of necessary diagram in case Newton's Ring. 4

ii) Compare Fraunhoffer and Fresnel class of diffraction. 4

iii) A parallel beam of monochromatic light with wavelength 5890A° is incident on thin glass plate of R.I. 1.2 such that angle of refraction into plate is 60° . Calculate the thickness of glass plate which will appear dark after refraction

5. A) Solve the following multiple choice questions.

- i) The diameter of core is smallest in ----- type of fibre 1
 - a) Graded Index
 - b) Step Index
 - c) Single Mode
 - d) All of above

- ii) Attenuation measures in ----- unit 1
 - a) m/sec
 - b) decibel/km
 - c) m.Volt/sec
 - d) volt/m

B) Solve **any two** questions of the following.

i) In optical fiber prove that the angle of acceptance is directly proportional to square root of difference of refractive Indices of core and cladding. 4

ii) State the principle of Fibre optics communication and explain construction of fibre optics cable. 4

iii) Obtain the loss specification of fiber of length 500 m, if the input Power is $8.6 \mu\text{w}$ and output power is $7.5 \mu\text{w}$. 4

6. A) Solve the following multiple choice questions.

- i) Laser light is ----- source of light. 1
 - a) Monochromatic
 - b) Coherent
 - c) Directional.
 - d) All of above

- ii) The wavelength of Ruby LASER is ----- 1
 - a) 6328A°
 - b) 5000A°
 - c) 5400A°
 - d) 46943A°

B) Solve **any two** questions of the following.

i) A tiny laser beam is directed from the Earth to the Moon. If the beam is to have a diameter of 2.50 m at the Moon, how small must divergence angle be for the beam? The distance of Moon from the Earth is $3.8 \times 10^8 \text{m}$. 4

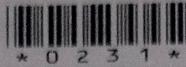
ii) Explain with necessary energy level diagram, the role of metastable state in the production of LASER in three level energy system. 4

iii) Elaborate the meaning of Population Inversion, Absorption, Spontaneous Emission and Pumping. 4

**B.Tech. First Year (Second Semester) Computer Science & Engineering /
Artificial Intelligence & Data Science / Machine Learning**

Mathematics for Computing-II
(AI24201 / CS24201 / ML24201)

Total Pages : 4



* 0 2 3 1 *

Time : Three Hours

Max. Marks : 60

Instructions to Candidates :

1. Illustrate your answer with neat and clear sketch.
 2. Assume Suitable data whenever necessary
 3. Use of scientific calculator is allowed.

1. A) Solve the following multiple-choice questions.

i) What is the expected value (mean) for the Binomial Distribution $n = 10$, $p = 0.55$.
a) 7 b) 13.6
c) 12.4 d) 5.5

ii) In binomial Probability distribution, Probability of r successes in n trials is (where p probability of successes and q probability of failure in a single trial)
a) $p^r q^{n-r}$ b) ${}^n C_r p^r q^{n-r}$
c) ${}^n C_r p^r q^{n+r}$ d) ${}^n C_r p^r q^n$

B) Solve **any two** questions of the following.

i) In certain factory turning out razor blades, there is small chance of 1/500 for any blade to be defective. The blades are in supplied in packets of 10, Using Poisson distribution find the probability that a packet contain one defective blade.

ii) Assume that on an average one telephone number out of fifteen calls on week days is busy. What is the probability that if 6 randomly selected telephone numbers are called, not more than three will be busy?

iii) In a sample of 1000 candidates, the mean of certain test is 14 and standard deviation is 2.5. Assuming normal distribution, find the probability of candidate getting less than eight marks.
(Area between $z=0$ to $z=2.4$ is 0.4918)

2. a) Solve the following multiple-choice questions.

i) The line obtained by the method of least square is known as the line of---
a) Regression b) Best fit
c) Interpolation d) Polynomial equation

ii) The range of correlation coefficient is-
a) $(-1, 1)$ b) $[-1, 1]$
c) $(0, 1)$ d) $[0, 1]$

b) Solve any two questions of the following:

i) Fit a straight line of the form $y = a + bx$ by the Least Square Method for the data:

x	0	1	2	3	4
y	1	1.8	3.3	4.5	6.3

ii) Obtain the line of regression of y on x for the data:

x	1	2	3	4	5	6	7	8	9
y	9	8	10	12	11	13	14	16	15

iii) Find the coefficient of correlation for the data:

x	10	14	18	22	26	30
y	18	12	24	6	30	36

3. a) Solve the following multiple choice questions.

i) A compound proposition that is neither a tautology nor a contradiction is called a -----

- a) Contingency
- b) Equivalence
- c) Condition
- d) Inference

ii) Let p : I am in Bangalore.

q : I love cricket. Then $q \rightarrow p$ is?

- a) I love cricket
 - b) If I am in Bangalore then I love cricket
 - c) I am not in Bangalore
 - d) If I love cricket then I am in Bangalore

b) Solve **any two** questions of the following:

i) Show that following statement is logically equivalent using truth table
 $\sim(p \vee (\sim p \wedge q)) \Leftrightarrow \sim p \wedge \sim(\sim p \wedge q)$

ii) Explain with examples:

- a) Tautology
 - b) Contradiction
 - c) Contingency

iii) Show the following conditional statement is a tautology by using truth table

$$[(P \rightarrow Q) \wedge (Q \rightarrow R)] \rightarrow (P \rightarrow R)$$

4. a) Solve the following multiple-choice questions.

i) The statement "Either the sky is blue, or it is raining" can be translated into which of the following logical equations?

- a) $B \rightarrow R$ b) $B \vee R$
c) $\sim B \rightarrow R$ d) $B \wedge R$

- ii) Which of the following correctly represents the intersection of sets A and B in a Venn diagram? 1
- Area inside circle A only.
 - Area inside both circles A and B.
 - Area outside both circles.
 - Area inside circle B only.
- b) Solve **any two** questions of the following: 4
- Explain predicates and quantifier with examples. 4
 - Show that $R \vee S$ is a valid inference from the following premises
 $H_1 : C \vee D, H_2 : (C \vee D) \rightarrow \sim H,$
 $H_3 : \sim H \rightarrow (A \wedge \sim B), H_4 : (A \wedge \sim B) \rightarrow R \vee S$ 4
 - Draw the Venn diagram of
 $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$ 4
5. a) Solve the following multiple-choice questions: 1
- Which of the following is the inverse of the function $f(x) = 2x + 1$? 1
 - a) $f^{-1}(x) = 2x - 1$ b) $f^{-1}(x) = x - 1$
c) $f^{-1}(x) = (x - 1) / 2$ d) $f^{-1}(x) = x + 1$
 - If $P(x) : x$ is apple, $Q(x) : x$ is red. 1
 Then which of the following is the symbolic form of "Every apple is red".
 a) $\forall x(P(x) \rightarrow Q(x))$ b) $\forall x(Q(x) \wedge P(x))$
 c) $\exists x(P(x) \rightarrow Q(x))$ d) $\exists x(Q(x) \wedge P(x))$
- b) Solve **any two** questions of the following: 4
- Find $RoS, SoR, Ro(SoR), (RoS)oR, RoR, SoS$ for the relations given by,
 $R = \{<1, 2>, <3, 4>, <2, 2>\}$ and
 $S = \{<4, 2>, <2, 5>, <3, 1>, <1, 3>\}$ 4
 - If $A = \{0, 1\}, B = \{1, 2\}, C = \{0, 1, 2\}$. Then find
 $AxBxC, BxCxA, AxAxA, CxCxC$ 4
 - Show that, $R = \{<x, y> | x - y \text{ is divisible by } 3\}$ is equivalent relation if $X = \{1, 2, 3, 4, 5, 6, 7\}$. 4
6. a) Solve the following multiple-choice questions. 1
- Let G be a group and H a subgroup. It is possible to express the elements of a left coset of H in G as $xH = \{ \underline{\quad} | h \in H \}$ for any $x \in G$.
 a) xhh b) hx
 c) xxh d) xh